

U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE IOWA AGRICULTURAL EXPERIMENT STATION,
C. F. CURTISS, DIRECTOR; W. H. STEVENSON, IN CHARGE OF SOIL
SURVEY; P. E. BROWN, ASSOCIATE IN CHARGE.

SOIL SURVEY OF WAYNE COUNTY,
IOWA.

BY

CLARENCE LOUNSBURY, OF THE U. S. DEPARTMENT OF AGRICULTURE, IN CHARGE, AND P. C. WIECHMANN AND DONALD S. GRAY, OF THE IOWA AGRICULTURAL EXPERIMENT STATION.

THOMAS D. RICE, INSPECTOR, NORTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1918.]



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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., April 24, 1919.

SIR: I have the honor to transmit herewith the manuscript report and map covering the survey of Wayne County, Iowa, and to recommend that they be published as advance sheets of Field Operations of the Bureau of Soils, 1918, as authorized by law. This work was done in cooperation with the Iowa Agricultural Experiment Station.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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Soil map, Wayne County sheet, Iowa.

SOIL SURVEY OF WAYNE COUNTY, IOWA.

By CLARENCE LOUNSBURY, of the U. S. Department of Agriculture, In Charge, and P. C. WIECHMANN and DONALD S. GRAY, of the Iowa Agricultural Experiment Station.—Area Inspected by THOMAS D. RICE.

DESCRIPTION OF THE AREA.

Wayne County, Iowa—area, 524 square miles or 335,360 acres—is one of the southern tier of counties situated about midway on the southern boundary of the State. It forms part of an extensive plateau having an average elevation of a little less than 1,100 feet.

It lies within the glaciated part of the United States, and on the retreat of the last ice sheet by which the region was invaded it seems to have consisted of a broad gently undulating plain. The existing topography is the result of erosion acting upon the material underlying this plain, with an apparent slight modification due to the accumulation of a few feet of silty material thought by many to be loess.

Drainage waters have been active in cutting into this plain, producing fairly deep valleys. The generally level, intervening ridges, little modified by erosion, vary in width and in outline with the local thoroughness of dissection that has taken place. The encroachment upon the flat uplands is still in progress, as shown in Plate I, the process being aided somewhat by tillage operations. Part of the eroded material has been deposited along the stream courses, forming strips of flood plain. The county may be classed in three topographic divisions, the level to undulating ridges, the flat stream bottoms, and the intervening areas, consisting of a succession of valleys and ravines separated by minor ridges. The last division has by far the greatest extent.

The valleys are generally V-shaped. They are relatively shallow as they leave the flat uplands, but gradually increase in width and depth with the joining of the tributaries, and usually the slopes become a little steeper as the lower courses are approached. The more broken uplands occur near the larger streams, particularly along Caleb Creek and along the southern slopes of the South Fork of the Chariton River. The relief is angular rather than rounded, and the

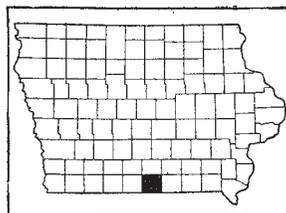


FIG. 1.—Sketch map showing location of the Wayne County area, Iowa.

lines of demarcation between the flat uplands and the valley slopes in most cases are fairly sharp.

There are no well-developed stream terraces, though a few low, fragmentary terraces remain along the South Fork of the Chariton River.

The main drainage divides follow in general the northern, western, and southern borders of the county. Along the northern border a rather narrow divide follows a sinuous course westward to the vicinity of Humeston, where it broadens out and occupies nearly all the northwestern township of Richman. From here it continues south and slightly southeastward for 12 to 15 miles, there turning eastward through Allerton to the eastern county boundary near Seymour. Extending southward to the Missouri line are three minor divides, one passing through Clio, another running from Harvard south through Sewal, and another south from Seymour through Genoa.

There is comparatively little range in elevation throughout the generally flat upland. Corydon, near the center of the county, has an elevation of 1,105 feet; Humeston, in the northwestern part, 1,104 feet; Lineville, near the southwestern corner, 1,094 feet; Seymour, at the eastern county boundary, 1,074 feet; and Allerton, about 4 miles southwest of Corydon, 1,130 feet, the highest elevation in the county.

With the exception of the North Fork of the Chariton River, which barely cuts through the northeastern corner, all the streams rise within the county. The central two-fifths, approximately, is drained by the South Fork of the Chariton River, which rises about 3 miles southwest of Allerton and flows northward for about 9 miles, where it turns to the east and continues into Appanoose County. Along the northern boundary there are several small creeks, all flowing northward and nearly all entering the North Fork of the Chariton River in Lucas County. Caleb and Steele Creeks, which have a southwesterly course, drain the western part of the county. In the southern part the drainage flows southward and is tributary to the Missouri.

Erosion has advanced until the streams have ramified into nearly all parts of the uplands and have developed well into the dendritic stage. The territory in the northwestern part of the county, around Humeston, forms the most notable exception to this rule. Here drainage ways have not become thoroughly established, and the run-off is relatively slow.

The larger streams have worn their flood plains well down toward base level and follow meandering channels. Nearly all the streams are intermittent, and in the driest part of each season even the largest streams carry little or no water. There are a few springs

in the county, mostly south of Cambria and in the western and southeastern parts of the county.

Wayne County, originally a part of Des Moines County, was organized in 1846. Settlement had begun five or six years before, by emigrants from Kentucky. These were followed by settlers from the other States to the east, especially Ohio and Indiana. Most of the present population is native American, though a small proportion is of Scandinavian and German extraction. Wayne County, according to the State census of 1915, has a population of 16,243, all of which is classed as rural. The population is well distributed and averages 30.9 persons to the square mile.

Corydon, with a population of 1,757, is the county seat and an important trading point. Seymour, with a population of 2,146, is the largest town in the county. Lincville, Clio, Allerton, Harvard, and Sewal, in the southern part, and Humeston, Cambria, and Millerton, in the northern part, are the most important of the other towns. All these places are trading and shipping points.

The county is well supplied with railroad facilities. The main line of the Chicago, Rock Island & Pacific Railway between Chicago and Kansas City passes through the southern part of the county. A branch known as the "Short Line" extends northward from Allerton through Corydon to Des Moines and points north. A branch of the Chicago, Milwaukee & St. Paul Railway passes through the southeastern corner of the county, crossing the Rock Island Railway at Seymour. The Keokuk & Western Branch of the Chicago, Burlington & Quincy Railroad enters at the eastern county boundary, passes through Corydon, and leaves the county west of Humeston. At the latter place a line of the Burlington between Chariton and St. Joseph, Mo., crosses it.

Most of the public highways follow section or other land lines. The main highways, some of which are under the supervision of the Iowa State highway commission, are well graded and kept dragged. Rural mail delivery routes and telephone service reach all parts of the county.

Coal is mined in various places in the eastern part of the county. Most of this is consumed locally, but one mine near Seymour ships coal to outside points.

Minor farm products are marketed locally and at neighboring towns of southern Iowa. Most of the live stock is shipped to Chicago, St. Louis, or Kansas City. From Corydon the distance to Chicago is 354 miles; to St. Louis, 286 miles; and to Kansas City, 156 miles.

CLIMATE.

The climate of Wayne County, like that of all southern Iowa and northern Missouri, is characterized by warm summers and moder-

ately cold winters, with occasional climatic extremes sufficient to injure crops or live stock. The temperature shows an absolute range from 112° to -31° F., but such extremes are rarely approached and are of short duration.

The average annual rainfall of 33.11 inches is well distributed throughout the year, and the rainfall is nearly always sufficient, with suitable tillage, for profitable yields. The heaviest precipitation occurs during the summer months. An average snowfall of 28.5 inches ordinarily gives good protection to grasses and winter grains.

The average date of the last killing frost in the spring is April 26, and that of the first in the fall, October 12, which gives a safe average growing season of 169 days. Killing frost has been recorded as late in the spring as May 18, however, and as early in the fall as September 22. Frequently farm work begins by the middle of March, and plowing, late gathering of crops, and pasturing usually can be carried well into December.

The accompanying table gives the normal monthly, seasonal, and annual temperature and precipitation as recorded at the Weather Bureau station at Corydon:

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

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.....	27.4	65	-20	1.42	0.19	2.39	5.9
January.....	21.8	64	-30	1.33	1.69	.81	5.8
February.....	24.4	68	-31	1.46	.41	1.16	8.7
Winter.....	24.5	68	-31	4.21	2.29	4.36	20.4
March.....	36.8	87	-14	1.90	.34	1.12	5.4
April.....	51.2	89	8	3.13	2.53	2.55	.6
May.....	61.9	92	21	4.51	4.73	4.83	.2
Spring.....	50.0	92	-14	9.54	7.60	8.50	6.2
June.....	70.3	100	37	4.29	1.34	6.04	0.0
July.....	75.5	112	48	3.77	1.89	11.57	0.0
August.....	73.9	106	43	3.56	.45	8.64	0.0
Summer.....	73.2	112	37	11.62	3.68	26.25	0.0
September.....	66.0	105	23	3.48	2.76	7.57	0.0
October.....	53.9	92	15	2.82	.14	4.60	.3
November.....	38.2	82	1	1.44	.31	2.44	1.6
Fall.....	52.7	105	1	7.74	3.21	14.61	1.9
Year.....	50.1	112	-31	33.11	16.78	53.72	28.5

AGRICULTURE.

From the date of the earliest settlements in Wayne County, which took place about 1840, near Lineville, agriculture has been the chief occupation. The early settlers found the slopes, low ridges, and smaller valleys covered with timber, mainly white oak, black oak, bur oak, hickory, walnut, ash, and locust, while the flat to gently undulating uplands and wider bottoms supported a luxuriant growth of prairie grasses. Live stock of various kinds was brought in by the settlers and had the freedom of the range.

In 1880 the principal crops were about the same as at present, except that some tobacco, broom corn, and flax were produced. During the last three decades also the production of sorghum has decreased.

The present agriculture of Wayne County consists of general farming, with particular attention given to the raising of stock, chiefly beef cattle and hogs, and to some extent sheep, horses, and mules. To a large extent the various field crops are used to support the animal industries. Corn, oats, wheat, timothy, and clover are the main field crops. Occasionally rye, barley, millet, sorghum, and buckwheat are grown. A surplus of the cereals is frequently marketed.

Corn is the leading crop in point of acreage and importance. According to the census there were 76,911 acres in corn in 1909, producing 1,945,125 bushels, or a little over 25 bushels per acre. In 1879 the area in corn was 88,081 acres and the production 3,479,724 bushels, or an average of 39.5 bushels. Yellow dent varieties, especially Reid's Yellow Dent, are most commonly grown, though white varieties, notably Silvermine, are preferred by some of the farmers. A considerable acreage of corn is cut for silage, which is being used more and more in stock feeding.

For 1909 the census reports 28,170 acres in oats, producing 667,043 bushels, or an average of 23.6 bushels per acre. The oats are generally fed on the farm, either to work stock or to meat animals. The varieties grown include the Champion, Kherson, and Iowa No. 103.

During recent years wheat has been an incidental crop, though formerly it was of some importance. The present demand for this cereal on account of war conditions has greatly increased the acreage. In 1909 there were only 1,757 acres in wheat, which produced 18,593 bushels. In 1879 there were 8,220 acres producing 67,124 bushels. Practically all the wheat is grown as a cash crop.

Rye is occasionally grown, sometimes for winter pasturage. In the spring it may be turned under as a green manure or allowed to mature. Barley and buckwheat are occasional crops. The census gives the value of all cereals produced in 1909 as \$1,363,177.

Of the hay and forage crops, timothy and clover easily lead. These two crops usually are sown together, but they are sometimes kept separate, as is frequently the case when grown for the seed. In 1909 there were 21,244 acres in timothy alone, producing 23,682 tons; 369 acres in clover alone, producing 438 tons; and 42,911 acres of mixed timothy and clover, producing 47,572 tons. In the same year there were grown 1,611 acres of millet, producing 2,118 tons, and 1,616 acres were devoted to coarse forage, of which the production was 4,068 tons.

Potatoes never have been an important crop, and they are grown primarily to supply the home, though a small surplus is sometimes marketed. In 1909, 28,697 bushels of Irish potatoes were grown, on 746 acres. These were mostly of the early-maturing varieties. Sweet potatoes were grown on a total of 6 acres, and a total of 559 acres was used for other vegetables. The vegetable crops usually satisfy the farm demand, but potatoes and other staples are shipped into the county for consumption in the various towns. Some sorghum is grown, principally for sirup, of which 2,782 gallons were produced in 1909.

Nearly every farm has a small apple orchard, but there are no commercial orchards. As a rule, very little attention is given to pruning, spraying, or other cultural methods. Some cherries, peaches, plums, and a variety of berry fruits are grown on most farms. In 1909 the total value of vegetable products is given as \$63,701, and of fruits and nuts as \$91,509.

The live-stock industry is the most important source of income. The 1910 census reports the value of all live stock sold or slaughtered in 1909 as \$1,973,715. There were included 1,489 calves, 19,451 other cattle, 49,107 hogs, and 4,478 sheep and goats. The principal breeds of beef cattle are the Shorthorn, Aberdeen-Angus, and Hereford. Few of the cattle are pure bred, though many breeders have pure-bred sires and maintain good grade herds. The hogs are mainly of the Duroc-Jersey, Poland-China, or Chester White breeds. The sheep are mostly Shropshire or Cotswold. Wool to the value of \$8,022 was produced in 1909.

As a rule, horses and mules of good quality are used in the farm work. Horses of Percheron breed are common, as well as some Belgians and Clydesdales. A large number of farmers raise one or more colts each year to maintain their work stock and for sale. Some mules are raised, though horses predominate as work stock. The census reports 3,256 horses and mules sold in 1909.

Dairying is mostly an incidental farming industry. Milk is produced largely from the beef type of cattle or those of mixed breeding. A few Jerseys, some pure-bred, and here and there some Holsteins, are kept. In February, 1918, as reported through the local

county agent, 7,624 cattle, including some heifers, were used for dairy purposes. Cream is separated on the farm and may either be sold as such or be made into butter. From farms in the vicinity of the larger towns some whole milk is marketed. The creamery at Humeston, the only one now operated in the county, receives some cream from that vicinity, and even more is said to be shipped to Ottumwa. In 1909 the dairy products sold from farms amounted to \$135,634.

On most farms flocks of 50 to 100 or more hens are kept, and on some a few turkeys, ducks, and geese are raised. The poultry and eggs produced in 1909 had a value of \$316,909.

Beekeeping is another minor industry, the value of honey produced in 1909 being \$3,635.

The general crop adaptations of the different soils are recognized by most farmers. The flatter uplands, occupied by the Grundy soils, have been found well adapted to corn and are extensively used for regular cropping. Likewise the Wabash soils, where sufficiently well drained and reasonably free from overflow, are found well suited for corn production. The more gently rolling areas of the Shelby loam are well suited for the general farm crops, and, with their free drainage, give better results in wet seasons than the more level Grundy and Wabash soils. As a rule the rougher parts of the Shelby loam are used for permanent pastures or allowed to remain in timber.

In harvesting corn the ears are snapped from the standing stalks and stored in cribs. Occasionally some corn is cut by machine or by hand, when it is desired to use the fodder for winter feeding. Corn for ensilage is cut with harvesters. Small grains are commonly thrashed from the shock, although some grain is stacked before thrashing. Most of the hay crop is stacked in the field, but a considerable quantity is stored in barn lofts.

Most of the farms of Wayne County are equipped with well-built, attractive houses, barns, and outbuildings. (See Plate I, fig. 1.) The barns are of moderate size and rarely have basement room, in contrast to the large basement barns common in dairy sections. Many farms have silos, and while these as yet are not common their number is gradually increasing. Most of the silos are of the stave type. Modern machinery, of types well suited to handle the various soils, is largely used. Among the machines found on the well-equipped farms are sulky and gang plows, disk and smoothing harrows, manure spreaders, check-row corn planters, riding cultivators, corn harvesters, grain drills and broadcast seeders, grain binders, headers, and haying tools, consisting of mowers, both dump and side-delivery rakes, tedders, loaders, and stackers. The fences are largely of barbed wire, with woven-wire bases where hogs or sheep are confined. Osage-

orange hedges are also common, but as they stunt growing crops near them and require considerable labor to keep them subdued, they are gradually being uprooted. Plowing, harrowing, and other heavy work is performed with 3 or 4 horse teams. A few gasoline tractors are in use. According to the 1910 census the average farm has 73.2 per cent of its value in land, 11 per cent in buildings, 2.4 per cent in implements, and 13.5 per cent in domestic animals.

In the preparation of the seed bed, as much as possible of the land intended for corn is plowed in the fall. The land is sometimes disked before plowing, and disked or harrowed afterwards until a suitable seed bed is worked up. Nearly all the planting is done with a check-row planter, except where the crop is grown for ensilage, when it may be drilled. Planting is done ordinarily during the first half of May. A light smoothing harrow is generally used after the crop is planted, to create a mulch and leave a smooth, even surface. Several cultivations are given before the crop is laid by.

Oats are seeded during the latter part of March and the first half of April, if possible. The land is usually prepared by disking, though sometimes it is plowed. Seeding is done with the drill or end-gate seeder. For fall wheat, which usually follows oats, the land is also usually disked, though it may be plowed early in the season and allowed to settle and compact. Many farmers prefer disking to plowing, as it results in a firmer seed bed and the stubble near the surface affords some winter protection. Better success usually follows the seeding of timothy and clover in the fall with winter grains, as the crop gets a better start to withstand the ravages of grasshoppers, which often cause serious damage. Most of the fall wheat as well as rye is sown during the latter half of September. Some spring wheat is grown, but the yields are smaller, and considering all the factors the crop is probably less profitable in a series of years than winter wheat. It is a useful crop, however, on occasions when fall-sown wheat winter kills.

Many farmers do not follow well-defined crop rotations. Not infrequently corn is grown several years in succession, especially on soils well adapted to it. Some farmers follow with good success a rotation consisting of corn two years, oats one year, and timothy and clover two or three years. Often the rotation is lengthened by letting wheat follow oats. A shorter rotation of corn and oats each for one year, followed by timothy and clover for two years, is sometimes followed.

Fertilization is confined mainly to applications of stable manure. In a few instances commercial fertilizer is used, but mostly in an experimental way. The use of lime is beginning to find favor. Occasionally a crop of clover or rye is turned under as a green manure.

The supply of farm labor has usually been sufficient, but at the time this survey was made conditions were abnormal. Many farms are operated by the farmer and members of his family. Some labor is employed by the month and occasionally by the day, especially during harvesting and corn-picking seasons. Monthly wages at present (1918) range from \$45 to \$50 with board, for efficient help. Day wages range from \$2.50 to \$3. Corn pickers are paid 7 to 8 cents a bushel.

Farms in Wayne County range in size usually from 120 to 200 acres, the holdings being larger in the rougher parts. In 1910 the average size of the farms was 164.5 acres, of which an average of 149.3 acres was improved. According to the census the average size of the farms has gradually increased during the last three decades.

In 1910, 70.8 per cent of the farms were operated by owners, 28.5 per cent by tenants, and 0.7 per cent by managers. Some tenants pay a cash rent varying from about \$5 an acre for less desirable land to about \$8 for more productive land. The usual lease is on a share basis, the crops being divided equally between landlord and tenant. Each party usually has an interest in the live stock.

Land values in Wayne County are generally advancing. According to census figures the average assessed value of land increased 113.9 per cent between 1900 and 1910. In the latter year the average assessed land value was \$62.64. According to local reports, land of the Grundy soils sells at present for \$125 to \$150 and occasionally for as much as \$200 an acre, while the Shelby loam ranges from about \$75 in the rougher localities to about \$150 for desirable, well-improved land.

SOILS.

Wayne County, situated in the glacial and loessial region of the middle West, has soils which with reference to origin fall into three classes, glacial, loessial, and alluvial. Practically all the upland is covered with glacial drift, over the higher, nearly level portions of which lies a thin mantle of fine-textured material, presumably loess. These transported soil materials are underlain by indurated rocks of the Carboniferous period.¹ A few inextensive rock exposures are found in the northeastern part of the county. A notable exposure of limestone occurs along the lower course of the South Fork of the Chariton River. These outcrops have no appreciable influence on the soils of the county.

The glacial material is composed of *débris* of a variety of rock formations, ground up by the southern advance of the ice sheets.

¹ Statements concerning geology are based on the *Geology of Wayne County*, by Melvin F. Arey, Annual Report of the Iowa Geological Survey, 1909.

With the final retreat of the glacier the rock débris, crushed to various degrees of fineness, was left over the surface and formed the material from which the principal soils of the area have been derived. Two, and possibly three, different drift sheets cover the bed-rock formations, but the drift most widely exposed and forming the greater part of the glacial soil material is the Kansan. Investigators have found from borings and mine shafts that this drift varies in thickness from about 40 to 400 feet. In general, it is shallowest in the northeastern and southwestern parts of the county and thickest in the northwestern part.

At some time subsequent to the recession of the glacier there was deposited a mantle, not exceeding 2 feet in thickness, of fine-textured material believed to be loess. The loess is usually held to be a wind-blown deposit, but some authorities hold that it may be an accumulation of glacial outwash sediment. Since its deposition the surface in places on the slopes has been severely eroded, leaving the upland in its present well-dissected condition. The flat ridge tops represent remnants of the original plain.

In the process of erosion, drainage waters have carried materials from both the glacial and loessial deposits, and with the checking of the velocities of the stream currents the sediments have been deposited and flood plains of varying widths built up.

In classifying the soils of the county, those soils having a similar origin, color, topography, and drainage are grouped in series, the members of each of which differ only in texture. The upland prairie soils largely of loessial origin are grouped in the Grundy series. This is characterized by dark-colored surface soils ranging from black to brown. The lower surface soil is lighter in color than the upper part, giving a suggestion in many places of a subsurface gray layer. The upper subsoil is heavy, and rather plastic when wet or hard when dry. It is mottled with dark drab and yellowish brown. This upper subsoil passes gradually into a layer of somewhat lighter color and coarser texture. The topography is gently rolling.

The soil of glacial origin is classed in the Shelby series. The Shelby soils are dark brown to almost black in color and are usually quite shallow. The subsoils are composed of yellow, reddish-brown, or brown, sticky sandy clay, often containing coarse sand and gravel. Lime concretions and streaks of calcareous material are frequently found in the lower subsoil. As a rule, the subsoil becomes more clayey and compact with depth. The topography is usually gently rolling to sharply rolling, as the series occurs on slopes where the sandy drift is exposed.

The alluvial soils include first-bottom on flood-plain soils, and second-bottom or terrace soils. The soil in the second bottoms is

classed in the Calhoun series and that in the first bottoms in the Wabash series.

The Calhoun series is distinguished by gray soils and gray or drab, heavy clay subsoils. The latter are characterized by a tenacious, waxy, impervious structure, and commonly contain iron concretions. In places the substratum consists of sandy material. The Calhoun soils occupy poorly drained, flat stream terraces. They are not subject to inundation, but water stands on the surface for long periods after rains. Both soil and subsoil are deficient in lime.

The members of the Wabash series have dark-brown to black soils, high in organic matter, and gray, heavy subsoils. Both soil and subsoil have a low lime content. This series is typically developed in the first bottoms of streams in the Central Prairie States, the material being derived principally from the loessial and silty glacial soils of this region. They are subject to overflow, but natural drainage is well established in some areas.

In following pages of this report the various soils of Wayne County are described in detail and their relation to agriculture discussed. The distribution of the soils is shown on the map accompanying this report, and the table below shows the name and the actual and relative extent of each:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Grundy silt loam.....	155,008	46.2	Grundy clay loam.....	3,136	0.9
Shelby loam.....	153,024	45.6	Calhoun silt loam.....	320	.1
Wabash silt loam.....	18,624	5.6			
Wabash clay loam.....	5,248	1.6	Total.....	335,360

GRUNDY SILT LOAM.

The Grundy silt loam to a depth of 8 to 10 inches is a dark grayish brown to nearly black silt loam. This is underlain by a lighter colored, mealy silt loam to silty clay loam, varying from grayish brown to brown and occasionally containing some faint yellowish mottlings and small concretions. Where the gray color is present it is developed in various degrees and in places takes the form of a thin gray layer. At 18 to 20 inches the material grades quickly into a dense, plastic clay of a drab color mottled with brown, yellowish brown, and gray. With increase in depth the general color becomes lighter and the mottling more pronounced. Throughout the subsoil there occur small rounded, dark-colored iron concretions. As mapped in narrow strips on some of the ridges in the broader areas of Shelby loam, the soil varies from typical in having a lighter color and a somewhat more friable subsoil.

On a few of the very flat divides in the southeastern part of the county the gray subsurface layer is well developed, having a thickness of 6 inches or more. The surface soil and lower subsoil are not greatly different from the typical Grundy silt loam. This soil would now be mapped with the Edina silt loam, as the Edina series has been established since this survey was made to include this variation. The most extensive developments of the gray subsurface material are found on the divides north of Harvard, between Harvard and Sewal, and in small areas west and northwest of Seymour.

The Grundy silt loam occurs throughout the upland portions of the county, occupying most of the flat ridge tops. These ridges, irregular in outline from the jutting in of numerous draws or ravines occupied by Shelby loam, vary in width from narrow, irregular, undulating crests a few hundred feet wide to broader, nearly level reaches a mile or two wide, such as is shown in Plate I, fig. 2. In general the type has fair to good drainage, though in some of the broader flat areas there is some deficiency, as the compact soil retards the ready downward percolation of water. Such areas do not admit of the best results with tile drainage.

This soil is practically all improved and regularly cultivated. Most of it was native prairie, though some of the narrow strips are said to have had a sparse growth of trees and brush. The areas in the northern part of the county are regarded as more productive than most of the type in the central and southern parts.

Most of the general farm crops are grown on this soil. Corn and oats lead in importance, but wheat and occasionally rye, barley, millet, and sorghum are grown by many farmers. Timothy and clover are important hay crops. Hog raising is a well-developed industry and furnishes a profitable means of using much of the corn crop. Some cattle, mostly of the beef type, and occasionally sheep are kept, but cattle raising is not as well established as on the Shelby and Wabash soils, which frequently form the pasture land on farms predominatingly of Grundy silt loam.

Corn on the Grundy silt loam is reported to give yields varying from 35 to 75 bushels per acre, averaging about 50 bushels; oats 30 to 65 bushels, averaging about 47 bushels; wheat 15 to 30 bushels; and hay 1 to 2 tons. Timothy seed sometimes yields as much as 10 to 12 bushels, though the usual return is around 3 to 5 bushels per acre.

Good methods of farming are generally followed on this soil. The soil is plowed usually about 5 inches deep, though some do not break the land as deeply. Much of the plowing is done in the fall, when weather conditions and opportunity permit. The soil is put in condition with disk and smoothing harrows, and tilled crops receive frequent and usually efficient cultivation. Fertilization is mostly

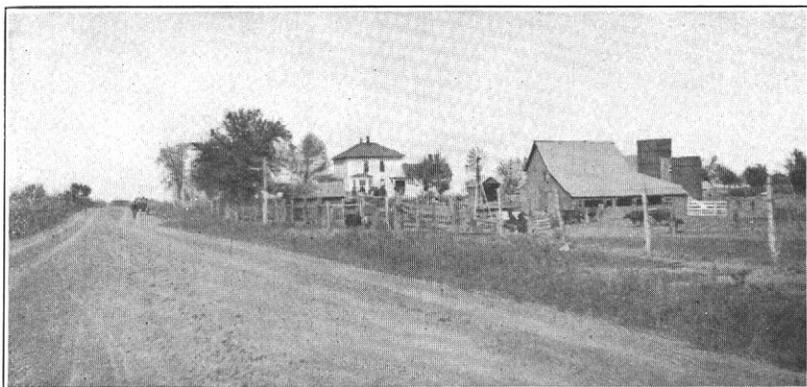


FIG. 1.—TYPICAL FARM BUILDINGS.



FIG. 2.—CHARACTERISTIC TOPOGRAPHY OF THE GRUNDY SILT LOAM.

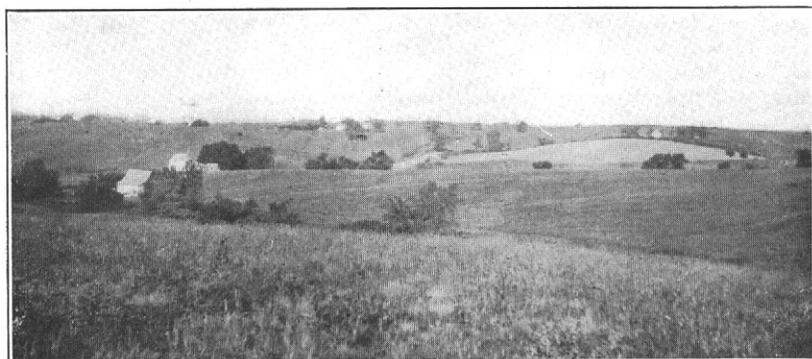


FIG. 3.—SHELBY LOAM, 5 MILES NORTH OF LINEVILLE.

Note contrast between the topography of this type and that of the Grundy silt loam in the illustration above.

confined to the use of stable manure, commercial fertilizers and green manures being employed only occasionally.

Land of this type is valued ordinarily at \$125 to \$150 an acre. Occasional well-located and better improved farms command a much higher figure.

As tests with litmus paper indicate an acid condition of this soil, it is believed that a general use of lime would prove profitable. The common lack of success in getting stands of clover also indicates a need of lime. Applications of at least 1,500 to 2,000 pounds per acre are doubtless needed to correct the acid condition. Liming in addition would improve the tilth and facilitate drainage. Applications of lime doubtless would be essential for success with alfalfa, though a few farmers have obtained satisfactory stands of this crop without having applied lime or having inoculated the soil.

In many localities more live stock, especially cattle, should be kept in order to maintain a proper balance between the cropping system and the maintenance of the soil productiveness.

GRUNDY CLAY LOAM.

The surface soil of the Grundy clay loam consists of 8 to 10 inches of dark-brown to nearly black clay loam to silty clay loam, which works up into a mellow tilth. This grades below into a dark-brown or dark-drab, dense, plastic silty clay, containing slight brownish mottlings, some apparently of concretionary nature. At about 20 inches the color becomes lighter and the mottling more pronounced, until at about 30 inches the subsoil is a mottled yellowish-brown, drab, and gray, heavy, plastic clay. Small iron concretions occur frequently in the subsoil. The subsoil, while not indurated, is usually known among the farmers as "hardpan," owing to its dense compact nature. Upon drying, the soil is subject to cracking, which is especially noticeable in untilled fields. In places the boundary line between this soil and the Grundy silt loam is drawn rather arbitrarily.

The Grundy clay loam is of comparatively small extent and is confined mostly to the northern part of the county. Its principal development is in the vicinity of Humeston, with smaller areas north of New York and near Bethlehem. Another area is located just west of Seymour. The type is found in strips one-fourth to three-fourths mile wide, or in isolated patches within areas of Grundy silt loam on nearly level divides.

As a whole the drainage is somewhat deficient, owing to the generally level surface and the dense character of the subsoil. A few slightly depressed areas are said originally to have been marshy. Apparently as a result of deficient drainage, there sometimes occur

infertile spots where faint incrustations form on the surface, resembling alkali deposits. Some tile drains have been installed.

Nearly all the type is improved, and it is mostly under cultivation. Its agricultural value, in seasons of well-distributed rainfall, is considered equal to that of the Grundy silt loam. The range of crops is about the same as on the silt loam.

Corn, a leading crop, yields as much as 60 to 70 bushels per acre in favorable seasons, but with less favorable conditions as to tilth and moisture the yields may not average over 35 to 40 bushels per acre. Oats yield 40 to 60 bushels, and wheat, 20 to 25 bushels. Good stands of hay are usually obtained, and the pastures are good. Clover usually succeeds where there is good tilth and drainage.

About the same farming methods are practiced as on the Grundy silt loam. More care has to be exercised in plowing and tilling when moisture conditions are favorable, and more draft power is needed than on the lighter textured soil. Stable manure is the principal fertilizer used.

Land values are about the same as on similar areas of the adjoining Grundy silt loam.

SHELBY LOAM.

In general the surface soil of the Shelby loam consists of about 10 inches of dark-brown loam or silty loam containing appreciable amounts of sandy material. Below the surface soil lies a brown or dull-brown stiff sandy clay loam which, with increase in depth, assumes a light-brown to yellowish-brown color more or less mottled with brown, yellow, and gray, the lighter color and deeper mottling being more pronounced below 30 inches. In the subsoil there occur some rounded, coarse gravel, and calcareous concretionary or nodular material, as well as iron concretions. Larger glacial boulders or cobbles of quartzite, granite, gneiss, limestone, and similar rocks occur more or less abundantly in the soil section and sometimes are strewn on the surface, but they are seldom numerous enough to interfere with cultivation, though occasionally they have been removed from fields. The lower subsoil and substratum, as observed in road cuts, contain lime fragments in the form of concretions or aggregates.

In many places along the lower slopes there is included with this soil a variation in which the soil is deeper, consisting of materials accumulated by creep and wash from the higher slopes. This generally consists of a dark-brown to nearly black loam to silty clay loam, 10 to 18 inches deep, overlying a dull-brown to drab, more or less loamy sandy clay, mottled in varying degrees with brown, yellowish brown, or gray. In these positions streaks and pockets of sandy materials washed from the higher elevations are of common occurrence.

In a few localities, notably along the breaks of the southern slope of the South Fork of the Chariton River, there is a light-colored

variation known locally as "white-oak land," usually occupying the narrower, irregular, projecting ridges. This consists of a light-brown or grayish-brown silt loam or silty clay loam, 6 to 8 inches deep, which passes below into a light-brown or light-drab compact silty clay to sandy clay containing in the lower part of the 3-foot section varied mottlings of yellowish brown, brown, or gray.

The Shelby loam is found in all parts of the county, associated with the Grundy silt loam. It occupies slopes and the lower rounded and sloping ridges intermediate between the stream-bottom soils and the nearly level ridge tops occupied by the Grundy silt loam. (See Pl. I, fig. 3.)

Practically every appreciable slope bordering a stream course has soil of this character. Along the larger streams it occupies broad belts which, with numerous projections bordering tributary branches, gradually become narrower toward the higher uplands.

The surface varies from sloping to rolling and broken. The rougher more broken areas are more extensively developed in the southwestern part of the county drained by Caleb Creek and its tributaries and on the slopes bordering the south side of the South Fork of the Chariton River.

Drainage in general is thorough, and in the more rolling situations often excessive. The steeper slopes, unless carefully managed, are subject to injurious erosion, and gullies often work backward into the hillsides.

A considerable proportion of this type, perhaps 50 per cent, is more or less regularly in cultivation, and it is one of the more important soils of the county. The untilled parts, usually the more broken areas, are either in permanent pasture or combined timber and pasture land. The characteristic timber growth includes red oak, black oak, bur oak, white oak, hickory, elm, ash, box elder, red haw, and hazel. In the smoother areas the appearance of many farms indicates prosperous conditions, but in the rougher localities some farms appear rather backward.

All the general farm crops, corn, oats, hay, wheat, rye, millet, sorghum, beans, potatoes, and minor crops, are grown on this soil. The raising of live stock, mostly beef cattle, with hogs and some sheep, is important.

Crop returns vary to a greater extent than on the Grundy silt loam. Corn is said to yield from 25 to 60 bushels per acre, averaging 30 to 35 bushels; oats 20 to 50 bushels, with an estimated average of 35 to 40 bushels; wheat, 15 to 20 bushels; and timothy and clover hay, from 1 to 2 tons. A little better success seems to be had with clover than on the more level Grundy soils. The pastures are largely of bluegrass, with some white clover and miscellaneous grasses, and they are almost invariably first class.

Systematic crop rotations are followed by many farmers, but some give this matter too little attention, with the result that the productivity of the soil is diminished. Stable manure is the principal fertilizer used.

The better located and improved land of this type sells at \$100 to \$150 an acre, while the rougher and more or less timbered land may not be worth over \$75 to \$85 an acre.

The foremost requirement in handling this soil is to prevent injurious erosion. This would seem to include the adopting of rather short rotations in which provision is made for frequently replenishing the supply of organic matter. This could be accomplished most efficiently by plowing under clover, rye, or similar crops. In places steep lands that should remain in permanent pasture are cultivated.

CALHOUN SILT LOAM.

The surface soil of the Calhoun silt loam consists of 8 to 10 inches of brown to dark grayish brown silt loam or silty loam, of fairly friable structure. This is underlain by a few inches of whitish or light-gray mealy silt loam, which becomes a little heavier with depth and contains faint mottlings of yellow or dull yellow. At 18 to 20 inches the subsoil becomes a dense plastic clay of dull-drab color mottled with yellow, grayish brown, and black, the color in general becoming lighter with increase in depth. Occasionally small concretions are present. Sandy variations occur frequently in both soil and subsoil along the outer margins of the terraces.

This type is found in a few small areas not exceeding one-fourth mile in width, occurring mainly along the south side of the South Fork of the Chariton River. It lies 20 to 30 feet above the adjacent first bottoms, in distinct terrace positions above overflow. The surface is fairly smooth, but the type is fairly well drained, the drainage being considerably better established than on some of the broader areas of the type in other counties.

Practically all of this soil in Wayne County is improved and used successfully for producing the usual farm crops. Clover usually thrives and good pastures are maintained.

WABASH SILT LOAM.

The Wabash silt loam consists ordinarily of about 10 inches of dark grayish brown to dark-brown, smooth, friable silt loam. This gradually merges below into a grayish-brown, compact silt loam, which is usually a little lighter colored than the surface soil and becomes heavier with increase in depth. At 20 to 24 inches the material approximates a compact, dark-drab silty clay loam or silty clay, generally mottled with gray and grayish brown.

Considerable variation in color and texture is noticed from place to place. In the narrower bottoms the soil, as a rule, is a little lighter colored than in the wider bottoms, and the subsoil frequently is a dark-brown to black silt loam, indicating that the present lighter colored surface layer has been washed over the darker colored material which formerly made up the surface soil. The soil adjacent to stream channels is of lighter texture than farther back. In some of the wider bottoms back from the stream channel the subsoil below 20 to 24 inches is a heavy, plastic, dark-drab silty clay.

The Wabash silt loam, as mapped along many of the smaller streams, and to some extent along the outer margins of the wider bottoms, includes a semialluvial or colluvial variation similar to the soil mapped in a few other surveys as a colluvial phase of the Wabash silt loam. The material varies from a dark-brown to black loam or silty loam to clay loam, overlying a drab or grayish-brown silty loam or clay loam more or less mottled with brown and light gray.

In the bottoms along the South Fork of the Chariton River in section 1 of South Fork Township and in section 36 of Wright Township is a small area of 80 to 90 acres, consisting of light-brown to grayish-brown fine sandy loam, 10 to 12 inches deep. This overlies a compact fine sandy loam of grayish to yellowish-brown color. This soil is really the Genesee fine sandy loam, but it is not separated as such on account of its small extent.

The Wabash silt loam is the most extensive first-bottom soil in the county. It is found bordering all the principal streams except in parts of the bottoms of the South Fork of the Chariton River and Caleb Creek, which are occupied by the Wabash clay loam. The type occurs in narrow strips, seldom exceeding one-fourth mile in width.

The surface is flat or nearly level, with a gentle slope in the direction of stream flow. A few areas have a slightly billowy surface caused by abandoned channels or are mildly sloping in some of the colluvial situations.

The type has fair to good drainage. Occasional overflows during the growing season sometimes damage crops, but with the clearing of some of the channels, the straightening of others, and the opening of ditches, drainage has improved and the liability to overflow has lessened.

Owing to the overflows and to the occurrence of this soil in narrow strips, which are more or less dissected by stream channels, it is not extensively used for cultivated crops. Some of the wider, better drained bottoms are in cultivation. The soil is considered productive, and often is more drought resistant than the upland soils. Most of the type remains in pasture, and it is often pastured in connection with the adjoining areas of Shelby loam. A timber growth consisting largely of elm, hickory, black walnut, willow ash, and some oak

usually borders the stream channels and often occupies more or less of the entire bottoms.

Corn is the most important and most extensively grown crop. It yields from 35 to 70 bushels, averaging about 45 bushels, per acre. As much as 75 to 80 bushels per acre is sometimes obtained. Small grains are grown to a less extent, as there is some tendency to lodge. Oats yield from 25 to 50 bushels and wheat from 15 to 20 bushels per acre. Timothy and clover do fairly well in suitable locations. Wild grasses furnish some hay. Bluegrass and white clover do well, and the pastures are maintained in good condition.

This type is managed in about the same manner as the upland soils. Some farmers plow as much of the land as possible in the fall, to insure a good seed bed in the spring. Little attention is paid to fertilization, though barnyard manures are sometimes applied.

WABASH CLAY LOAM.

The surface soil of the Wabash clay loam consists of 6 to 10 inches of dark-brown to nearly black clay loam or loamy silty clay which is rather compact in its original state, though it pulverizes well when handled under the best moisture conditions. The surface of the heavier areas tends to check and form cracks upon drying. The dark color indicates an ample supply of organic matter. The surface soil grades imperceptibly into a nearly black or dark-drab, dense, plastic clay varied with slight mottlings and with concretionary material of yellowish-brown and brown colors. Below about 30 inches the color becomes a little lighter, with more noticeable mottlings of yellow and brown. Frequently the lower subsoil contains appreciable amounts of very fine sand. This soil is relatively difficult to till, and because of its stiff structure it is locally known as "gumbo."

The Wabash clay loam occurs in the wider bottoms of the larger streams. Its principal development is along the South Fork of the Chariton River and lower Jackson Creek. Other areas occur in the bottoms of the North Fork of the Chariton River at the extreme northeastern corner of the county, and along Caleb Creek. One small area occurs along the Big Fork of the Medicine River and another along Locust Creek. The type may occupy either the whole stream bottom, as along the North Fork of the Chariton and parts of the South Fork, or may occur in detached areas, as along Caleb Creek. Where it does not occupy the whole width of the bottom it is situated back from the stream course, where relatively quiet flood waters have slowly deposited the fine sediments, while the swifter waters along the channel have laid down coarser materials, largely silt loam. Where possible, these different textures are shown on the map.

The surface of the Wabash clay loam is nearly level, and in a few swales slightly depressed. Because of the low, flat surface and the

width of the bottoms which in some cases are nearly three-quarters of a mile across, the run-off is slow, and in swales water often stands for considerable periods. Open ditches have worked some improvement in places.

The poor drainage and difficulty of tillage have discouraged any considerable development of this soil, and a large part of it remains in pasture, although the better situated areas are cultivated. Some of the broader areas are like prairie, while others have a growth of walnut, elm, willow, and several other species of trees.

Corn is the leading cultivated crop, and in favorable seasons, when the ground can be suitably prepared, it frequently gives as high yields as on the Wabash silt loam. Wet seasons or overflows, however, may cause crops to fail. Oats and wheat often give good returns, although they have some tendency to lodge. Good pastures of bluegrass and the native grasses are maintained. This soil is naturally fertile and strong, and potentially is one of the most productive soils in the county. The frequency of overflow could be lessened considerably by straightening the usually tortuous channels of the watercourses, and well-placed ditches would facilitate surface drainage.

Land of this type is considered worth \$85 to \$90 an acre.

SUMMARY.

Wayne County, Iowa, is one of the southern tier of counties of the State. It is situated about 50 miles south of Des Moines. It has an area of 524 square miles, or 335,360 acres.

The surface consists of an originally smooth plain considerably dissected by erosion. Nearly all the streams have their sources within the county. The interior of the county is drained by the eastward-flowing South Fork of the Chariton River. Flowing out of the county are smaller streams proceeding northward, southwesterly, and southerly. The smoothest area is in the northwestern part of the county, and relatively even divides stretch across near the northern, western, and south-central parts. The average elevation of the upland is about 1,100 feet.

The population of Wayne County is composed almost entirely of white persons, mostly native. According to the State census of 1915 the county has a population of 16,243. Corydon is the county seat. Seymour, Allerton, Lineville, and Humeston are other larger towns. There are good railroad facilities in all sections.

The mean annual temperature is 50.1° F., and the mean annual precipitation 33.11 inches. There is an average growing season of 169 days.

Agriculture in Wayne County consists of general farming and stock raising. Crops are grown largely to support the animal in-

dustry. The live stock consists chiefly of beef cattle, hogs, sheep, and horses. The principal crops are corn, oats, wheat, timothy, and clover. Dairying is of some importance.

The soils are classified as loessial, glacial, and alluvial. The loessial soils occupy the remnants of the original undissected plain. The glacial soils occupy the slopes resulting from erosion, and the alluvial soils, derived from material washed from the uplands, occupy the stream bottoms.

The loessial soils are classed in the Grundy series. The dark-colored Grundy silt loam occupies the ridges, which are mainly prairie. This soil is well suited to corn and general farm crops. It has fair to good drainage. The Grundy clay loam is found mostly in the northern part of the county, on the broader ridges within areas of Grundy silt loam. Drainage is somewhat deficient, but the soil is valuable for corn and general farming crops.

The only glacial soil is the Shelby loam. This is an extensive soil which occupies rolling and sloping areas intermediate between the flat uplands and the stream bottoms. It was originally timbered. The smoother areas are successfully farmed, but a considerable proportion of the type remains in pasture. It is everywhere well drained.

The alluvial soils include second-bottom and first-bottom types. The second-bottom soil is classed in the Calhoun series, and the first-bottom soils in the Wabash series. The Calhoun silt loam is a light-colored soil of small extent used for general farming. The Wabash silt loam occurs along most of the stream courses and is subject to overflow. It is a good corn soil and is also used for other crops. It furnishes good pasturage. The Wabash clay loam is developed in the wider bottoms and is subject to overflow. It is a difficult soil to handle, but fairly good yields are obtained when the rainfall is not heavy and when damaging overflows do not occur. The type affords good pasturage.



[PUBLIC RESOLUTION—No. 9.]

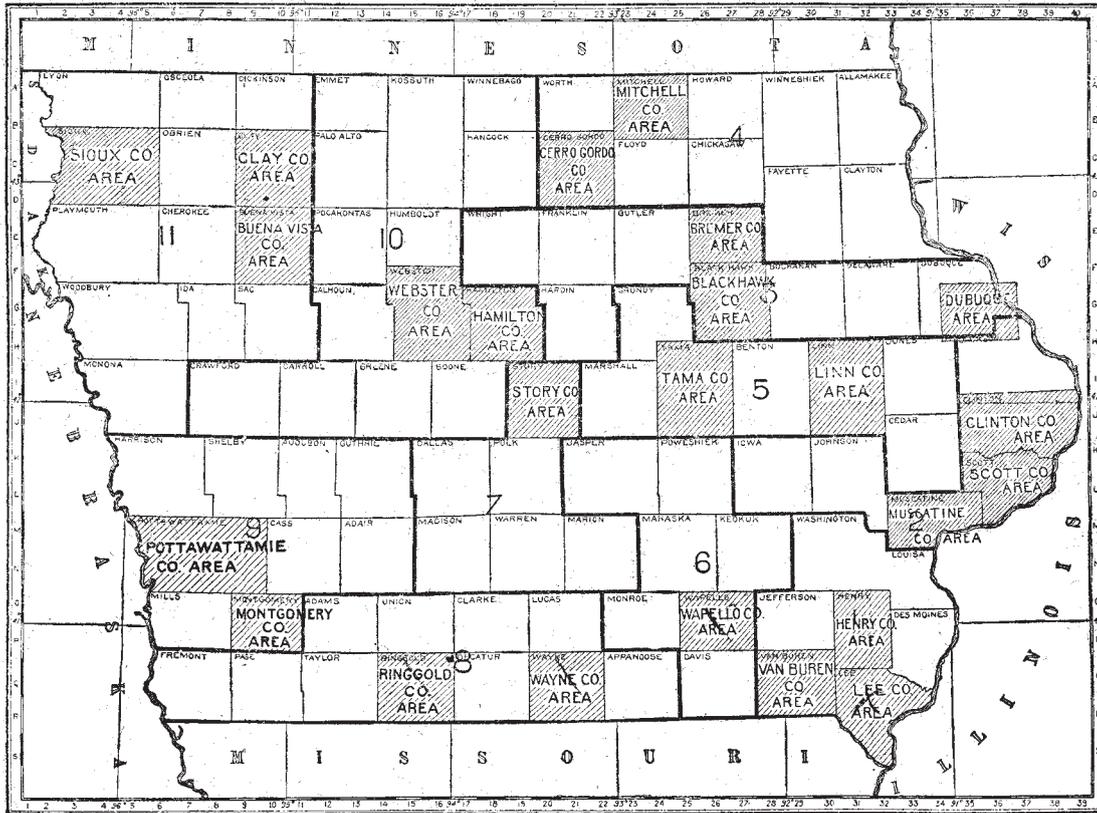
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

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

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

Approved, March 14, 1904.

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



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