SOIL SURVEY OF FLOYD COUNTY, IOWA

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DESCRIPTION OF THE AREA

Floyd County is situated in the northeastern part of Iowa. The extreme northeastern corner is 21 miles south of the Iowa-Minnesota State line and 72 miles due west of the Mississippi River. The county contains 12 full townships, and on the north the southern half of four additional townships. The included area is 495 square miles, or 316,800 acres.

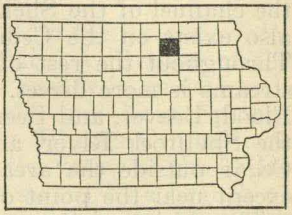

FIG. 12.—Sketch map showing location of the Floyd County area, Iowa

The territory included in Floyd County is physiographically a broad, drift-covered plain, originally quite flat but now altered and modified by the erosional action of streams.

The topography varies considerably in different parts of the county. Along the Cedar and Shellrock Rivers, which flow in a southeasterly direction through the county, the relief is more pronounced, except on the west side, from Charles City and Marble Rock south, where a more gently rolling topography predominates. The slopes are often steep, broken, and badly gullied, and in a number of places the limestone bedrock outcrops, the bluffs rising from 10 to 20 feet sheer above the streams. Small areas having similar characteristics lie along Little Cedar River, Lime, Beaver, and Beemis Creeks, and Ackley Run. These strips of rough, broken land, however, are generally narrow and rarely extend back more than a mile before they merge with the more gently rolling topography which predominates over the greater part of the county. Throughout the main body of the uplands the divides are broad and the slopes to the shallow stream valleys are long and gentle, giving rise to a level to very gently rolling landscape. This kind of topography characterizes the greater part of Cedar, Rudd, and Rock Grove Townships and the western part of St. Charles and Ulster Townships.

Terraces which are above the reach of overflow occur along the larger streams, and below these first bottoms ordinarily appear. The most extensive developments of alluvial lands lie on Shellrock River, from 2½ miles north of the junction of the river and Lime Creek to a point approximately 1½ miles northwest of Marble Rock, and along Cedar River from Charles City north to Floyd. These lands consist of broad third terraces, narrower second terraces, and still narrower strips of overflow lands, the combined area varying in width from 1 to 2½ miles. Similar terraces are also developed along other stretches of the rivers and along most of the larger creeks, but are much narrower, varying ordinarily between 100 feet and 1 mile in width. Along some of the smaller creeks the terraces are not continuous.

The average elevation of the county above sea level is 1,150 feet. The highest point is along the line of the Illinois Central Railroad

in the vicinity of Carrville, where an elevation of 1,250 feet is reached. The elevations of various points in the county are: Charles City, 1,003 feet; Marble Rock, 1,002 feet; Rockford, 1,022 feet; Nora Springs, 1,068 feet; and Rudd, 1,117 feet. The prevailing slope is toward the southeast.

The Cedar and Shellrock Rivers and their tributaries drain the entire county. These master streams cut through the area in a southeasterly direction and meander through valleys which vary from 1 mile to 2½ miles wide. Between Rockford and Marble Rock the channel of the Shellrock River is very crooked, a condition that also exists on the Cedar River between Floyd and Charles City. Throughout the rest of the distance, however, the course of these streams is more direct. The principal tributary streams are Lime, Flood, Beaver, and Beemis Creeks and Ackley Run, which flow into the Shellrock River, and the Little Cedar River, which joins the Cedar outside the area. The valleys of these creeks are narrow, except near the point of confluence with the master streams.

The drainage system for a large part of the county is not completely developed. Along the rivers and the lower reaches of the larger creeks, where the valleys have been cut from 30 to 100 feet below the average level of the surrounding prairies, the bordering uplands have been eroded to produce a rolling to gently rolling topography and drainage is sufficient. However, along the smaller creeks and streams the valleys are shallow and the surrounding country has a gently rolling to flat appearance. Throughout such areas and around the heads of drainage ways, where the prairies have much of their original plain surface, the run-off is slow or obstructed and must be assisted by ditching and tiling.

The Cedar and Shellrock Rivers have considerable fall and in many places suitable sites for power plants exist. Such plants now are situated at Charles City, Rockford, and Marble Rock, and at Greene and Nashua, places just outside the county. The power is utilized for the generation of electric current, which is used in the towns of the area.

Water for farm use is obtained mainly from wells. These are drilled into the underlying limestone and vary in depth from 100 to 350 feet. The needs of some farms are supplied by springs.

Floyd County was organized in 1851. The first settlement was made some years prior to this date, the pioneers locating near the rivers, where game was plentiful. The early settlers moved in from the States to the east and south.

The 1920 census gives the population as 18,860, which is almost exclusively native born. A large percentage is of German descent. The population increased from 14,677 in 1880 to 17,754 in 1900, but dropped off 675 during the next decade. Since then the growth has been steady. An increase of 1,741 occurred between 1910 and 1920. The total rural population in 1920 is given as 11,510 and the urban as 7,350. The density of rural population is 23.2 to the square mile.

Charles City is the largest town and county seat, with a population of 7,350 in 1920. It is situated in the east-central part of the county and is quite an important manufacturing and trading center. Nora Springs, Rockford, and Marble Rock, situated in the western part of the county, are the next towns in size and importance, with 1,055, 1,031, and 483 inhabitants, respectively. Rudd, with a population of

487, Floyd with 308, and Colwell with 150, are smaller towns enjoying railway facilities. Oakwood, Carrville, Devonia, Powersville, Roseville, and Floyd Crossing are villages of less than 100 inhabitants located along the railroads and highways of the county.

The interests of Floyd County are principally agricultural, although considerable manufacturing is done at Charles City and Rockford. Charles City has a large plant for the manufacture of tractors, as well as other machine shops, foundries, and woodworking establishments. A tile factory located at Rockford is one of the more important industrial plants of the county.

The county is well supplied with transportation facilities, no farm being more than 7 miles from a railroad point. A division of the Chicago, Milwaukee, & St. Paul traverses the county in an east-and-west direction, connecting Charles City, Rudd, and Nora Springs with points east and west. A branch of the Illinois Central cuts through the northeast part, following closely the valley of the Cedar River. The southwestern part of the area is served by a branch of the Chicago, Rock Island & Pacific, which parallels the Shellrock River, and a division of the Chicago & North Western, which cuts through the extreme southwest corner. The Charles City Western, an electric line, connects Charles City with Colwell to the north and Marble Rock to the southwest.

Floyd County has a complete road system. A large percentage of the county roads have been brought to grade and are kept in excellent condition most of the year by dragging after rains. The principal roads have been graveled in a number of places and the North Iowa Pike from Charles City to Nora Springs is now paved. During the progress of the survey a considerable mileage was being brought to grade preparatory to graveling and paving. The county is traversed by two State highways—the North Iowa Pike, which runs east and west, and the Red Ball Route, which cuts across the northeast part, following closely the valley of the Cedar River.

In schools the county compares favorably with other counties of the State. Rural schools are located at 2-mile intervals throughout the county, except where they have given way to consolidated schools. These latter are situated in some town and the pupils are taken to-and-fro in busses. The grade and high schools in the larger towns offer excellent courses. A number of churches are located at convenient places throughout the county. Telephones are in general use and some parts of the county are served by power lines. Rural mail routes radiate from the principal towns.

The towns of the county furnish a ready market for most of the farm products. The principal outside markets are Chicago, Sioux City, Mason City, and Austin, Minn.

CLIMATE

Floyd County has the essential factors of climate to make it favorable for the production of all the staple crops common to this region. The cold of winter is sufficient to disintegrate the soil, and the summers are hot and long enough to insure the maturity of short-season crops practically every season. The climate is continental in type, being characterized by wide variation in temperature and rainfall. A large percentage of sunshiny days is the rule.

The winters are usually cold and long, with a mean temperature of 15.2° F. and a recorded minimum temperature of −34° F. Wide fluctuations are not uncommon, and if it were not for the fact that the air is ordinarily very dry during such changes great suffering would be caused.

The summers are characterized by moderately high temperatures, with an occasional hot spell. These hot spells, however, are of short duration and seldom damage crops. The mean temperature for the summer months is 71° F. with a maximum of 108° F. recorded in July. The mean annual temperature is 44.6° F.

The latest date of killing frost in the spring recorded at Charles City is May 20 and the earliest in the fall September 22. The average date of the last killing frost in the spring is April 27 and of the first in the fall October 7, which gives an average growing season of 162 days.

The average annual rainfall is 31.23 inches, the greater part of which falls during the six crop months—April to September. Late spring rains interfere with planting at rare intervals. Droughts are rare. Heavy wind and hail storms occasionally damage growing crops, but are as a rule local. During the fall, at time of harvest, excellent weather is the rule. The precipitation during the winter is usually in the form of snow; the mean annual snowfall is 38.7 inches. Most of this falls during the period December to March, inclusive.

The following table, compiled from records of the Weather Bureau station located at Charles City, gives the normal, monthly, seasonal, and annual temperature and precipitation for Floyd County:

Normal monthly, seasonal, and annual temperature and precipitation at Charles City

[Elevation, 1,015 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1910)	Total amount for the wettest year (1902)	Snow, average depth
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	19.0	56	−24	1.28	0.53	2.30	7.4
January	11.4	58	−34	.97	1.75	.65	9.5
February	15.1	62	−31	.97	.61	.33	9.1
Winter	15.2	62	−34	3.22	2.89	3.28	26.0
March	28.4	86	−16	1.92	.18	2.19	6.6
April	46.3	92	8	2.83	.87	1.05	2.3
May	59.5	92	20	4.94	2.67	9.19	.1
Spring	44.7	92	−16	9.69	3.72	12.43	9.0
June	68.8	99	34	5.10	.61	8.36	.0
July	73.5	108	39	3.58	.43	7.92	.0
August	70.7	102	34	3.42	5.84	6.71	.0
Summer	71.0	108	34	12.10	6.88	22.99	.0
September	61.7	98	19	2.80	1.74	2.80	.0
October	48.2	87	9	2.03	.36	1.13	T
November	33.0	76	−13	1.39	.29	3.18	3.7
Fall	47.6	98	−13	6.22	2.39	7.11	3.7
Year	44.6	108	−34	31.23	15.88	45.81	38.7

AGRICULTURE

The agriculture of Floyd County has consisted from the beginning of the production of grain and hay. In the early days only a few crops were grown to supply the demands of the home, the settlers devoting most of their time to trapping and hunting, as game was plentiful. As settlement increased more land was broken and put in cultivation and devoted to the production of corn, oats, wheat, barley, and rye. Flax was often grown on the new land the first year. However, the development was slow, owing to lack of markets. The building of the railroads was the turning point, and subsequent to this event many people moved in and an ever-increasing acreage was put in cultivation, the use of improved farm machinery became more general, and a larger number of cattle and hogs were raised and fed.

The early settlers paid little attention to maintaining the productiveness of their land. Only the well-drained areas were taken up at first, leaving the poorly drained flatter areas for pasture. The use of lime was unknown and stable manure was scarcely ever applied to the land.

The following table, compiled from reports of the last five censuses, showing the increase in population, the tenure of farms, the total number of farms, the proportion of area in farms, the average size of farms, and the percentage of improved land in farms, will give the reader an idea of the development that has taken place in the last 40 years.

Population, tenure of farms, number and acreage of farms, and improved land in farms, 1880–1920, inclusive

Year	Total population	Farms operated by owners	Farms operated by tenants	Farms operated by managers	Total farms	Proportion of area in farms	Average size of farms	Proportion of improved land in farms	Average improved acreage per farm
		Per cent	*Per cent*	*Per cent*		*Per cent*	*Acres*	*Per cent*	*Acres*
1880	14,677	76.0	24.0	0.0	1,912	83.7	139.0	86.9	120.6
1890	15,424	68.3	31.7	.0	1,874	85.7	145.0	88.5	128.3
1900	17,754	62.2	37.2	.6	2,054	95.9	147.9	91.3	135.6
1910	17,119	56.8	42.6	.6	1,907	94.2	156.6	89.3	139.7
1920	18,860	51.9	46.8	1.3	1,916	93.3	154.2	86.1	132.8

With exception of the decade 1900–1910, the population has increased steadily since 1880. During the same 40-year period the number of farms has shown a net increase of only four, but there has been a considerable increase in the size of farms. The proportion of improved land in farms is slightly lower than in 1880, the actual improved acreage about 10 per cent greater. The farms operated by owners declined from 76 per cent in 1880 to 51.9 per cent in 1920, whereas those operated by tenants increased from 24 per cent to 46.8 per cent. This has been accompanied by the removal of landowners from the farms to the towns of the county.

The value of land and farm property has increased materially during the period under consideration, as will be seen from the following table compiled from the census:

Value of farm property

Year	Value of farm property, per farm						Land, value per acre
	All property	Land	Buildings	Land and buildings	Implements	Domestic animals	
	Dollars	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Dollars*
1880	3,773			79.7	5.7	14.6	
1890	4,818			78.2	3.7	18.1	
1900	8,147	68.9	14.2	83.1	3.7	13.2	37.96
1910	15,531	72.7	13.8	86.5	3.1	10.3	72.10
1920	34,534	75.9	12.9	88.8	3.8	7.4	169.91

The increase in the value of all property per farm, it will be noted, is for the first 10-year period 27.6 per cent. During the ensuing 30 years it has been at a very much more rapid rate, being 69 per cent, 90.6 per cent, and 122.3 per cent for the three included decades, respectively. During the last two census periods from 1900 to 1920 the estimated value of farm land per acre jumped from $37.96 to $169.91, much of the increase taking place during the land boom of 1919 and the early part of 1920.

The acreage and production of the general farm crops as returned by the last four censuses are given in the following table:

Acreage and production of principal crops

Year	Corn		Oats		Wheat		Barley	
	Acres	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*
1879	42,948	1,801,836	19,197	695,235	90,374	896,006	1,318	28,103
1889	64,695	2,009,256	54,149	2,284,241	2,219	35,029	1,226	41,118
1899	84,952	3,249,300	78,446	3,207,600	4,116	38,900	6,678	223,560
1909	78,636	2,739,694	70,639	1,679,064	643	10,274	2,867	52,006
1919	70,498	2,581,374	69,989	2,046,945	2,087	21,675	2,546	68,966

Year	Rye		Buckwheat		Cultivated or tame grasses		Wild hay	
	Acres	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*
1879	120	1,773	262	2,592			25,731	35,396
1889	930	18,536	694	7,568			53,318	63,520
1899	962	14,380	209	2,910	25,741	36,321	7,185	8,666
1909	430	5,579	175	1,824	36,426	57,662	6,721	9,025
1919	687	10,536	444	6,935	32,167	43,784	4,287	5,541

This table shows some marked changes in the crops grown. In 1879 Floyd County was first of all a wheat-growing section. From an acreage of more than 90,000 acres in wheat in that year the area dropped to a little more than 2,000 in 1919. Apparently this abandoned acreage was absorbed by corn, which occupied 70,498 acres in 1919 against 42,948 acres in 1879, and by oats, 19,197 acres in 1879 and 69,989 in 1919.

Another very notable change is the substitution of the tame grasses for the wild prairie grasses as a source of hay, and, though the table does not show this, doubtless to a considerable extent for pasture. At the maximum period some 50,000 acres of wild grasses were cut for hay; now only a little more than 4,000 acres are used for that purpose. Hay was cut from 32,167 acres of tame grasses in 1919; tame grasses were not reported 40 years ago.

Agriculture at the present time consists of the growing of grain and hay for home use and for sale. The raising of hogs, the raising and feeding of beef cattle, and to a very limited extent dairying are also carried on as coordinate industries. Garden truck and fruit are also grown to help supply in part the demands of the home, but not commercially.

To-day corn is the most important crop of the county, and the system of farming is based largely on its production. The greater part of the corn is fed on the farms to work stock, beef cattle, hogs, and dairy cows. A small part of the crop produced in the section of the county around Rudd, Rockford, and Marble Rock is sold and shipped to outside markets.

The white varieties of corn, mainly Silver King, are best liked and are grown on approximately 60 per cent of the total area. The yellow corns grown include various strains of hard dent varieties that have been selected to suit this particular region. The larger part of the corn is husked in the field; a small acreage is harvested with a binder and shocked till feeding time. About 40 to 50 per cent of the farms are equipped with silos, and a considerable quantity of corn is cut to fill these. A few fields are hogged down, and where this is to be done soy beans are generally drilled in the corn.

Corn usually is planted during the first 10 days of May. Practically all of it is checkrowed, the exception being a few small areas planted for silage. It is cultivated four or five times, the corn being laid by, as a rule, early in July. When corn follows small grain the land is plowed in the fall, then disked the following spring before planting. Where the land remains in corn for a term of years, approximately half is fall plowed and the rest is either plowed and disked in the spring or else disked without plowing. The clover land, which is nearly always pastured late, is broken in the early spring.

Oats rank next in importance to corn. This crop fits well into the general rotation, which centers around the production of corn, and during 1919 there were 69,989 acres with a production of 2,046,945 bushels, or an average of 29.2 bushels per acre. The varieties best liked are the Green Russian and Iowar. The Richland (Iowa 105) and Albion (Iowa 103) have been used, but, as they produce less straw, are not as satisfactory. Practically the entire crop is threshed on the farms and more than 50 per cent of the crop is used as feed for the work stock, hogs, and beef cattle. The rest is marketed within 90 days after threshing, being shipped through elevators to outside markets.

Timothy and clover supply the most of the hay, which ranks third amongst the crops of the county. To these crops, grown separately and together, 31,682 acres were devoted in 1919. The clover is generally seeded with oats as a nurse crop. In the fall timothy is sown.

The following year the first crop of clover is cut for hay and the second is often pastured. A small acreage on the better type of farms is turned under as a green-manuring crop. Timothy occupies the land for a year or so and is cut for hay after the clover has disappeared. In addition to the above hay crops, a considerable acreage of other cultivated grasses and wild grasses were cut. The larger part of the hay crop is fed on the farms of the county, although a small surplus is shipped each year.

Barley is grown on a number of farms and during 1919 occupied 2,546 acres, with a production of 68,966 bushels, or an average of 27 bushels per acre. The crop is substituted for oats in the general rotation. The entire output is fed on the farms.

The acreage in wheat as reported in the 1920 census was slightly less than that for barley. In 1879 the area was 90,374 acres; in 1919 only 2,087 acres. This decrease in acreage has been due probably to the fact that it is not here as profitable a crop as corn and oats. Practically all the wheat is sold and shipped to markets outside the county.

Rye, buckwheat, flax, and sorghum are grown on a small scale for local consumption. The buckwheat and flax are generally used as catch crops when rains prevent the planting of corn. In the western part of the county a considerable area is devoted to the production of Pearl and Japan millet seed. Soy beans also are grown, generally with corn, when this crop is to be used for silage or hogged down. The year of the survey a small acreage was in onions, the product being sold locally or shipped to outside markets.

Alfalfa is not an extensive crop. The farm bureau has demonstrated that by liming the soil and inoculating the seed excellent results can be had. Throughout the residual areas west of Rockford even liming is unnecessary, as the disintegrated limestone lies within the 3-foot section. Alfalfa, like clover, is generally sown with oats as a nurse crop. The fields should be scarified with a spring-tooth harrow at least once a year to help keep down the grass. The yields range from 3 to 4 tons an acre and the stand will last from 4 to 7 years before it is choked out by bluegrass.

Fruit growing has not developed to any great extent. Just south of Charles City there is one commercial apple orchard, and the State operates a small experimental orchard at this point. The excellent results obtained here would indicate that this industry could be profitably extended. Small orchards also are found on a number of farms, but the trees receive very little care.

The raising of hogs is important. The average farm carries from 15 to 18 brood sows, from which 60 to 70 pigs are raised each year. Duroc-Jersey and Poland-China are the breeds best liked. There are only four or five breeders of purebred animals in the county. After supplying the local demand, hogs are shipped in carload lots to Mason City and Waterloo, Iowa, and Austin, Minn.

The Iowa Year Book of Agriculture for 1920 reports that there were 31,473 beef cattle in the county, an average of 16 per farm. In spite of the smallness of these figures, this industry is the source of considerable income. Only a few farmers raise cattle, preferring to buy them late in the fall in the Omaha or Sioux City market. Good Angus and Shorthorn grades are preferred, as they seem to do best,

although a few herds of Hereford cattle were seen at pasture during the progress of the survey. Cattle are generally pastured at first on corn stubble and then put on a good feeding ration. They are either sold to buyers or shipped in carload lots by the farmers.

Dairying is a considerable interest in the county. On most farms a few milk cows are kept to supply home needs. In certain localities a surplus is sold, and where this is done the milk is gathered up by trucks and transported to the dairies. There is only one dairy in the county, although three or four are located just outside. A herd of registered Jersey cattle supplies milk and butter to a large number of the inhabitants of Charles City. The 1920 census reported that the value of dairy products, exclusive of home use, amounted to $574,391 in 1919.

The raising of poultry is an important side line, and during 1920 the total received from the sale of poultry and eggs amounted to $654,497. The products are sold locally to produce houses, which ship to outside markets.

The adaptability of certain crops to certain soils is recognized, but the farmers can not always apply this knowledge, as the land must be made to make returns. It is recognized that the Carrington, Waukesha, and Buckner soils are naturally best adapted to the growing of general farm crops in ordinary seasons. The O'Neill soils are known to be droughty and crop yields are low, especially in dry seasons. The Wabash and Lamoure soils are nearly always left in pasture, except where drained. In such places the land is well adapted to the growing of corn. The poorly drained areas of Clyde silt loam and Floyd silt loam are used for the production of wild hay.

Crop rotations are practiced in only a broad general way on the majority of farms. Corn is grown from three to five years, followed by oats, barley, or wheat one year, after which the land is seeded to timothy and clover for one or two years. On the better class of farms, however, a shorter and better rotation is practiced, consisting of corn, oats, and hay.

The land is handled in about the same way as in other counties in this section of the State. Manure is used wherever it can be had. The general practice is to pile the manure in the stable lot, where it is left till hauled out and scattered over the land. Handled in this way a considerable part of the available plant food is leached out by rains and lost before application to the land. Lime has been used in the past to considerable advantage, but during the last two years practically none has been shipped in. Commercial fertilizers are never applied.

The farm dwellings in most parts of the county are large two-story buildings, well built, modern, and in many cases attractive. Along some of the streams where limestone is available a few of the older houses and outhouses are of stone. The farmsteads are usually well laid out. The barns are spacious. There were 535 silos in the county in 1920.

Improved farm machinery is in general use. The usual equipment includes plows, gang plows, cultivators, hay rake, binder or reaper, thresher, harrows, and manure spreader. Tractors are used on a number of farms and small gas engines are quite common around dwellings, where they are used for various purposes. Some

windmills were seen. They are used mostly for pumping water for the stock. Where the farms can not be supplied with electricity by central plants, independent lighting plants are often installed.

The work stock consists of draft horses of medium and heavy weight. A few mules are used.

The labor problem on the farms is not nearly so serious as formerly. Laborers receive from $2 to $3 a day and board. For husking corn it is customary to pay 4 or 5 cents a bushel, with board. On a few farms married men are employed by the year. Such laborers receive from $40 to $50 a month, together with a house, a garden, the use of chickens and a cow, and pigs to raise on shares.

The 1920 census reports that 46.8 per cent of the farms were operated by tenants. During 1918 and 1919 most of the farms were rented on a cash basis, the rent per acre ranging from $6 to $14. Leases usually run for only one year. At present most of the land is rented on shares, the renter giving two-fifths of the crop and paying from $5 to $7 an acre for the grass and pasture land. In a few places the landlord owns half the stock and the leases are on a 50–50 basis.

The 1920 census reports that 93.3 per cent of the county was in farms and that 86.1 per cent was improved land. During the progress of the survey several large drainage districts were being ditched and tiled and within the next few years a considerable acreage will be reclaimed and made available for the growing of general farm crops.

The average estimated value of land, as reported in the 1920 census, is $169.91 per acre. Based on conditions of improvements, drainage, and location, the selling price varies considerably within the area. In the uplands, where well drained and where farm improvements are substantial and the farmstead nicely laid out, the values range from $250 to $300 an acre; in the river bottoms and more poorly drained sections of the county land brings from $100 to $200 an acre. Very little land has changed hands in recent years.

SOILS [1]

The soils of Floyd County have been developed under the influence of a native vegetation consisting of grass on the broad prairies and timber on the few areas covered originally with trees and shrubs. The grass-covered treeless areas formed the greater part of the county, embracing approximately 90 per cent of the total area.

The forested area was made up more or less of isolated tracts. The largest timbered belt lay 2 miles north of Floyd, where it covered an area of little more than 3 square miles. Two other forested areas of slightly less extent were found just west of the present village of Oakwood, along both sides of Flood Creek and 3½ miles due south of Colwell, along the west side of Little Cedar River. Other small isolated forest tracts also existed on both sides of the

[1] In a few places the soils as mapped in Floyd County do not have the same name as those mapped just across the line in Mitchell County. For example, some of the Shelby soils as mapped in Mitchell County join Dickinson soils in Floyd County. The Dickinson soils are identical with the Shelby soils in all respects except that of a more sandy or gravelly subsoil. When Mitchell County was mapped such soils were not separated from the Shelby, but since that time it has been concluded to do so and to call them Dickinson soils. The same or a similar change has taken place with regard to the Waukesha soils. Those with sandy and gravelly subsoils are called O'Neill soils.

larger streams of the county, the most conspicuous belts occurring in the vicinity of Devonia, Nora Springs, Marble Rock, and along the Little Cedar River, 3 miles northwest of Colwell.

The mean annual precipitation under which the soils of the area have developed is approximately 30 inches. This is well distributed throughout the year and is practically constant for the entire area, so that moisture differences have had no influence upon soil difference. Owing to the fact that the Iowa drift, from which nearly all these soils are weathered, contained little lime-bearing material and that this small amount was largely removed by leaching, all the soils are low in carbonates, except in sections where the decomposed Devonian limestone lies within the 3-foot section. In a number of places the underlying drift showed no effervescence at depths of several feet. The textural difference between soil and subsoil is quite noticeable, the subsoil being predominantly heavier. This characteristic is particularly noticeable in those areas where the soils have been formed under the influence of forest cover and where drainage conditions have been good for a long time.

The soils of Floyd County can therefore be divided broadly on a basis of color into light-colored soils and dark-colored soils. The last-named group can further be separated, for the sake of convenience, into two classes—those formed under conditions of poor drainage, and those developed where erosion has given greater topographic relief and consequently more complete surface and subsurface drainage.

The first main group, the light-colored soils, includes the Lindley, Roseville, and Clinton series, soils developed under the influence of a native vegetation consisting of trees. The surface layers in these soils resemble one another somewhat closely, consisting of grayish or brownish-gray to pale brownish yellow or pale-yellow floury silt loams, 6 to 12 inches deep. When in a very dry state the surface has a whitish color. In the Lindley soils the upper subsoil is a brown to pale yellowish brown silty clay loam having a granular or so-called nut structure. Below 2 feet this nut structure disappears or else the granules become larger and the texture is more compact. The subsoil of the Roseville silt loam is less granular and becomes quite heavy and compact and slightly plastic in the lower depths. The Clinton series, on the other hand, has a coarse granular structure to depths of 2 to 4 feet, below which the texture is less compact and more porous.

The group of dark-colored soils, here developed under conditions of good soil and subsoil drainage, includes the more extensive soil types of the county. The typical profile consists of a brown to dark-brown granular surface layer 8 to 16 inches thick. This is underlain by a lighter brown to brown layer having a coarser granular structure than the surface. This layer, which is the upper part of the subsoil, varies in thickness from a few inches to approximately 8 inches and rests upon a brown to yellowish-brown heavier textured stratum. The subsoil layer extends to 2½ to 3 feet or more, where normally it rests upon the parent bowlder clay, which has a yellowish-brown to brownish-gray or mottled gray and brown color.

This group includes the various members of the Carrington, Dodgeville, Dickinson, O'Neill, Buckner, Bremer, and Waukesha

series. Owing probably to the age of the material from which these soils have been derived and the active movement of the soil waters the carbonates, as a rule, have been leached away, in many places to great depths. An exception occurs in the case of the Dodgeville soils, where limestone is encountered within the 3-foot section. The Buckner soils also show in a few places either a neutral or a slightly alkaline reaction, but not enough lime is present to give effervescence with acid.

The soils of the subgroup of prairie soils developed under poor drainage conditions normally have a surface layer of dark-brown to almost black somewhat granular material. This is underlain by a dark-drab, grayish-yellow or mottled yellowish-brown and gray subsoil, typically much heavier than the surface material. In many places the surface soil is well drained, and only the subsoil has been formed under wet conditions, whereas in other areas only the lower part of the 3-foot section has been subjected to excessive moisture. Throughout some of the broad divides water has stood over the surface for long periods and the soils have formed under conditions that prevented aeration and oxidation. There is therefore a great variation in soil profiles, the details of which will be brought out in later descriptions of the individual types.

This group includes the soils that have been developed throughout the broad, flat areas in the uplands, terraces, and first bottoms, namely, the various members of the Floyd, Clyde, Bremer, Wabash, and Lamoure series. The Bremer, Wabash, and Lamoure soils represent newer material washed from the darker colored uplands, and formation of the profile has not developed to as great an extent as in the upland types.

Floyd County lies entirely within the boundaries of the Iowan drift sheet, which left thick deposits of material over the country rock of limestone. West of Rockford along Lime, Beaver, and Beemis Creeks and Ackley Run the mantle has either been entirely removed or thinned to such an extent that the underlying limestone comes within the 3-foot soil section. Outcrops of this formation also occur in other parts of the area along creeks and on high knolls. In such places the soils have been derived from the weathering of the underlying rock and are influenced to only a slight extent by material of glacial origin. After the retreat of the ice a small area along the east side of the Cedar River in the vicinity of Floyd was covered by a deposit of silty material. The soil-forming processes acting on these various materials have given place to the following groups of soils: First, soils derived from glacial drift; second, residual soils; third, wind-blown soils; fourth, terrace soils; and fifth, recent-alluvial or flood-plain soils.

Soils developed from glacial materials occupy the largest part of the county. Since the deposition of this material the surface has been materially changed, and now the topography shows differences varying from level to rolling. These differences have had considerable influence in developing the characteristics of the various soils of the county.

Throughout the greater part of the county the lower section of the soil profile and upper section of the parent drift consists of a brown to yellowish-brown rather heavy material, mottled in various

degrees with gray, and containing some sand and a few rock fragments. These rock fragments are commonly of granite, chert, and quartz. Lime-bearing rocks are never found, and the till to great depths, as observed in cuts, gives no sign of effervescence with acid. Owing to the porosity of the substratum, oxidation and aeration have extended to depths of 2 to 4 feet, which insures a healthy soil. In the flatter areas where drainage has been restricted, areas coextensive with the Floyd silt loam, the lower part of the subsoil is quite sandy, consisting as a rule of a gritty sandy clay loam. Along hillsides in the more rolling areas the underlying till, which often comes within the soil section and was observed in cuts, had a mottled gray and yellowish-brown color and a heavy compact structure. This gray mottling did not seem to be caused by poor drainage but by the weathering of some material of the parent drift. Bowlders occur throughout the drift area. These consist mostly of granite, gabbro, diorite, and basalt. Most of them are small, but a few very large ones were seen, one measuring approximately 18 feet long, 9 feet wide, and 8 feet high.

The glacial drift has been converted into its present productive state by weathering and the accumulation of a large quantity of organic matter. Where drainage has been adequate, thorough oxidation has been the result, whereas, on the other hand, weathering under poor drainage conditions has resulted in the mottling of the lower subsoil.

The glacial soils separated on a basis of color, topography, and drainage have been grouped into the Carrington, Floyd, Clyde, Lindley, and Dickinson series.

The Carrington series includes types characterized by dark-brown soils and light-brown to yellowish-brown subsoils. The soils are developed throughout the glacial uplands. The topography varies from undulating to rolling. Neither soil nor subsoil is calcareous. The series in this county includes two types, the loam and the silt loam.

The surface soils of the types in the Floyd series are dark brown to black. The subsoils are grayish brown in the upper part grading with depth into grayish brown mottled with gray and yellowish brown, the mottlings becoming yellowish and more pronounced in the lower part. This series also is derived from glacial drift. The topography is flat to very gently undulating and the natural drainage poor. The Floyd silt loam is the only type mapped.

The soils of the types in the Clyde series are dark brown to black and the subsoil is gray or yellow, typically mottled with gray and yellow. The glacial till is usually encountered within the lower part of the 3-foot soil section. The topography is level to very gently sloping, the soils occurring in depressed areas where drainage is restricted or in wide poorly drained stream channels. The types are not calcareous. Two types, the Clyde silt loam and silty clay loam, have been mapped.

The types of the Lindley series have prevailingly gray to yellowish-brown and somewhat shallow surface soils resting on a yellowish or yellowish-brown subsoil, in many places faintly mottled with gray. The subsoil is normally heavier than the soils, though in most

places containing a considerable percentage of sand and gravel. Iron concretions always appear in the lower subsoil. The topography is usually rough to rolling. Originally the type was covered with oak and hazel brush. This series is derived from glacial drift. Drainage is good to excessive. The Lindley silt loam is the only type mapped.

The Dickinson series includes types having dark-brown surface soils and a brown to yellowish-brown subsoil. The series resembles the Carrington soils in the color of the surface and subsoil, the difference being that the Dickinson grades into sandy material, typically a fine sand to fine sandy loam, at 24 to 30 inches. The topography is undulating to gently rolling and drainage is good to excessive. The Dickinson loam and fine sandy loam are mapped.

The residual soils occupy a comparatively small part of the total area. These soils have been formed largely by the weathering of material coming from the underlying limestone, although the surface soils in places have been modified to a slight extent by admixture of glacial material. Included with this group are soils in which the dark-brown surface material rests at depths varying from a few inches to 20 inches upon the limestone bed. Such soils are not strictly speaking residual, but resemble them more closely than the other groups. These residual soils are classed with the Dodgeville and Roseville series.

With the Dodgeville series are placed types having dark-brown to almost black surface soils and yellowish-brown, buff, or brown subsoils. The subsoils are rather tough and plastic and the bedrock in most areas is encountered within the 3-foot soil section. The topography ranges from smoothly rolling to hilly. Natural drainage is fair to good. The Dodgeville silt loam is the only type mapped.

The types included in the Roseville series have brownish-gray to gray surface soils and a brownish-gray, gray or mottled gray, brown, and red heavy plastic subsoil. The topography is undulating to gently sloping and drainage is moderately well established. The surface soil and subsoil are not highly calcareous. Only one type, the silt loam, is mapped in the present area.

The soils derived from loess were formed from silty material deposited by wind over the drift sheet along the east bank of the Cedar River in the vicinity of Floyd. The material as observed in cuts has a columnar structure and in places is approximately 15 feet thick, thinning out toward the east. Thin bands of very fine sand appear in this deposit in several places, commonly from 5 to 8 feet below the surface. The material has an open, porous structure and is free from carbonates, except in a few places where effervescence occurred in samples taken at considerable depth. The soils derived from this material are placed in the Clinton series.

The types of the Clinton series are characterized by gray to dark-gray soils and a light-brown to yellowish-brown compact subsoil. The subsoil ordinarily does not contain lime carbonate. The topography is rolling to broken and drainage is thorough and often excessive. The series is derived by weathering from loess.

The fourth group, or terrace soils, have been formed from old material washed from the uplands and deposited during periods of

overflow of streams but now lying above the reach of floods, owing to the cutting of deeper channels. These soils have been classed in the O'Neill, Buckner, Waukesha, Bremer, and Millsdale series.

The types included in the O'Neill series have dark-gray, dark-brown to almost black soils, underlain by a light-brown to yellowish-brown subsoil below which appears a stratum of sand and gravel. The soils are derived through weathering of glacial outwash plains or terrace material. They occupy high terraces varying in topography from nearly level to gently sloping. Neither soil nor subsoil material is calcareous. Drainage is excessive. Three types are mapped in the present survey—the O'Neill loam, silt loam, and sandy loam.

The Waukesha series includes types with brown to black surface soils and a lighter brown to yellowish-brown subsoil, which is heavier than the soils but is not compact and impervious. The topography varies from level to gently sloping and drainage is well established. The Waukesha silt loam is the only type mapped.

The surface soils of the types in the Buckner series are dark-brown to almost black and underlain by a lighter colored subsoil. Neither soil nor subsoil is calcareous. These soils are composed of material washed from dark-colored soils farther upstream. Three types, the Buckner loam, fine sandy loam, and fine sand, are mapped.

The Bremer series comprises types with black to very dark brown surface soils and a dark-gray to very dark grayish brown heavy subsoil. The different types are fairly well to poorly drained. Neither soil nor subsoil is calcareous. The topography varies from level to very gently undulating. One type, the Bremer silt loam, is mapped.

The types of the Millsdale series are characterized by dark-brown to almost black surface soils resting at a depth of 15 to 24 inches upon bedrock. The soils represent material washed within comparatively recent years from the dark-colored upland soils and deposited during periods of overflow upon rock ledges. The Millsdale loam is the only type mapped.

The flood plain soils, like the terrace soils, are formed from reworked material deposited by streams during periods of overflow, the difference being that the flood plains represent newer material. Included with this group are the few pond and swamp areas of the uplands. The alluvial soils are classed with the Wabash, Lamoure, and Meadow.

The Lamoure series includes types characterized by dark-brown to black surface soils and a yellowish-brown to gray or mottled dark-gray and yellowish-brown subsoil. The soils of this series are derived from material washed from calcareous soils and both soil and subsoil usually show strong effervescence with acid. The soils are moderately to poorly drained. One type, the Lamoure silty clay loam, is mapped.

The soils of the types in Wabash series are dark brown to black and have a high organic-matter content. The subsoil is dark olive drab to gray and heavy. Neither soil nor subsoil is calcareous. The series is typically developed in the first bottoms of streams in the central prairie States from material that has been washed from glacial and loessial soils. The soils are subject to overflow, and

drainage is generally poor. Two types, the Wabash silt loam and loam, are mapped.

Along some of the larger streams recent overflows have washed and mixed the material to such an extent that separation into types is almost impossible. Such areas are mapped as Meadow.

Throughout the uplands appear small depressed areas in which a luxuriant growth of water-loving grasses and other plants have resulted in the accumulation of masses of partly decayed matter. This has been separated and mapped as Peat and Muck, Muck representing a stage of weathering more advanced than Peat, which retains some of the original fibrous structure of the plants.

The following table gives the actual and relative extent of the various soils mapped in Floyd County; their distribution is shown by means of colors on the accompanying soil map:

Areas of different soils

Soil	Acres	Per cent	Soil	Acres	Per cent
Carrington silt loam	161,472	51.0	O'Neill sandy loam	2,560	0.8
Clyde silt loam	44,992	14.2	Buckner loam	2,240	.7
Floyd silt loam	24,448	7.7	Dickinson loam	1,216	.4
O'Neill loam	12,992	4.1	Clinton silt loam	960	.3
Lindley silt loam	9,792	3.1	Meadow	832	.3
O'Neill silt loam	9,088	2.9	Buckner fine sandy loam	512	.2
Dodgeville silt loam	8,576	2.7	Roseville silt loam	448	.1
Wabash silt loam	8,256	2.6	Peat and Muck	384	.1
Waukesha silt loam	6,656	2.1	Millsdale loam	320	.1
Carrington loam	6,400	2.0	Lamoure silty clay loam	320	.1
Dickinson fine sandy loam	5,120	1.6	Buckner fine sand	256	.1
Wabash loam	3,264	1.0			
Clyde silty clay loam	2,880	.9	Total	316,800	
Bremer silt loam	2,816	.9			

CARRINGTON LOAM

The Carrington loam consists of a brown to dark-brown mellow loam, 9 to 14 inches deep, containing a considerable percentage of coarse sand. The subsoil is a yellowish-brown heavy silt loam to silty clay loam that passes at 20 to 24 inches into a yellowish-brown gritty silty clay loam, faintly mottled with gray. The gray mottlings increase with depth until at 3 feet the mass has a mottled gray and yellowish-brown color.

Where the type is bounded by areas of Dickinson fine sandy loam the transition from one type to the other is in many places very gradual and boundaries are more or less arbitrarily drawn. Included with this type are areas of fine sandy loam and silt loam of the series too small to separate on a map of the scale used in this survey.

The principal areas of Carrington loam occupy sloping to rolling country adjacent to the larger streams. The largest most continuous bodies are developed along the east side of the Cedar River from Carrville north to a point approximately 1½ miles north of Charles City. Smaller areas occur in the vicinity of Devonia and Floyd, along both banks of the Shellrock River, and in various other parts of the upland.

Drainage is well established both in the soil and subsoil. The subsoil, though clayey enough to prevent excessive leaching, is sufficiently porous to insure thorough aeration and oxidation.

Although it does not cover a large acreage, the Carrington loam is an important agricultural type. Approximately all of it is under cultivation or in pasture, the only tree growth consisting of a few clumps of oak and hazel brush and windbreaks of evergreens, maple, ash, and elm, set out on the north and west of farm dwellings.

Corn, oats, and hay are the principal crops, with the largest acreage in corn. The entire production is fed on the farms to work stock, beef cattle, and hogs, except in years of unusually heavy yields, when a small surplus is sold for shipment to outside markets. Some rye, wheat, barley, and sorghum are grown for local consumption. Gardens are maintained on practically every farm to help supply the demands of the home. Hogs and cattle are raised and fed. These are either sold to local buyers or shipped direct to outside markets. Where fields have been limed excellent stands of clover and alfalfa are obtained.

The yields on this type are slightly lower than on the Carrington silt loam, owing probably to the lower content of organic matter. Corn yields from 32 to 50 bushels per acre, oats 25 to 50 bushels, and hay 1 to 2 tons.

The Carrington loam can be handled under wider moisture conditions than the silt loam without impairment of its physical conditions. Stable manure is used wherever it can be had. Commercial fertilizers and lime are never applied. Cultural methods used on this type are practically the same as those employed on the silt loam, as the two are generally farmed together.

The incorporation of more organic matter in the surface soil is very necessary, and legumes should have a more important place in the rotations. The use of lime is strongly urged, and when applied should be thoroughly worked into the top 2 or 3 inches, never plowed under or left on the surface. The yields on this type of soil have been increased in other areas by the use of phosphates, either in the form of acid phosphate or rock phosphate, and the application of some phosphatic fertilizer is recommended.

The price of land of this type is slightly less than that of the Carrington silt loam.

CARRINGTON SILT LOAM

The surface soil of the Carrington silt loam consists of a dark-brown silt loam, 10 to 14 inches deep, containing a relatively large proportion of fine sand, which gives it a friable structure. The subsoil is a lighter brown to yellowish-brown silty clay loam passing at 20 to 26 inches into a yellowish-brown, faintly mottled with gray and brownish yellow, sandy clay loam to sandy clay. The lower part of the 3-foot section contains much coarse sand and fine gravel, and in some places bowlders are embedded in the soil material. Both soil and subsoil are acid.

Predominantly in this county the subsoil of the Carrington, which is formed from the Iowan drift, differs from the Carrington of the Wisconsin glaciation in that the faint gray mottlings are more pronounced. While this variation is quite noticeable to the expert, the difference is not enough to justify the establishing of a new series. These gray mottlings do not seem to be caused by poor drainage, but probably are the effect of weathering of certain materials of the parent till.

The Carrington silt loam throughout the areas of its development in this county is quite uniform in both color and texture, except for a few outstanding variations. Throughout parts of sections 14 and 15, T. 95 N., R. 17 W., and sections 3, 4, 9, 10, and 11, T. 94 N., R. 17 W., the surface soil is much deeper, ranging from 16 to 20 inches, and the material below this a yellowish-brown heavy friable silt loam to silty clay loam, comparatively free from mottlings. In that part of the county lying to the east of the Cedar River, particularly in parts of sections 5 and 6, T. 97 N., R. 16 W., and sections 7, 8, 9, 15, and 16, T. 97 N., R. 15 W., a few areas occur midway of many slopes where the soil profile differs from the typical in that the surface contains a higher percentage of fine sand approaching closely a fine loam. The subsoil is a mottled gray and yellowish-brown sandy clay, containing a considerable quantity of gravel and some bowlders. Similar areas are found in sections 26 and 27, T. 94 N., R. 16 W. Included with the type are a few very small areas of fine sandy loam which are not of sufficient importance to justify separation on the map.

The Carrington silt loam, the most extensive soil in the county, covers a little more than half its total area. It is the predominant type of the upland. The topography ranges from gently rolling to strongly rolling, but over the greater part it varies from undulating to rolling, the slopes being even and long and the hill crests rounded. Along the Cedar, Little Cedar, and Shellrock Rivers, however, there occur narrow bands, from a quarter of a mile to 2 miles wide, where the relief is more pronounced. These surface characteristics have produced well-drained soils, except midway of some of the slopes where seepage spots may occur.

The Carrington silt loam is the most important and valuable agricultural soil in the county and practically all of it is suitable for farming. The area in forest is small, consisting of a few clumps of native trees along streams and the groves that have been set out on the north and west sides of farmsteads to protect them from the cold winds of winter. The trees consist mostly of oak, elm, maple, and ash, with some evergreens in the shelter belts.

Corn is the principal crop and occupies the largest acreage. The larger part is fed on the farms to work stock, hogs, beef cattle, and dairy cows. In the vicinity of Rudd, Rockford, and Marble Rock a surplus is generally produced which is sold in outside markets; around Charles City the production is not equal to the demand. Silver King is the best liked and most largely grown variety, although about 40 per cent of the acreage is planted with various strains of yellow corn. Silos are a part of the improvements on approximately 50 per cent of the farms, and a considerable acreage of corn is cut for silage. A relatively small area is hogged down, and where the crop is grown for this purpose soybeans are often drilled in with the corn.

Oats and hay are the next crops of importance. About half the production of oats is consumed on the farms; the rest is sold within 90 days and shipped through the cooperative elevators to outside markets. A surplus of hay is grown and shipped to outside markets. Wheat is a relatively unprofitable crop and only a small acreage is grown. The entire production is sold and shipped out of the county. Some barley, alfalfa, rye, buckwheat, and sorghum are

grown for home use. In the western part of the county a small acreage of Pearl and Japanese millet is grown for seed. A few fields of onions were seen during the course of the survey. When the markets are favorable a considerable income is derived from the sale of this crop.

The crop yields on the Carrington silt loam are [2] corn, ordinarily 35 to 60 bushels per acre, with the average around 37 bushels; oats, 28 to 55 bushels per acre; wheat, 10 to 18 bushels; barley, 15 to 30 bushels, and hay, 1 to 2½ tons per acre. On land in a very high state of productiveness corn may return from 50 to 90 bushels per acre.

The main livestock industries consist of the raising of hogs, the raising and feeding of beef cattle and, to a very limited extent, dairying. The general practice is to raise from 50 to 70 head of hogs annually. The hogs are sold to local buyers or shipped in carload lots to outside markets, usually Mason City, Iowa, or Austin, Minn. There are a few breeders of purebred hogs in the county. These dispose of their stock through sales. The farmers on this type usually feed on an average of one carload of cattle a year. Feeders are generally bought in the fall, held a few months, and then sold. Very few strictly dairy cows are kept, excepting one herd of registered Jersey cattle at Charles City. A small number of sheep were seen during the progress of the survey.

The Carrington silt loam is a mellow, friable soil, and cultivation can be carried on under wider moisture conditions than on some of the adjoining heavier types. The general practice is to plow from 5 to 6 inches deep. Where corn follows corn, the land is usually plowed and disked in the spring. On the better type of farms, however, fall plowing is done whenever practicable. Manure, when available, is spread on the sod land in the fall before plowing.

The farmers of the county practice a rather broad general rotation. Corn is grown from four to five years, oats one year, and clover and timothy two years. The more progressive, however, produce corn only two or three years in succession in the same field before seeding to small grain. On a number of farms the second crop of clover is often plowed under. During the last two years no lime has been used, but prior to that a considerable quantity was applied, with excellent results.

The value of land of this type ranges from $175 to $400 an acre, according to location with reference to towns and railroads and the condition of the improvements.

The Carrington silt loam is considered a valuable soil for general farming. It is easy to cultivate, and, owing to the retentive nature of the subsoil, which has a moderate degree of compactness but is not impervious, it can be brought to a high state of productiveness. This, of course, is not possible, except with the practice of the best methods, including crop rotations, in which legumes, such as clovers and soybeans, are extensively grown, both as forage and green-manuring crops. A considerable acreage of each farm should be seeded to clover every year. A more thorough preparation of the seed bed is urged, as this not only gives the roots a better chance but improves

[2] Yields are based on information received from farmers.

the moisture capacity and holding power of the soil during dry years.

The excellent stands of alfalfa obtained by some of the better farmers would indicate that the growing of this crop could be profitably extended. Apples and small fruits should also be grown more extensively. One commercial orchard is located just south of Charles City, and a very good grade of fruit produced. The State of Iowa also has an experimental orchard located on this type at Charles City.

FLOYD SILT LOAM

The surface soil of the Floyd silt loam is a dark-brown to almost black mellow silt loam, 16 to 18 inches deep. The upper subsoil is a lighter brown to grayish-brown heavy silt loam which grades at 22 to 24 inches into a grayish-brown to gray silty clay loam, mottled with gray and brownish yellow. This in turn is underlain at from 33 to 36 inches by a gritty grayish-brown sandy loam, strongly mottled with rusty brown and yellow. Iron concretions appear in many places in the lower part of the 3-foot section.

The surface soil of this type is remarkably uniform in both color and texture, a characteristic also of the subsoil, except in a few small areas, in which noticeable variations appear. Throughout the more strongly undulating areas the subsoil resembles closely the Carrington, differing from it only in that the lower 6 or 8 inches of the soil section is a mottled grayish-brown, yellow, and gray sandy clay loam to sandy clay. Such areas are small in extent, except in sections 1, 11, 12, 13, and 14, T. 94 N., R. 16 W., where this characteristic of profile prevails. In sections 20, 21, 28, and 29, T. 96 N., R. 15 W., the predominant soil is a brown to dark-brown silt loam, 8 to 10 inches deep, underlain to 14 to 18 inches by a grayish to grayish-brown silt loam. The subsoil is a grayish-yellow or yellowish-brown silty clay loam, becoming quite sandy below 30 inches. Three miles north of Powersville one area of approximately 160 acres, which embraces the adjoining corners of sections 2, 3, 10, and 11, T. 94 N., R. 16 W., occurs where the surface soil is a black heavy silt loam to silty clay loam rich in organic matter, underlain at from 18 to 22 inches by a gray silty clay loam, mottled in the lower depths with yellow and dark gray.

Included with this type are four areas that would have been separated as a different soil had they been more extensively developed. One body of about 40 acres occurs in the eastern part of section 31, T. 97 N., R. 17 W., two other very small areas lie near the center of section 5, T. 96 N., R. 17 W., and the fourth and largest, containing approximately 80 acres, extends from the southern part of section 27 south to about the center of section 34, T. 95 N., R. 17 W. Throughout such areas the predominant profile consists of a dark-brown to black silt loam, underlain at 16 to 18 inches by a yellowish-brown to grayish-brown heavy silty clay, mottled with gray, brownish red, and yellow.

The Floyd silt loam also contains small depressed areas that would have been separated as Clyde silt loam had they been sufficiently large.

Areas of the Floyd silt loam are developed in all parts of the county, the largest areas lying north of Rudd, in the extreme north-

east corner north of Colwell, and in the vicinity of Oakwood. Throughout those sections of the county that have greater relief the areas are smaller and more isolated.

The Floyd silt loam occupies broad tablelike areas in the uplands and rarely extends down the slopes. The topography varies from level to undulating. Drainage is poor and tiling necessary to fit the land for cultivated crops.

The Floyd silt loam when drained is an important farming soil, as it is extensively developed and naturally productive and durable. It is a prairie type, and the only trees consist of a few willows along old fence rows and the windbreaks that have been planted to protect the farmsteads. Owing to the poor drainage of much of the type, a considerable area is still devoted to the growing of wild hay and to pasture. Corn, oats, and hay are the most important crops. Corn occupies the largest acreage, the greater part of the crop being used as feed on the farms. Oats and hay are next in importance. A small surplus of these products is shipped out of the county annually. Wheat occupies a small area, as it is not considered a profitable crop. Some barley and rye are grown. Flax and buckwheat are often grown as catch crops when late rains prevent the planting of corn. The only special crops consist of a few fields of onions.

The crop yields on the better-drained areas compare favorably with those obtained on the Carrington silt loam, and in some cases are slightly higher. The systems of handling the Floyd silt loam are practically the same as those employed on the Carrington silt loam, except that more land is left in natural pasture. On the better farms a four-year rotation, consisting of corn, corn, oats, and hay, is extensively used. The average farmer, however, keeps the land in corn for a longer period.

Corn usually is planted in checkrows and is cultivated three to four times. Most of the corn is husked in the field, though a considerable acreage is harvested with a binder and shocked in the field, where it is left until feeding time. A small acreage is cut for silage and a few fields are hogged down. The popular varieties of oats are the Green Russian and Iowar, as they not only produce excellent yields but a considerable tonnage of straw. Clover is becoming a more important crop.

Barnyard manure is used on all farms, being spread over the stubble or grassland before plowing. Crushed limestone has been applied with excellent results. Commercial fertilizers are never used.

The livestock industries consist chiefly of hog raising and feeding a few beef cattle, bought in the fall and sold a few months later. A few sheep are kept on some of the farms to supply the local demand for lamb and mutton. Most of the farmers keep a flock of chickens, and the sale of poultry products is one source of farm income.

The Floyd silt loam sells at $175 to $275 an acre, the price varying with the character of improvements and the location.

This type is naturally very rich and, when well drained, valuable. Tiling is necessary for the best results. Liming, as well as draining, improves the physical condition of the soil, and it increases yields in part because of this action. Crushed limestone should be harrowed into the first few inches of the soil, never plowed under. Deeper

plowing, the more thorough preparation of the seed bed, and the use of rotations in which legumes play an important part are very necessary if the productiveness of this land is to be maintained or increased.

The following table shows the results of mechanical analyses of samples of the soil and upper and lower subsoil of the Floyd silt loam:

Mechanical analyses of Floyd 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*
335309	Soil, 0 to 8 inches	0.0	1.9	2.2	5.0	14.4	53.8	23.0
335310	Upper subsoil, 8 to 24 inches.	.2	1.2	1.2	2.9	12.2	54.5	27.7
335311	Lower subsoil, 24 to 36 inches.	1.4	6.4	5.8	17.6	20.2	33.1	15.6

CLYDE SILT LOAM

The surface soil of the Clyde silt loam consists of a very dark brown to black silt loam, 10 to 12 inches deep, containing a relatively high percentage of organic matter. The upper subsoil is a black silty clay loam grading at 18 to 20 inches into a gray silty clay loam to brown clay, mottled with dark gray and stained with iron. The lower part of the soil section in most places contains some fine gravel or fragments of the parent till. In some of the areas small bowlders are scattered over the surface and embedded in the soil material. Both soil and subsoil are acid.

The Clyde silt loam is quite uniform in both color and texture. Throughout the more level areas, in those localities at the head of small drainage ways where it occurs in close association with the Floyd silt loam, the transition from one type to the other is gradual. In such places the boundary lines are arbitrarily drawn. The type also includes a few very small areas of Clyde silty clay loam. Along some of the intermittent drainage ways very narrow bands of Wabash silt loam occur. These would have been mapped separately could this have been done without too great exaggeration.

The type is developed in small areas in all parts of the county. The most extensive areas lie in St. Charles Township approximately 2½ miles east of Oakwood, and in Rock Grove and Cedar Townships, here occupying the broad flats and depressions along the heads of drainage. In other parts of the county it occurs principally in narrow depressions where drainage is either lacking or poorly defined.

The Clyde silt loam owes its development to poor drainage conditions. The larger part is still in its natural undrained state. Wild grasses make excellent growth and the larger areas are used in the production of wild hay. The smaller areas are utilized as pasture.

Some of the hay is fed on the farms, a considerable quantity is sold in other parts of the county, and a very small tonnage is shipped to outside markets. In the areas where drainage is fairly well established corn gives very good yields. Oats have a tendency to lodge and are not a profitable crop. The new Iowar oat, which is

adapted to rich soils, gives best results. A few beef cattle are pastured on this type.

Crop yields on this type of soil compare favorably with those reported for the Floyd silt loam. Neither commercial fertilizer nor lime is applied to this land.

Drainage is of first consideration in the handling of this soil. Ditches should be dug and tiles laid at close enough intervals to insure free movement of the soil water. The land should be plowed under proper moisture conditions, for when too wet it clods badly and makes subsequent cultivation difficult. As the type is acid, lime would be of great benefit. Deeper plowing, more thorough preparation of the seed bed, and the use of rotations in which legumes play a part would greatly increase the returns.

The price of land of this type, owing to the poor drainage, is less than that of the Carrington and Floyd silt loams, ranging from $100 to $150 an acre.

CLYDE SILTY CLAY LOAM

The Clyde silty clay loam consists of a very dark brown to black silty clay loam, 10 to 16 inches deep. The subsoil is a gray clay or silty clay loam, mottled with dark gray and a few iron stains. Some fragments of the parent till appear in the lower part of the soil section. In the more poorly drained areas the surface soil for the upper 2 or 3 inches is in many places mucky and the subsoil more generally mottled. The proportion of organic matter in the surface soil and upper subsoil is everywhere large, which accounts for the black color.

The Clyde silty clay loam covers a small total area, the most extensive areas lying just west of Floyd Crossing and northwest of Powersville. Like the silt loam, it occupies depressions and flat areas near the head of streams and broad flat stream channels where drainage is sluggish or lacking.

The Clyde silty clay loam differs from the Clyde silt loam not only in texture but also in color, which is slightly darker, the result of larger content of organic matter, and in topographic position, which is slightly lower than that of the silt loam.

The surface of the Clyde silty clay loam is nearly level and the drainage is poor. In some areas that have not been ditched or tiled water stands over the surface for some time after rains.

A small part of this soil is cultivated in conjunction with the adjoining Carrington silt loam. Where well drained it yields as well as the latter type. Small grains are likely to lodge badly. Most of the type is in native grasses which are either cut for hay or pastured. The yield of hay ranges from 1 to 2½ tons per acre.

The type is never sold alone, being included in farms composed chiefly of Carrington and Floyd soils.

The methods suggested for the improvement of the silt loam will apply equally well to this type. Owing to its heavier texture, greater care must be exercised in handling it. Deeper plowing and the more thorough preparation of the seed bed is suggested. The type should be well ditched and tiled. Ground limestone thoroughly worked into the first few inches of the soil would improve both the physical and chemical condition.

LINDLEY SILT LOAM

The surface soil of the Lindley silt loam consists of 8 to 12 inches of grayish-brown to gray silt loam containing a considerable quantity of fine sand. When dry the surface has a whitish floury appearance. The subsoil is a brownish-yellow to yellowish-brown heavy tough sandy clay, mottled with gray and brown and containing much gravel. Some bowlders also are present in the soil and subsoil.

This type in general is quite uniform, but there are a few variations worth noting. Two miles north of Floyd the soil differs from the typical in having a more silty surface soil and a tougher and more compact subsoil. Here the surface is a gray to light-gray floury silt loam, 10 to 12 inches deep, underlain to 3 feet or more by a very compact tough gray silty clay loam to heavy silt loam, mottled with yellowish brown and bright yellow. In a few areas the subsoil contains some fine fragments of the parent till. In the zones of transition between this type and the Carrington silt loam the surface soil has a brownish-gray color and the subsoil is more uniformly a yellowish brown.

The Lindley silt loam occurs along the principal drainage ways of the county, throughout areas where the soils have developed under the influence of a forest cover. The largest areas lie along the west bank of Little Cedar River, on the east bank of Cedar River north of Floyd, northeast of Charles City, and on both sides of Flood Creek just west of Oakwood. Elsewhere the type appears in small isolated areas.

Typically the Lindley silt loam occupies gently undulating to rolling country bordering the streams, and in many places it extends down the slopes to the stream valleys. Drainage is generally sufficient for crop production. The subsoil is retentive of moisture.

This type covers a comparatively small total area. Approximately 70 per cent of it has been cleared and either put in cultivation or devoted to pasture. The tree growth consists mostly of oaks, elm, ash, and hazel.

Corn is the principal crop. Oats, barley, clover, and timothy are grown on a small scale. Practically all the grain and hay are used on the farms as feed.

The price of land of this type is lower than for the Carrington silt loam, ranging from $125 to $150 an acre.

The Lindley silt loam is deficient in organic matter. To correct this condition green-manuring crops should be grown, and crop rotations in which legumes are important are very necessary. Deeper plowing and the more thorough preparation of the seed bed also is urged. Lime would prove very beneficial.

DICKINSON FINE SANDY LOAM

The surface soil of the Dickinson fine sandy loam consists of a dark-brown to very dark brown fine sandy loam, 15 to 18 inches deep, underlain by a brownish-yellow to yellowish-brown fine sand. The surface soil in many places approaches closely a loamy fine sand to fine sand containing a relatively high percentage of organic matter.

The type is comparatively uniform both in color and texture, but some variations are notable. Thus in section 15, T. 96 N., R. 15 W., there are two small areas which have a light-brown to grayish-brown fine loam to sandy loam surface soil, 8 to 12 inches deep, underlain by a yellowish-brown sandy loam that grades with depth into a sticky sand and gravel. Included with the type also are a few areas in which the soil has the texture of a loam and a few in which it is a silt loam. These, as well as the other conspicuous variations, were present in areas too small to show on a map of the scale used in this survey.

The Dickinson fine sandy loam is developed in all parts of the county, the more important areas lying along the Cedar and Shell-rock Rivers. In other sections it occurs as small more or less isolated bodies.

The type occupies knolls, low, rounded ridges, and hillsides along the larger streams, and knolls and knobs in other parts of the county. The topography varies from rolling to hillocky. Drainage is excessive and crops suffer from droughts, except during very wet seasons.

The Dickinson fine sandy loam is not considered as valuable an agricultural soil as some of the heavier types. Nevertheless the larger part is either in cultivation or pasture. It is always farmed in conjunction with the adjoining types, the Carrington silt loam and Floyd silt loam, and the same general farm crops, corn, oats, and hay, are grown. Watermelons, cantaloupes, potatoes, and all kinds of garden truck are grown to supply the local demand. A few hogs and cattle are kept on most of the farms.

Crop yields are lower than on the Carrington and Floyd silt loams. The type is handled in practically the same way as the adjoining Carrington silt loam. It can be plowed under wider moisture conditions.

The Dickinson fine sandy loam is well adapted to the growing of melons, potatoes, and all kinds of garden truck, and the production of these crops should prove profitable where markets are available. This type in places contains less organic matter than the darker colored soils, and this constituent should be supplied by growing green-manuring crops.

This type is always sold with the adjoining soils. It has a lower value than the Carrington silt loam.

DICKINSON LOAM

The surface soil of the Dickinson loam, while ranging from a coarse sandy loam to a silt loam, is predominantly a dark-brown to very dark brown loam, 9 to 12 inches deep. The subsoil is a lighter brown or yellowish-brown loam, which at from 18 to 20 inches is underlain by a yellowish gravelly sandy clay to gravelly sandy loam. Neither soil nor subsoil is calcareous. Bowlders are embedded in the soil material. In a few places the lower part of the 3-foot section consists of a mass of sticky sand and gravel.

Small areas of silt loam in the southwestern part of the county have been included with this type. The surface soil in these areas consists of a dark-brown to very dark brown silt loam containing a

considerable amount of fine sand. It is usually deeper than the soil of the typical loam, ranging from 12 to 18 inches in thickness. The subsoil is similar to that of the typical loam.

Only a small area of this soil is developed in Floyd County. It is mapped in small isolated areas in the southern and northeastern parts of the county, where it occupies low knolls in the Carrington silt loam areas. Owing to the porous nature of the subsoil, drainage is excessive.

Corn, oats, and hay are the principal crops, with the largest acreage in corn. All the grain and hay are used on the farm. A few hogs and beef cattle are raised and a few cattle fed.

The typical Dickinson loam is unimportant agriculturally, and the only cultivated areas are those farmed in conjunction with the adjoining more extensive types. In such areas the yields are below the average for the Carrington silt loam. Grasses make an indifferent growth. The type is best suited to the growing of vegetables and small fruits. The land of this type is never sold separately.

DODGEVILLE SILT LOAM

The surface soil of the Dodgeville silt loam is a dark-brown to very dark grayish brown silt loam from 8 to 14 inches deep. This is underlain by a brown or yellowish-brown heavy silt loam or silty clay loam, resting on limestone at a depth of less than 3 feet. The type has been developed on slopes where various rock strata outcrop, and therefore the soil profile varies greatly in different places, differences depending not only on the underlying formations but also on the rate of the erosion.

In the southeastern part of the county, where the type occurs in small isolated bodies, the dark-colored silt loam may rest upon the bedrock without any considerable development of a partly weathered zone. In such areas the entire weathered soil layer is thin and in places the rock outcrops. In other places erosion has removed the dark-colored surface soil on the slopes and patches of grayish-brown or yellowish-brown material are exposed. In that part of the county west of Lime Creek and Shellrock River the areas of this type show a relatively greater exposure of the light-colored material at the surface.

The largest area of the last-described variation occurs west of Rockford along the southwest side of Lime Creek and in smaller areas on both sides of Ackley Run, Beaver, and Beemis Creeks. The topography varies from undulating to strongly rolling.

This smoother part of the Dodgeville silt loam is considered a good agricultural soil and a considerable area is devoted to the production of general farm crops. The steeper slopes and more strongly rolling areas that are unfit for cultivation are left in grass and used for pasture. The only tree growth consists of windbreaks set out to protect the farmhouses.

Land of this type is used for the production of corn, oats, and hay. Corn occupies the largest acreage and is the principal crop. All the products, except small parts of the corn and oats sold to the elevators at Rockford, are used as feed on the farms. Owing to the considerable area of the type best suited to pasture, the number of beef cattle kept is relatively large. The presence of lime within the

3-foot section favors the production of alfalfa and clover, and these crops are more extensively grown than on the adjoining Carrington silt loam. All the hay is used locally.

The more eroded areas of this type occurring in the vicinity of Devonia and in areas in all parts of the county are excessively drained and crops suffer during periods of drought.

These areas are largely used as pasture, the nearness of the bedrock to surface preventing cultivation. Bluegrass makes an excellent growth and furnishes a very good pasture.

ROSEVILLE SILT LOAM

The surface soil of the Roseville silt loam is a gray to grayish-brown silt loam, 6 to 10 inches deep. The subsoil consists of two layers, an upper one of pale-yellowish to yellowish-brown silty clay loam and a lower one, beginning at 22 to 26 inches, consisting of a gray heavy, plastic, coarse sandy clay mottled with rusty brown, orange, and red. Neither soil nor subsoil shows effervescence when treated with acid, although the bedrock of limestone lies only 4 to 5 feet below the surface. A variation is noted 1 mile north of Marble Rock. Here the type includes an area of approximately 80 acres, in which the surface soil consists of brown to very dark brown mellow silt loam, 12 to 14 inches deep, underlain by a yellowish to grayish-brown heavy silt loam grading at 20 to 30 inches into a brownish-red plastic silty clay, slightly mottled with yellow and gray.

The type is of small extent and only two areas are developed within the county. The largest, containing approximately 400 acres, lies just east of the village of Roseville; the smaller about a mile north of Marble Rock. The larger area occupies a position slightly lower than the adjoining Lindley silt loam and from 2 to 3 feet higher than the O'Neill silt loam of the terraces. The topography varies from gently undulating to gently sloping. Surface drainage is thorough, but the impervious nature of the subsoil prevents adequate subdrainage.

Practically all the Roseville silt loam is in cultivation or pasture. Corn is the most important crop. Oats and hay come next in the order named. On many farms a small acreage is devoted to wheat, barley, and rye. All the grain, except a small part of the corn and oats, which is sold and shipped out of the county, is used on the farms where produced.

The yields compare favorably with those obtained on the Carrington silt loam, corn returning 35 to 55 bushels per acre, oats 28 to 60 bushels, and hay 1 to 2 tons. In growing this crop the methods are similar to those employed on the Lindley and Carrington silt loams. The price of land of this type ranges from $225 to $275 an acre.

The Roseville silt loam can be improved by following the suggestions made for the Carrington, Lindley, and Floyd types. The incorporation of organic matter is necessary for best results, and the use of legumes for this purpose is urged. Deeper plowing and the more thorough preparation of the seed bed also would improve the yields. Tile drains would tend to increase production.

In the table below are given the results of mechanical analyses of samples of the soil and upper and lower subsoil of the Roseville silt loam:

Mechanical analyses of Roseville 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*
335304	Soil, 0 to 6 inches	0.3	5.4	4.6	10.1	16.6	50.2	13.1
335305	Upper subsoil, 6 to 24 inches	2.2	4.6	4.0	10.3	12.0	47.0	20.0
335306	Lower subsoil, 24 to 36 inches	2.4	9.4	8.8	24.2	9.2	18.2	27.9

CLINTON SILT LOAM

The surface soil of the Clinton silt loam consists of a gray to light grayish brown mellow silt loam, 10 to 14 inches deep. The upper subsoil is a dark grayish brown heavy silt loam to silty clay loam; the lower subsoil, appearing at 22 to 26 inches, a pale-yellow to grayish-yellow silty clay loam, mottled with yellow and gray. The subsoil differs from that of the typical Clinton, mapped in the eastern part of the State, in that it is not so compact. Throughout the forested areas the upper inch or two has a dark brownish gray color due to the accumulation of leaf mold.

The Clinton silt loam is developed along the east side of the Cedar River just north of the town of Floyd. It occupies the tops of the higher hills and the topography varies from gently rolling to rolling. Drainage is well established. The subsoil is retentive of moisture and crops seldom suffer from drought.

The total area of the Clinton silt loam is less than 2 square miles. Approximately 70 per cent of this is in cultivation. The forested areas support a growth chiefly of oak, maple, ash, and elm. Around the dwellings windbreaks, consisting of evergreens and maple, have been set out as a protection in winter.

This type is used for the production of corn, oats, and hay, all of which are used as feed on the farms. The yields on this type are slightly lower than on the Carrington silt loam. A few hogs and beef cattle are raised and fed.

The Clinton silt loam is handled in practically the same way as the other upland types. It is deficient in organic matter, and green-manuring crops should be grown. All available manure should be carefully husbanded and applied to the fields. Deeper, more thorough preparation of the seed bed also would improve yields.

Land of the Clinton silt loam type is valued at from $130 to $225 an acre.

O'NEILL SANDY LOAM

The O'Neill sandy loam consists of a dark-brown sandy loam, 12 to 14 inches deep, underlain by a yellowish-brown to brownish-yellow sand to coarse sand. In the lower part of the 3-foot section the content of gravel is quite high.

The O'Neill sandy loam is confined to the terraces of the Shellrock, Cedar, and Little Cedar Rivers. The most extensive areas are found along both sides of the Shellrock River, midway between

Rockford and Marble Rock, and along the east bank of the Cedar River just north of Charles City.

The type lies above the reach of ordinary overflow and occupies a position from 10 to 18 feet above the normal level of the streams, except 2½ miles south of Rockford, where a second and third terrace is developed, the O'Neill sandy loam occupying the lower bench, which is about 8 feet below the third terrace. Both surface soil and subsoil are excessively drained, and crops suffer from drought.

Practically all this type is in cultivation. It is farmed in conjunction with the adjoining O'Neill silt loam and loam, and the same crops are grown on one type as on the other. The yields on the sandy loam are slightly lower. The type is best adapted to the production of truck crops. Watermelons, cantaloupes, and potatoes do exceptionally well.

The methods recommended for the improvement of the O'Neill loam and silt loam will apply to this soil type also. The O'Neill sandy loam is valued at from $100 to $175 an acre.

O'NEILL LOAM

The surface soil of the O'Neill loam consists of a dark-brown light-textured loam 10 to 12 inches deep. The upper subsoil is a brown to yellowish-brown sandy loam extending to 20 to 24 inches; the lower subsoil is a brownish-yellow fine to medium sand containing considerable gravel. The surface soil contains a high percentage of organic matter, as indicated by the dark color. Included with the type are a few small areas of fine sandy loam and silt loam too small to be shown on the map.

The O'Neill loam occurs on the stream terraces in all parts of the county. The largest development is along the Shellrock River from a point about 3½ miles north of the confluence of Lime Creek and Shellrock River south to within 2 miles of Marble Rock. North and south of these points the old stream channel is more restricted and the areas are less extensive. Along the Cedar River the areas are smaller, except at Charles City, where there occurs a large area. The type lies from 10 to 15 feet above the normal level of the rivers and larger creeks and 8 to 10 feet above the smaller streams. The only exception to this is 3 miles south of Rockford, where the soil occupies both the second and third terraces, the second lying from 2 to 4 feet above the first bottoms and the third from 10 to 12 feet above the second. The O'Neill loam is above overflow and is excessively drained.

The O'Neill loam is extensively developed, and in spite of the fact that it is droughty and not as highly prized as the uplands approximately all of it is in cultivation or pasture. The only tree growth consists of windbreaks that have been planted to the north and west of dwellings and a few willows along old fence rows.

Corn occupies the largest acreage. All the crop, except in the country around Rockford, where a small quantity is produced and shipped out of the county, is fed on the farms. As oats fit well into the general rotations which center around the production of corn, a considerable acreage is grown annually. Some wheat, barley, rye, millet, and sorgo are grown. The type is well adapted to the production of potatoes and considerable quantities are produced to sup-

ply the farm needs and the demand in the towns of the county. The livestock industry consists of the raising of a few hogs and the raising and feeding of beef cattle.

Crop yields are below the average for the uplands, owing to the droughty nature of the soil. They are also quite variable. In wet seasons corn produces from 25 to 40 bushels per acre and oats 28 to 45 bushels.

The O'Neill loam is handled in practically the same way as the Carrington silt loam. It can, however, be plowed under wider moisture conditions without injuring the physical condition of the soil or affecting adversely the crops. Stable manure is applied to the land wherever available. Lime is never used.

Deeper plowing and the incorporation of more organic matter are necessary for best results on this type. Rotations in which legumes are important are strongly recommended. Lime would improve the physical condition of the soil and tend to increase yields in other ways. The soil is well adapted to truck crops, such as potatoes and melons.

Land of this type is held for $150 to $225 an acre, according to location and condition of improvements.

O'NEILL SILT LOAM

The O'Neill silt loam consists of a dark-brown silt loam 8 to 12 inches deep, containing a relatively large percentage of organic matter. The subsoil is a lighter brown silt loam in the upper part and below 15 to 24 inches a yellowish-brown sandy clay to sticky clayey sand containing considerable coarse sand and gravel. This in turn grades into a stratum of sticky sand and gravel.

This type is quite uniform as to color and texture, except along Flood Creek in the vicinity of Roseville, where comparatively small areas in parts of sections 9, 15, 22, 23, 26, 35, and 36, T. 95 N., R. 17 W., and section 1, T. 94 N., R. 17 W., have a lighter colored surface soil. Two other areas having this characteristic lie along the north side of the Cedar River in section 1, T. 94 N., R. 15 W.

The O'Neill silt loam occupies terraces along the rivers and creeks of the area, the largest development being along Flood Creek from the Butler County line north to the vicinity of Roseville. The type lies above overflow, occupying positions from 6 to 15 feet above the normal stream level. The topography varies from level to very gently sloping, and drainage is excessive, the soil having a tendency toward droughtiness.

The larger part of the area of this soil, approximately 85 per cent, is in cultivation; the rest is used as pasture land. Corn and oats are the principal crops, with corn occupying the larger acreage. All the grain is used on the farms. Some millet and sorghum are grown. A few cattle are pastured during wet years, the grass in such seasons making a very good growth. The principal livestock industry, however, consists of the raising of hogs.

The yields on this soil type are practically the same as on the O'Neill loam.

The methods of handling are similar to those employed on the O'Neill loam and Carrington silt loam. Fall plowing is practiced, except where corn follows corn, when the land is plowed and disked

in the early spring. Stable manure, where available, is applied to the sod or stubble fields before plowing. Land of this type is valued at $125 to $200 an acre.

The fertility of the O'Neill silt loam can be increased by the use of the methods suggested for the improvement of the Carrington silt loam. Clovers and legumes should be more extensively used in the rotations and where practicable should be turned under as green manure. Lime also would improve the condition of the soil.

The results of mechanical analyses of samples of the soil and the upper and lower subsoil of the O'Neill silt loam are given in the following table:

Mechanical analyses of O'Neill 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*
335337	Soil, 0 to 6 inches	2.0	9.4	4.8	6.4	24.8	33.1	19.7
335338	Upper subsoil, 6 to 20 inches	1.4	5.8	2.8	5.0	26.8	39.6	18.5
335339	Lower subsoil, 20 to 30 inches	12.2	34.0	16.4	24.6	2.2	7.3	3.4

WAUKESHA SILT LOAM

The Waukesha silt loam consists of a dark-brown to very dark brown mellow silt loam, 16 to 18 inches deep, underlain by a yellowish-brown heavy silt loam to silty clay loam.

Some variations of this type occur. In section 31, T. 94 N., R. 18 W., the surface soil is a dark-brown to black mellow silt loam underlain at from 16 to 20 inches by a yellowish-brown silty clay loam, faintly mottled with gray in the lower depths. Areas having similar characteristics occur along the Mitchell County line north of Devonia. North of Rockford, in section 3, T. 95 N., R. 18 W., south of Marble Rock in the southeastern part of section 21, T. 94 N., R. 17 W. and in section 33, T. 94 N., R. 15 W., are small areas in which the majority of borings indicated a loam texture. As these areas are small and the slight difference of no agricultural importance, they are included with the main type.

This soil is mainly confined to the terraces of the Shellrock River, the most extensive areas being found in the vicinity of Rockford and Marble Rock. Smaller scattered areas also occur along the Cedar and Little Cedar Rivers and most of the smaller streams of the county.

The Waukesha silt loam is above the reach of overflows. Along the smaller streams it is 4 to 6 feet above normal water level, and along Shellrock, Cedar, and Little Cedar Rivers from 12 to 20 feet above. The topography varies from level to very gently sloping. The drainage conditions are satisfactory. The soil is retentive of moisture, and crops seldom suffer from drought.

The Waukesha silt loam is considered a valuable agricultural soil, and practically 90 per cent is in cultivation or used for pasture. Wild grasses and bluegrass make vigorous growth and may either be pastured or cut for hay. The tree growth consists of a few willows along old fence rows and the windbreaks which have been set out around the farmsteads.

The principal crops are corn, oats, and hay, named in the order of their importance. Some wheat, rye, and barley also are grown. All the grain except the wheat is fed on the farms. A few beef cattle and hogs are raised and a few fed. The yields on the Waukesha silt loam compare favorably with those of the Carrington silt loam, corn producing 35 to 50 bushels per acre, oats 30 to 55 bushels, and hay 1 to 2 tons.

The methods of handling this soil are identical with those employed on the Carrington silt loam.

The price of land of this type ranges from $150 to $275 an acre, according to location and improvements.

The Waukesha silt loam can be improved in the same way as the Carrington and Floyd silt loams. The use of lime, which should always be worked into the first few inches of the surface soil, would not only improve the physical condition of this type but would tend to increase yields in other ways. Definite crop rotations should be more generally used. The growing of soybeans with the corn that is to be hogged down is recommended.

BUCKNER FINE SAND

The surface soil of the Buckner fine sand consists of a dark-brown to very dark brown fine sand to loamy fine sand, 16 to 20 inches deep. The subsoil consists of a lighter brown to yellowish-brown fine sand, and this extends to considerable depths without change.

Less than one-half square mile of the Buckner fine sand is mapped in this survey. It is confined to the terraces of the Cedar River, where it occupies low, narrow ridges ranging in width from 20 to 100 feet. It lies slightly higher than the adjoining Buckner loam and above ordinary overflows. Drainage is excessive and crops suffer from drought.

The Buckner fine sand is at present unimportant. It is left in grass or weeds, which make a very indifferent growth. If developed and properly handled, it should be well adapted to the growing of melons and other truck crops. Owing to its small extent the type is never sold separately and the price is influenced by the other soils of the farms in which it occurs.

BUCKNER FINE SANDY LOAM

The Buckner fine sandy loam consists of a dark-brown to very dark brown mellow even-textured fine sandy loam, which extends to 3 feet or more without change other than that the material in the lower part of the soil section is slightly heavier. Included with the type are a few areas of fine sand too small to be shown separately on the map.

The Buckner fine sandy loam covers in all somewhat less than 1 square mile. It is developed only on the terraces of the Cedar River, where it occurs as small areas in the bends south of Floyd and in the vicinity of Charles City. The topography varies from level to very gently undulating. Drainage is slightly excessive.

The type is used almost exclusively for the production of corn, the yields being slightly lower than on the Buckner loam. The few

areas not in cultivation carry excellent stands of grass and are valued as pastures.

The Buckner fine sandy loam is always farmed in conjunction with the adjoining Buckner loam and O'Neill loam and the same cultural methods are used as on these heavier types.

BUCKNER LOAM

The Buckner loam consists of a dark-brown to black friable loam, 20 to 22 inches deep, containing a relatively large percentage of organic matter. The subsoil is a slightly lighter brown heavy silt loam, relatively high in fine sand.

A departure from this general description appears along the western side of the Shellrock River, in section 36, T. 95 N., R. 18 W., where the dark-brown loam extends to depths of 30 to 34 inches and rests on bedrock of limestone. Small fragments of the limestone are also imbedded in the soil and subsoil in many places.

This type is developed in comparatively small areas and, except for two small areas along the east side of Little Cedar River, just west of Colwell, one west of the river, 3 miles south of Colwell, and one on Gizzard Creek, is confined to the terraces of the Shellrock and Cedar Rivers. The surface is level to very gently sloping and lies approximately 4 to 6 feet above the normal level of the streams. This is above overflow and drainage during normal years is adequate. In wet seasons, however, crops sometimes suffer from excess water.

Isolated areas of soil of silt loam texture have been included with this type on account of the small total area. These occur on the terraces of Cedar, Little Cedar, and Shellrock Rivers. Except in the texture of the surface soil it does not differ from the typical Buckner loam.

Practically all of the Buckner loam is used for the production of corn or for pasture. Corn gives yields comparing favorably with those obtained on the Waukesha silt loam, averaging from 35 to 50 bushels per acre. Grasses make excellent growth and good pasturage is available for the few head of cattle usually kept. Small numbers of hogs are carried on the farms of this type.

The Buckner loam is farmed in the same way as the adjoining Waukesha silt loam and O'Neill loam. Early spring plowing is practiced. Care is taken in the preparation of the seed bed. Manure is scarcely ever applied to this type of soil, being saved for soils that are more deficient in organic matter.

The Buckner loam is a productive type, and with the use of proper methods it can easily be maintained in this state or improved. Clovers should be grown more generally and rotations used in which these or other legumes are given place.

The type is always sold with the adjoining soils. It has about the same crop value as the Buckner fine sandy loam. It is considered a slightly better soil than the O'Neill loam.

BREMER SILT LOAM

The surface soil of the Bremer silt loam consists of 16 to 18 inches of dark-brown to very dark brown friable silt loam containing a

relatively large proportion of very fine sand and high in organic matter. The subsoil is a dark grayish brown to black silty clay, slightly mottled with rusty brown. Some variations should be noted. In places the upper subsoil is a dark-brown to grayish-brown heavy silt loam to silty clay loam grading into a black silty clay at 24 to 28 inches. Such areas, however, are of small extent. Along Beaver and Beemis Creeks and Ackley Run the surface soil is a very dark brown to black mellow silt loam 16 to 18 inches deep. The content of organic matter here is very high and the material of the upper 2 or 3 inches of the uncultivated areas is quite mucky. The upper subsoil is a brown to slightly yellowish brown or grayish-brown heavy silt loam to 24 or 30 inches. The lower subsoil is a yellowish-brown to grayish-brown silty clay loam, slightly mottled with yellow. In depressions throughout such areas the lower 3 or 4 inches of the soil section is a gritty silty clay, strongly mottled with yellow and yellowish brown. Smaller areas possessing characteristics like those just described occur along Flood Creek, in the western part of section 7, T. 94 N., R. 16 W. In section 19, T. 97 N., R. 15 W., along the Mitchell County line, the soil profile resembles closely that of the Clyde silt loam, the only real difference being that of position. Small areas along the Cedar River might have been separated out as a loam had they been of sufficient size. A few areas of silty clay loam, too small to show on the map, also are included.

The Bremer silt loam is developed on the second terraces of the Cedar, Shellrock, and Little Cedar Rivers and Flood, Beaver, and Beemis Creeks, and Ackley Run. It lies some 2 to 6 feet above the first bottoms and has a surface ranging from level to gently sloping. Drainage is only fairly well established and tiling is necessary for best results. This is particularly true of the areas along Beemis and Beaver Creeks and Ackley Run, where the movement of the soil waters has been more sluggish, resulting in the accumulation of alkali in small spots.

Approximately 50 per cent of the type is in cultivation. It is used for the production of corn and oats. On well-drained areas these crops produce excellent yields; corn 35 to 70 bushels per acre and oats 40 to 60 bushels. Oats have a tendency to lodge, but by the use of the new variety, Iowar, which is adapted to rich lands, the difficulty is largely overcome. A large acreage is left in wild grasses. These in some instances are cut for hay. A few cattle are carried on the native pastures.

The methods of handling this soil are similar to those employed on the Carrington silt loam.

The price of land of the Bremer silt loam type ranges from $100 to $200 an acre, according to location and improvements.

The Bremer silt loam is naturally a strong, rich soil, but before it can be used for the growing of general farm crops it must be drained. Owing to the impervious nature of the subsoil, the laterals should be placed relatively close together. Drainage and the application of manure will cause the alkali spots now found in this type to disappear. Deeper plowing and the more thorough preparation of the seed bed is very necessary if maximum yields are to be obtained.

MILLSDALE LOAM

The Millsdale loam is a dark-brown fine-textured loam, 8 to 12 inches deep, underlain by a brown to slightly yellowish brown loam to fine sandy loam, and this by the limestone bed at from 18 to 24 inches. In a few borings the limestone lay much nearer the surface and the dark soil extended to the bedrock. South of the Shellrock River, in sections 35 and 36, T. 95 N., R. 18 W., the surface soil approaches closely a fine sandy loam in texture and the limestone is within 8 to 15 inches of the surface.

The Millsdale loam is confined to the terraces of the Shellrock River. It occurs as rather small scattered areas lying from 4 to 6 feet above the normal level of the river, except in sections 35 and 36, T. 95 N., R. 18 W., where it is developed as both a second and third terrace, the third terrace being some 5 to 8 feet above the level of the second.

The topography is level and drainage is inclined to be excessive. As the soil material is shallow, there is not the normal reservoir for moisture and crops are likely to suffer from drought.

The Millsdale loam is unimportant and is cultivated only when included with a field of some other soil. Grasses make a very good growth, especially in wet seasons, and the areas have value as pasture land.

LAMOURE SILTY CLAY LOAM

The surface soil of the Lamoure silty clay loam is a very dark brown to black silty clay loam to heavy silt loam, with a depth of 12 to 16 inches. The organic content of this layer is high and the first inch or two in many places resembles Muck. The subsoil is a dark-gray to very dark grayish brown silty clay to clay, mottled with rusty brown. Both soil and subsoil are calcareous, the surface material effervescing more freely, as a rule, than the subsoil.

The Lamoure silty clay loam is confined to the first bottoms of Beaver Creek, where it is developed in an area varying in width from 300 feet to one-half mile. It occupies a position some 1 to 3 feet below the level of the adjoining Waukesha silt loam and 2 to 4 feet above the stream. Drainage is poor, crops on undrained land suffering from excess of moisture.

This type covers an area of one-half square mile. A very small proportion of it, probably 10 to 20 per cent, is in cultivation; the rest is used as pasture or for the production of wild hay. The cultivated area is devoted to the growing of corn. The yields are not as large as on the better drained terrace soils.

The Lamoure silty clay loam is handled in the same way as the adjoining Waukesha silt loam, except that greater care must be exercised in plowing and cultivation. The type when drained and properly protected from overflow should prove a valuable soil for the production of corn, oats, and hay. Clover and alfalfa also should do well as the soil contains much calcareous material.

Land of this type is always sold with the adjoining types. It is priced at $125 to $185 an acre.

WABASH LOAM

The Wabash loam consists of a very dark brown to black mellow loam, 15 to 18 inches deep, underlain by a dark grayish brown to black friable silty clay loam. As is characteristic of most alluvial soils, this type is quite variable, and in many places many variations appear within short distances. The surface soil, while uniformly dark colored, varies from a fine-textured loam through a fine sandy loam to sandy loam, and the subsoil ranges from a grayish fine sandy loam to a black sandy clay mottled with dark gray.

The Wabash loam is developed in the first bottoms of all the rivers and tributary streams. It occurs as narrow bands, except along Flood Creek in sections 17 and 18, T. 94 N., R. 16 W., where it spreads out to nearly half a mile wide.

The surface is level or slopes gently toward the streams. It lies only a little above the normal water level of the stream and is subject to overflow. During dry years the drainage in many places is adequate, but the type as a whole should be tiled.

Although developed in all parts of the county, this soil is unimportant from an agricultural standpoint. Very few areas are in cultivation, the larger part being left in its natural state and devoted to pasture. The only tree growth consists of a few willows along old fence rows and stream channels.

Natural grasses make a good growth and afford excellent pasturage. Corn is the principal crop. Yields ranging from 35 to 70 bushels per acre are obtained in favorable years. The native grasses yield from 1 to 2½ tons of hay per acre.

The few cultivated areas are always farmed with the adjoining types. The methods of handling the soils are practically the same. The chief requirement is drainage. Streams should be straightened and dredged out and tiles laid. When this is done the type becomes very valuable for the production of corn. Oats give very good yields, but are likely to lodge, a difficulty that can be overcome by the use of the Iowar, an oat that is adapted to rich soils. Lime would improve the physical condition of the type.

WABASH SILT LOAM

The surface soil of the Wabash silt loam consists of a dark-brown to black silt loam, 10 to 15 inches deep. The subsoil is a grayish-brown to black silty clay loam to silty clay, faintly mottled with dark gray in the lower part of the 3-foot soil section. Both soil and subsoil are rich in organic matter.

Like the loam of this series, the silt loam is variable in color and texture, the result of periodic deposition under variable conditions. In some places the textural differences are quite pronounced within short distances; in others the type extends with fair uniformity over considerable areas.

The Wabash silt loam is a first-bottom type occurring along the rivers and most of the smaller streams of the county. It occupies a position slightly lower than the loam and is subject to overflow. The drainage is poor.

Practically all of this type remains in its natural state, the only cultivated land consisting of a few of the better drained areas that

are included with adjoining soils. Corn gives very good yields where the drainage conditions are satisfactory. Grasses thrive and afford excellent pasturage for the few cattle kept.

The Wabash silt loam is a rich durable soil well adapted to the growing of corn, provided it is drained and protected from overflow. The streams should be straightened and the channels dredged out. Tiles should also be laid. The type is more difficult to handle than the loam and greater care must be exercised to plow under proper moisture conditions. Deeper plowing and the more thorough preparation of the seed bed are necessary.

MEADOW

Meadow, as mapped in this area, comprises all first-bottom soils that are so variable in both color and texture that separation into types is impracticable. The surface consists of hummocky areas ranging from sands to clay loams intricately mixed.

The type is confined to the bottoms of Little Cedar and Cedar Rivers, where it occupies a position from 2 to 4 feet above the normal level of the streams. Frequent overflows constantly alter the surface configuration. It is mostly forested with a few scattered elms, but some ash, hickory, and maple appear in the growth. Grass makes an indifferent growth. The entire area remains in its natural state and is devoted to pasture.

PEAT AND MUCK

Peat consists of a brown to very dark brown or black finely fibrous mass of partly decomposed plant remains with which is mixed a small percentage of mineral matter. This material is from 6 to 20 inches deep, where it rests upon a bed of black to grayish-black or gray material ranging in texture from fine sand to silty clay. In a number of areas the decomposition has reached the stage where the fibrous structure has entirely disappeared and where the mineral content has been increased by an inwash from adjoining types. Such areas represent Muck. Peat and Muck are so closely associated in this county and are of such small extent they have been mapped together.

Areas of Peat and Muck appear in different parts of the county. Their normal situation is in depressions along some of the intermittent drainage ways, where restricted drainage has resulted in the accumulation of large quantities of organic material. The larger areas lie in the northern part of the county in sections 21 and 26, T. 97 N., R. 16 W.

The surface of the areas mapped as Peat and Muck is flat and the natural drainage is poor, in many places the water level being very near the surface the greater part of the year.

Excepting the small areas included in cultivated fields, Peat and Muck are unreclaimed and used only for pasture. On the cultivated patches corn is grown. The yields compare favorably to those obtained on the Carrington silt loam. When reclaimed these Peat and Muck areas also are well adapted to the production of onions and potatoes.

SUMMARY

Floyd County, Iowa, is located in the northeastern part of the State. It has an area of 495 square miles, or 316,800 acres.

The topography varies from almost level to strongly rolling. Throughout some parts of the uplands the prairie retains much of its original form and the surface is quite flat, but along the master streams the relief is more pronounced and the topography more rolling. Broad terraces have been developed along the rivers and some of the larger creeks, and first bottoms occur along all the streams.

The elevation of the county above sea level varies from 1,002 to 1,250 feet, the average being approximately 1,150 feet. The prevailing slope is toward the southeast.

The county is drained by the Cedar and Shellrock Rivers and their tributaries. Over the greater part of the county drainage is adequate, but on the broader divides, where the surface is flat to gently undulating, it is not well established, and artificial drainage is necessary to fit the land for farming.

Floyd County was organized in 1851. The 1920 census gives the population as 18,860. This is almost exclusively native born. Charles City is the principal town and county seat. Rockford, Nora Springs, Marble Rock, Rudd, and Floyd are the towns next in importance.

The county has good railroad service. The wagon roads are kept in very good condition the greater part of the year, and several of the main highways are graveled or paved.

Rural mail routes and telephone lines reach all parts of the county. Churches and schools are located conveniently to serve the various communities. In a number of places the schools have been consolidated.

The principal outside markets are Chicago, Sioux City and Mason City, Iowa, and Austin, Minn.

The climate of Floyd County is healthful and well suited to the production of all crops common to this general region. The mean annual temperature is 44.6° F., although extremes of —34° F. in the winter and 108° F. in the summer have been recorded. The mean annual precipitation is 31.23 inches. There is an average growing season of 162 days.

The agriculture of Floyd County consists of the growing of corn, oats, and hay for home use and for sale. The raising and feeding of hogs and cattle and, to a less extent, dairying are also important industries.

Crop rotations are practiced only in a broad way by the majority of farmers; the more progressive use a more intensive system. Stable manure is applied wherever it can be had. Commercial fertilizers have never been used, but lime has been applied with excellent results.

Improved farm machinery is in general use. The farm dwellings are large and well built. The barns usually are large.

The work stock consists chiefly of draft horses of heavy and medium weight. A few mules are used.

Labor is more plentiful than formerly. Nearly half the farms are operated by tenants. Most of the leases are based on shares.

The price of land has shown a decided drop in the last two years. It now averages from $100 to $300 an acre according to location and condition of improvements.

Floyd County lies within the boundaries of the Iowan Drift sheet. Excepting those areas where the drift has been removed, exposing the underlying limestone, and that section where the till has been covered by a mantle of silty material, the soils have been formed by the weathering of the glacial drift. This weathering has taken place under different conditions and resulted in the development of a number of different soils. These are grouped in 15 series, and the miscellaneous types, Peat and Muck, and Meadow. The glacial soils are correlated with the Carrington, Floyd, Clyde, Lindley, and Dickinson series. The Clinton has been derived from the silty material overlying the glacial till. Where the mantle of drift has been removed the residual soils, correlated as members of the Dodgeville and Roseville series, are developed. The alluvial deposits give soils of the O'Neill, Buckner, Millsdale, Waukesha, Bremer, Wabash, and Lamoure series.

The Carrington silt loam is the most important soil in Floyd County, and practically all of it is in cultivation. Corn is the principal crop and occupies the largest acreage. Oats and hay come next in the order named. The raising and feeding of hogs and cattle and, to a less extent, dairying are the principal livestock industries.

The soils of Floyd County are comparatively high in organic matter and are productive. The fertility can be maintained and increased by the use of proper methods, including the practicing of definite crop rotations in which legumes are made important, deeper plowing, the more thorough preparation of the seed bed, and the use of lime. Tiling the more poorly drained areas is also necessary for best results.