WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY

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SOIL SURVEY IN COOPERATION WITH THE COLLEGE OF AGRICULTURE,
H. L. RUSSELL, DEAN.

BULLETIN NO. XXX SOIL SERIES NO. 4

SOIL SURVEY

OF

IOWA COUNTY

WISCONSIN

BY

A. R. WHITSON, W. J. GEIB, T. J. DUNNEWALD AND EMIL TRUOG

OF THE

WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY

AND

CLARENCE LOUNSBURY

OF THE

UNITED STATES DEPARTMENT OF AGRICULTURE

SURVEY CONDUCTED IN COOPERATION WITH THE UNITED STATES
DEPARTMENT OF AGRICULTURE, BUREAU OF SOILS,
MILTON WHITNEY, CHIEF.
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY.

MADISON, WISCONSIN
PUBLISHED BY THE STATE
1914

Wisconsin Geological and Natural History Survey

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INTRODUCTION

Before the greatest success in agriculture can be reached, it is necessary that the farmer should have a thorough knowledge of the soil upon his own farm. A soil may be well adapted to one crop, and poorly adapted to another crop. Clover will produce a vigorous growth and profitable yields on the average loam soil which contains lime and is in a sweet condition; but on a sandy soil which is sour, or in an acid condition, clover will not make a satisfactory growth. We may say, therefore, that failure is certain to be invited when such important facts are disregarded, or overlooked. The degree of success which it is possible to win on any farm is in direct proportion to the practical knowledge possessed by the farmer concerning the soil and its adaptation to crops. A thorough knowledge of the soil is as essential to the farmer as a knowledge of merchandise and business methods is to the merchant.

The State of Wisconsin, working in coöperation with the United States Department of Agriculture, is making a careful study of soils and agricultural conditions throughout Wisconsin, and is preparing soil maps and soil reports of all counties in the State. A soil map shows the location and extent of the different kinds of soil. Tracts of 10 acres and over are mapped, but often areas of even smaller extent are shown. The soil map is prepared by trained men, who go over a county thoroughly, and examine the soil by making a sufficient number of borings to a depth of 36 inches to keep account of all variations. A report is also made, to accompany and explain the map, and this is based upon a careful study of the soils within the region surveyed, and upon such other features as have a direct bearing upon the agriculture of the area.

It is the object of this survey to make an inventory of the

soils of the State, and to be of practical help to farmers by locating and describing the different soils, by determining their physical character and chemical composition, and by offering suggestions for their management, based upon the work of the Soil Survey within the area, covered in the report, and upon the results of field tests made by the Experiment Station.

Soil fertility depends upon two factors: first, upon the physical characteristics of the soil, such as water holding capacity, workability, etc., and second, upon the chemical composition of the material composing the soil. The chemical composition depends upon the mode of origin of the soil, and the source of material from which the soil is derived.

Water holding capacity, and other physical properties of soil all depend chiefly upon *texture,* which refers to the size of the individual soil grains, or particles. A coarse sandy soil, for example, will not retain moisture so long as a loam soil, or clay loam, because the finer the soil grains, the greater will be the total soil-grain surface area to which moisture may adhere. Texture is determined in the field by rubbing the soil between the thumb and fingers, and with experience one soon becomes expert at judging the size of soil grains. This field judgment is verified in the laboratory by a *mechanical analysis,* which is made by a simple method of separating soil grains into different groups, of which there are seven. These are known as clay, silt, very fine sand, fine sand, medium sand, coarse sand, and fine gravel.

A chemical analysis is also made of the soil to determine the amounts of various essential plant-food elements which are present. A chemical analysis shows whether the soil contains a large store of plant food, or only a small quantity, and it indicates which kinds of plant food will probably be needed first. The amount of organic matter in the soil is also determined, and tests are made to show conditions relative to soil acidity.

SOIL CLASSIFICATION.

Soils are grouped according to texture into soil classes, a *soil class* being made up of soils having the same texture, though differing in other respects. A fine sand, for example, may be light colored and of alluvial origin, while another fine sand may be dark in color and of residual origin, while a third fine sand may have been blown into sand dumes by the wind, yet all of these soils would belong to the same class, because the greater proportion of the soil grains have the same size or texture. Thus we may have different kinds of clays, loams, sands, etc., and the class to which any soil will belong depends upon the size of the individual soil grains of which it is composed, and not upon its color, origin, topographic position, or agricultural value.

SOIL CLASSES

Soils Containing Less Than 20% Silt and Clay

Coarse sand.—Over 25% fine gravel and coarse sand, and less than 50% of any other grade of sand.

Sand.—Over 25% fine gravel, coarse and medium sand, and less than 50% fine sand.

Fine sand.—Over 50% fine sand, or less than 25% fine gravel, coarse and medium sand.

Very fine sand.—Over 50% very fine sand.

Soils Containing Between 20–50% of Silt and Clay

Sandy loam.—Over 25% fine gravel, coarse and medium sand.

Fine sandy loam.—Over 50% fine sand, or less than 25% fine gravel, coarse and medium sand.

Sandy clay.—Less than 20% silt.

Soils Containing over 50% of Silt and Clay Together

Loam.—Less than 20% clay, and less than 50% silt.

Silt loam.—Less than 20% clay, and over 50% silt.

Clay loam.—Between 20 and 30% clay, and less than 50% silt.

Silty clay loam.—Between 20 and 30% clay, and over 50% silt.

Clay.—Over 30% clay.

Soils may be grouped in another way. Where soils are closely related through similar sources of the material from which derived, mode of origin, topographic position, etc., so that the different soils constitute merely a graduation in texture of otherwise uniform material, such a group is called a *soil series.* It corresponds to the family which is made up of different individuals having the same parentage. The Miami series, for examples, includes light colored, glacial material where the soils

have been derived largely from the underlying limestone, and the soils in the series range in texture from a clay loam to sand and gravel. The Plainfield series includes light colored soils in regions where no limestone is present, and where the material occurs as outwash plains or stream terraces. The soils in this series also have a wide range in texture. The name used for a soil series usually indicates the locality where that particular series was first recognized and mapped by the Soil Survey.

By uniting the name of the *soil class,* which refers to texture. with the name of the *soil series,* which refers chiefly to origin, we get the *soil type,* which is the basis or unit of classifying and mapping soils. A *soil type,* thus, is a soil which is uniform throughout its entire extent in texture, color, topographic position, and other physical properties, and having a distinct agricultural unity, that is, being adapted to the same crops, and requiring the same treatment. It is also uniform in the source of material from which it is derived, and the mode of origin which, taken together, determine the chemical composition. Since the soil type is the unit in classifying and mapping soils, and the basis upon which experimental work should be conducted, every farmer should be familiar with the soil types on his farm, and their leading characteristics.

SOIL SURVEY OF IOWA COUNTY, WISCONSIN.

CHAPTER I.

GENERAL DESCRIPTION OF AREA.

Iowa County is situated in the southwestern part of Wisconsin, in the second tier of counties north of the Illinois line. The Wisconsin River forms its northern boundary, separating it from Sauk and Richland Counties. On the east are Dane and Green Counties, on the south Lafayette County, and on the west Grant County. The county has an area of 482,560 acres, or 754 square miles, and is nearly square, being 30 miles broad from east to west and approximately 25 miles from the river to its southern boundary.

The topography is that of a deeply dissected peneplain, being characterized by elevated undulating prairies and rougher, more rugged hill country. Military Ridge, which runs in a general way from east to west through the middle of the county as a broad, elevated ridge with mainly southward projecting lobes, is a remnant of an original upland plain and divides the drainage of the country, sending it southward by tributaries of the Pecatonica River into Rock River and the Mississippi and northward into the Wisconsin River and thence into the Mississippi.

The main ridge widens out in the western part of the county into a nearly level plain, which is some 10 miles wide along the western boundary. The stream valleys just south of the ridge are bounded by gentle slopes, which become somewhat steep as the valleys widen in the southernmost part of the county. To the north of the ridge the valley sides are much

more abrupt and the topography rapidly becomes quite rugged, culminating in the bluffs along the Wisconsin River. Rocky ledges and precipitous ravines and hollows are here common along the upper stream courses.

The central ridge and projecting lobes have an elevation of 1,100 to 1,200 feet. The Wisconsin Valley bottom has an elevation of slightly over 700 feet, while stream beds in the extreme southern part of the county have an approximate elevation of 900 feet. West Blue Mound, located on the ridge at the eastern edge of the county, is the highest point, both in the county and in this part of the State, and has an elevation of approximately 1,700 feet.

The larger streams emptying into the Wisconsin Valley retain an elevation of 800 feet or less 8 miles back from the river, their greatest descent being accomplished in the first 4 or 5 miles north of Military Ridge.

The Wisconsin River, which forms the north boundary of the county, is the largest river within the State, and but for the sandy character of its bed and of the valley in general could be made navigable. Shifting sand bars and a shallow, ever-changing channel have so far discouraged all navigation within the county. The streams in this county which flow into the Wisconsin River are small creeks supplied mainly by springs on the north side of Military Ridge. These streams from west to east, successively, are Underwood, Otter, Sneed, Wyoming, Mill, and Blue Mound Creeks. Streams flowing south from the ridge are tributaries of the Pecatonica River, which traverses part of the southern edge of the county.

The Chicago, Milwaukee & St. Paul Railway line follows the river valley on the north edge of the county. Fifteen miles south, the Chicago & North Western Railway follows the prairie ridge from east to west through the county. A branch line of the Illinois Central Railroad traverses the county from its southwest corner to Dodgeville. The Mineral Point & Northern Railway follows a branch of the Pecatonica River from Mineral Point north to Highland. These railroads furnish good transportation facilities for the county.

The population of the county is 22,497, the foreign born being largely English, German, Norwegian, and Irish. Zinc and

lead mining early attracted people to the county. Many of the first settlers were from the South; later many came from more eastern States.

Dodgeville, the county seat, with a population of 2,200, and Mineral Point, in the southern part of the county, with 3,200 are the most important towns. Cobb, Edmund, Rewey, and Ridgeway on the prairie, and Arena and Avoca in the Wisconsin Valley, are the more prosperous of the smaller towns.

Excepting when snow is deep in winter, the prairie roads are good the year around. Roads on Knox silt loam are hard in dry weather, but become rather heavy in wet weather. On the sands they are often poor, but where surfaced with heavy material they are very satisfactory.

SOILS.

Iowa County is situated in the area which was not covered by ice during the glacial period. This region includes a large part of the southwestern part of the State and small portions of the three adjoining States.

The soils of this county were chiefly formed by the weathering of the underlying rocks, which are for the most part limestones with thinner beds of sandstone. Over the higher parts of the county, however, there is found an extensive layer of fine silt loam, largely free from stony material and known to geologists as "loess." This loess was brought to this section and deposited by wind. Over the more level, prairie-like areas on the western portion of Military Ridge, there has been developed a dark loess-like soil high in organic matter, covering the light colored loess which thus becomes the subsoil. This dark soil is called Marshall silt loam. On the slopes toward the north and south, however, this blanket of light colored loess becomes the surface soil, constituting Knox silt loam. Along the slopes of the highland this cover of loess becomes mixed with residual material derived by weathering from the underlying limestones and sandstones, so that very generally it would be difficult to say whether the soil was more largely of loessial or residual origin. Along the beds of valleys are occasionally found patches of loess varying in extent

from a few acres to 2 or 3 square miles. This material was washed down from the upland and redeposited in the valleys, and the large amount of organic matter present gives this material a dark color. This is the region of Wabash soils. Where material has been washed down from the loessial uplands and deposited as light colored terraces or as colluvial slopes, such soil has been classed in the Lintonia series. In addition to the Marshall silt loam and Knox silt loam, there are soils of dark color similar to the Marshall, but lying on a subsoil which is practically entirely residual material from underlying limestones and contains no loess. This soil has been named Dodgeville silt loam. Where the residual material from the sandstone rock develops sandy soils of sufficient extent, they have been mapped as the Boone series. The larger part of the terraces of the Wisconsin Valley consist of sandy and gravelly soils, the material of which was brought down by the river itself, probably during the latter part of the glacial period, when large volumes of water were formed by the melting ice. These light colored terrace soils are classed with the Plainfield series. There are also areas of Muck on these terraces caused by the growth and decay of a rank vegetation in low places, chiefly at the mouth of tributary streams. There are also some small areas of Dunesand caused by the blowing of the loose sands.

The following table gives the names and extent of the several types of soil. Their distribution is shown by means of colors in the accompanying map.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Knox silt loam	177,856	51.3	Boone fine sandy loam	5,440	1.1
Steep phase	69,504		Plainfield sandy loam	4,864	1.0
Rough stony land	57,280	11.9	Wabash loam	4,160	.9
Dodgeville silt loam	56,128	11.6	Muck	2,432	.5
Marshall silt loam	46,080	9.6	Lintonia silt loam	2,368	.5
Wabash silt loam	36,288	7.5	Dunesand	2,240	.5
Plainfield sand	9,920	2.0			
Meadow	8,000	1.6	Total	482,560	

CHAPTER II.

GROUP OF UPLAND SILT LOAM SOILS.

KNOX SILT LOAM.

Description.—The surface soil of Knox silt loam to an average depth of 10 to 12 inches consists of a light-brown or grayish friable silt loam having a soft, floury feel. The amount of organic matter in the soil is comparatively small, as is indicated by the light color. The subsoil consists of a light-brown or yellowish brown compact silt loam in which the clay content gradually increases with depth until a silty clay loam is reached at a depth of from 20 to 24 inches. This heavy material usually extends to the underlying rock which is covered to a depth of from 3 to 20 or more feet.

The depth of the surface soil is somewhat variable owing to the topographic position which this soil type occupies. On the steeper slopes the surface has been eroded to varying degrees, and frequently the heavy subsoil is exposed. Along the lower slopes the wash from the higher portions of the type has accumulated so that the depth in such places is greater than usual. Along the tops of some of the narrow ridges the soil is also shallow, and the plow frequently turns up the heavy subsoil. The texture of this type of soil is remarkably uniform.

While this soil is quite compact, it is subject to severe erosion on the steeper slopes. Hard rains start ditches in cultivated fields which subsequently become so deep that the land is ruined for the production of cultivated crops. When the ditches are once started it is difficult to prevent their progress. Brush and straw are sometimes thrown into them to catch the soil as it crumbles away, and to retard further washing, but with only partial success. On the map the steep and rougher

parts of the type are indicated by cross-lining over the color that indicates the main body of the type.

Extent and distribution.—Knox silt loam is far the most extensive type in the county, covering about 51.3 per cent of the area. It predominates on the uplands north of Military Ridge. South of the ridge it projects into the Dodgeville and Marshall silt loams along stream depressions, widening from such places into broad areas. Elevation does not seem to be a controlling factor in its development, for it is found on some hills and ridges equal in elevation to those of the prairie types. It is found about and west of Mineral Point and predominates in the southeastern part of the county.

Topography and drainage.—The surface of the type is irregular, varying from gently rolling to rolling, and is hilly and even broken in places. As a whole, it is the roughest type in the county with the exception of the Rough, stony land which is largely non-agricultural. The topography is more rough and broken in the northern than in the southern part of the county. A considerable portion of the type consists of ridges and steep slopes upon which erosion is an important factor. Owing to the uneven surface features, the natural drainage is good; and it is not at all likely that tile drains will ever be needed over any portion of the type.

Origin.—The uniform character of this type and the buff color of the subsoil, together with other field characteristics, indicate that this soil is largely of loessial origin. The material is very much like loess in character, though its exact geological origin is not thoroughly understood, and it is quite probable that it is considerably modified at least by residual material derived from the consolidated rocks of the region. In some places where the loesslike covering is thin, and where the underlying rock is limestone, it is very evident that the residual material from this formation has influenced the type to a limited extent. In other places, however, the evidence is not so clear, and the pure loessial material appears to be many feet in depth.

FIG. 1. VIEW OF KNOX SILT LOAM, SHOWING CHARACTERISTIC TOPOGRAPHY AND FARM BUILDINGS.

This type of soil covers over half of Iowa County. The foreground, and the top of the ridge near buildings, represents the typical soil, while the steep slopes leading to ravine on right are characteristic of the steep phase.

WISCONSIN GEOL. AND NAT. HIST. SURVEY. PLATE I

FIG. 2. VIEW OF STEEP SLOPE SHOWING ONE METHOD OF CROPPING TO PREVENT EROSION.

A cultivated crop may be grown on the ridge top, or gentle slope, as shown on the left, but on the steeper slopes the fields should be kept in grass as much as possible, as indicated in center of view. Where the slope is very steep, as on the right, timber should be left standing.

Native vegetation.—Originally the area of Knox silt loam was all timbered, and portions still have a growth of forest in which white, bur, and black oaks predominate. Maple, poplar, hickory, white birch, and basswood are also common species. Hazel brush is abundant on many of the steep slopes.

Agricultural development.—Dairying is the chief interest on this type of soil. Corn yields 30 to 60 bushels per acre, averaging 40 bushels. Where corn, or any tilled crop, is grown on the same land more than one year in succession, washing takes place even on comparatively gentle slopes. On some of the steeper slopes no cultivated crops are grown, and in places the native forest growth has been allowed to stand. Consequently, careful rotation and intelligent cultivation are necessary. Oats and barley yield 25 to 50 bushels per acre, averaging 30 bushels. Barley is regarded as a surer crop than oats. Wheat is now but little grown, though yields of 10 to 20 bushels can be secured. One to two tons of hay per acre is the ordinary return. Alfalfa has been tried in small patches with some success. Where the soil is deep and fairly productive, this crop should succeed. The pastures are in general excellent, but on bare ridges, where the soil is apt to be thin, they are likely to fail in dry weather.

Clovers are generally seeded with other grasses, and are also made use of in maintaining and increasing the productiveness of the land. Some farmers complain of poor stands of red clover and get better results with alsike. Medium red clover is, however, the most common and is more beneficial to the land than alsike.

Farm manures are well utilized and usually applied with manure spreaders. No commercial fertilizers are used. Farmers, as a rule, are prosperous, fences and buildings are in good repair, and a large number of modern barns are being built. Silos can not be said to be in general use, though many farms have them. Dairying has resulted in marked improvement in conditions on this type.

Methods of improvement.—Chemical analysis of Knox silt loam shows it to contain, on the average, about 900 pounds of

phosphorus in the surface 8 inches of an acre, about 35,000 pounds of potassium, and 2,700 pounds of nitrogen. These analyses are on soils taken from fields which have had the average history of farms in Iowa county. The virgin soil of that section contains considerably more phosphorus, but the years of cropping to small grains which occurred previous to the present decade have removed important quantities of that element. From now on it will be necessary for farmers on this type of soil to consider carefully the means of retaining and increasing the phosphorus content of their soils. The total potassium is sufficient to meet any demands, but its availability will depend upon the supply of actively decomposing organic matter; and the improvement of this type as a whole calls chiefly for the addition of green manuring crops in the system of rotation followed, unless, indeed, unusually large amounts of barnyard manure are available through intensive stock farming. The underlying rocks of this entire region are chiefly limestone, and where fields are on the lower slopes of hills, they are rarely acid, since lime is brought to them from the rocks lying under the higher portions of the hills. On the ridges, however, more or less acidity has developed, and each farmer should make the test for acidity * on each field, especially with reference to the growth of clover and alfalfa. Where an acid condition is found to exist, from 1,200 to 2,000 pounds of ground limestone per acre should be applied.

The question of preventing erosion is one which should be carefully considered by all farmers on Knox silt loan. It is a difficult matter to check erosion and repair the damage when once it has made considerable headway, but there are a num-

* As a number of the soils in Iowa County are in an acid condition and would be greatly benefited by the application of some form of lime, every farmer should know how to test his soil for acidity. Bulletin 230 of the Wisconsin Experiment Station on "Soil Acidity and Liming" gives the following method which can be readily applied." A very simple and reliable method to detect soil acidity is by the use of the blue litmus paper, which can be secured of any good druggist. Take a handful of moist soil and form it into a ball. Break the ball into halves and place a piece of blue litmus paper in the center on one of the halves, and cover over with the other half. After 5 minutes break the ball, and if the paper is pink in spots or over the whole end, the soil is acid." "Soil acidity is also usually indicated by the growth of certain weeds, such as sheep sorrel, horse-tail rush, corn spurry, and wood horse-tail."

ber of ways by which washing may be prevented, or at least reduced to the minimum. Figure 2, Plate I, shows an arrangement of fields which will tend to prevent erosion on the steep slopes. On the tops of ridges and on gentle slopes, cultivated crops may be grown in rotation with other crops in the usual way; but when the slope becomes so steep that the bare ground would wash to any extent, fields should be used for hay or pasture as much of the time as practicable. Where the slope is so steep that modern farm machinery cannot be used, no cultivated crops should be grown, but the fields should be kept as permanent pastures. If such slopes are in timber they should be allowed to remain so. In some instances it would doubtless be advisable to reforest some of the steep slopes which have been cleared.

Where it is found necessary to cultivate steep land, the plow should follow the contour of the hill, and narrow strips of sod should alternate with the cultivated strips. In some places strips of sod may be left running with the slope at points where most of the run off water flows. Erosion at such places will thus be held in check while the remainder of the field is being put into a grain crop and reseeded.

The dairy industry could well be developed to a higher degree on this type. More silos should be constructed, and more attention given to the growing of alfalfa. By supplementing the supply of stable manure with green manuring crops the supply of humus forming material in the soil will be enlarged, and its productivity increased.

The following table gives the average results of mechanical analyses of the soil and the subsoil of this type:

Mechanical analyses of Knox silt loam.

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.*
Soil	0.0	0.5	0.5	1.5	17.1	65.7	14.3
Subsoil	.0	.2	.3	1.0	7.5	67.3	23.5

MARSHALL SILT LOAM.

Description.—Marshall silt loam is a dark-brown or, occasionally, black silt loam, from 8 to 12 inches in depth, resting on a subsoil of compact silt loam of a light-orange, brown, or buff color, which gradually becomes somewhat lighter and the texture more compact with depth. Often the lower subsoil, though silty, has a close, rather compact claylike structure, and a layer of heavy, reddish-brown clay, containing angular, cherty limestone fragments, lies next to the rock. Where this type of soil is relatively thin, the clay stratum over the rock is in places displaced by 1 or 2 inches of yellowish sandy material due to the locally granular, crumbly character of the underlying Galena limestone. The soil is free from stones, gravel, or coarse materials. It is generally friable, loose, and contains a relatively large proportion of organic matter.

Extent and distribution.—This type is confined to the western portion of the county. The boundary between it and Dodgeville silt loam, which is placed between Dodgeville and Edmund on Military Ridge, is a more or less arbitrary one, as the two types grade imperceptibly into each other, with no sharp line of demarcation. As indicated on the map, the Chicago & North Western Railway forms a fairly good boundary on the north of the type, except below Highland. An elevated ridge bearing this soil projects north from the main prairie area to Highland. Another level ridge extends southward along the western border of the county. From near Dodgeville, westward, the prairie soil becomes deeper. The soil material ranges in depth from 3 to 4 feet near Dodgeville, to 15 or 20 feet in depth west of Edmund. A depth of 30 feet is reported in many places in the western part of the county.

Topography and drainage.—This type of soil occupies the upland prairie sections of the county, which consist of elevated ridges and level to gently rolling plains. None of the type in the county is found below an elevation of 1,000 feet above sea level. The surface is usually undulating or gently rolling, though on the broader divides it may be nearly level. There

is good natural drainage, and there is little or no necessity for artificial drainage on any of the type.

Origin.—Marshall silt loam in this area is derived from an intermixture of residual soil, from the underlying Gelena limestone, and transported silty material which is largely of loessial origin. Over the eastern portion of the type the loessial covering is thin, and the underlying residual material is often exposed in road cuts or on eroded slopes. To the west the covering becomes deeper, and along the west county line, it has a depth of over 20 feet.

Native vegetation.—This type embraces a portion of the prairie region of Iowa County and has never supported a forest growth. The native vegetation consisted chiefly of prairie grasses, with only a very limited tree growth along the borders of the prairie and adjoining stream courses.

*Agricultural development.**—Marshall silt loam is a good soil for general farming, and all portions of it are under cultivation and highly improved. The raising and feeding of beef cattle is an important industry on this type and many of the farmers turn off a considerable number of fat steers every year. Dairying is not carried on as extensively as in other parts of the area on some other types, but it appears to be increasing in favor, and this industry, along with general farming, forms the chief type of agriculture. While all of the general farm crops common to this region are successfully grown, it is probably better adapted to corn than to small grains. Corn is extensively grown and yields from 50 to 70 bushels per acre. In some localities it has been grown continuously for many years on the same fields, with no diminution of yield, care being taken to manure the land each year. Oats and barley yield from 40 to 50 bushels, barley producing a little better than oats. Hay is of good quality, yielding 1½ to 2 tons. Wheat and rye are not extensively grown. Wheat will yield 15 to 20 bushels per acre. A few years ago the chinch bug became so troublesome as greatly to discourage

* For methods of improvement of Marshall silt loam see page 25.

wheat growing. Most of the wheat grown is sown in the fall, though some spring varieties are grown. Hog and sheep raising are quite largely carried on.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of this type:

Mechanical analysis of Marshall silt loam.

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.*
Soil.....	0.0	0.5	0.3	0.6	23.1	54.0	20.9
Subsoil.....	.0	.2	.2	.3	.3	68.0	31.1

DODGEVILLE SILT LOAM.

Description.—The surface soil of Dodgeville silt loam is a dark-brown to nearly black silt loam ranging from 8 to 10 inches in depth. Where typically developed, it is generally friable, free from stones on the surface, and contains a considerable amount of organic matter. The subsoil is a compact silt loam of a light reddish brown or yellowish color, becoming more compact in structure with increase in depth. This type is often less than 3 feet deep, and in such cases the subsoil next the rock often consists of a heavy, dense, reddish-brown clay, containing angular, cherty limestone fragments. Again, this clay stratum may be nearly absent and immediately over the rock there occurs an inch or two of material having the appearance of a yellowish sand, but which is really composed principally of sharp calcium-carbonate crystals, easily disintegrated.

On the eastern edge of the county this soil is rather shallow, probably averaging less than 3 feet in depth, though in many places it is more than 3 feet deep. The areas east of Mineral Point will average rather more than 3 feet in depth. Frequently on hills and on slopes near stream courses, the rock is either exposed or covered with a few inches of soil usually

mixed with cherty limestone fragments. Southeast of Barneveld, in the vicinity of Barber, the rock gathered from the fields is sufficient to build some fences. Although Dodgeville silt loam resembles closely Marshall silt loam, it is because of this shallowness, and apparent lack of transported material, or loess that the type is considered separately.

Extent and distribution.—This type of soil occupies the upland prairie sections of the eastern portion of the county, and consists of high plains and ridges. No area of the type is found below 1,000 feet elevation. It extends east from Dodgeville across the county on what is known as Military Ridge. Its continuity, however, is broken at Ridgeway, where a strip of Knox silt loam cuts through. It will be noticed from the map that the Chicago & North Western Railway forms a fairly good boundary for the type. A strip extends south from Dodgeville, and broadens out east of Mineral Point, where it continues southward into Lafayette County.

Topography and drainage.—The surface is undulating to gently rolling, and rarely hilly, while some of the broader areas are nearly level. The type has good natural drainage, and there is little or no need for artificial drainage anywhere.

Origin.—In origin Dodgeville silt loam is essentially a residual soil, derived chiefly from the decay of limestone. It is possible that there is incorporated with it a small amount of loess, which occurs chiefly as a thin covering over the residual material. The dark color of the surface soil indicates the presence of organic matter—the accumulation from the decay of prairie grasses, which formed the chief original vegetation.

Native vegetation.—This type embraces a portion of the prairie region of Iowa county and has never supported a forest growth. The native vegetation consisted chiefly of prairie grasses, with only a limited tree growth along the borders of the prairie and adjacent to stream courses.

Agricultural development.—The thinness and stony character of portions of this type have effected the kind of farm-

ing adapted to and developed in this part of the county. South and southwest of West Blue Mound the prairie type is 4 or 5 miles wide north and south. Here the thinness of the soil has rendered it susceptible to drought, and corn and the cereals are not as sure or as profitable crops as they are on the Marshall silt loam type. Much land is devoted to pasture, and dairying seems to be the type of farming best adapted to this part of the county.

There has been great improvement in buildings and in general prosperity in this section since dairying was introduced. Creameries and cheese factories are much more numerous here than on the Marshall silt loam type in the western part of the county. American cheddar and some Swiss cheese are manufactured. The product is shipped largely to Chicago, St. Louis, and other large centers. Many farmers make butter, which for the most part is consumed in the locality where it is produced. Few farmers ship cream or milk. Dairy herds consist of 15 to 40 cows. Corn is grown for fodder and silage purposes largely. Alfalfa has been successfully grown by some farmers and this crop will be more widely utilized in the future. Some difficulty has been experienced in securing a good growth of clover, owing to unfavorable weather conditions in winter and early spring.

The following table gives the average results of mechanical analyses of samples of the soil and subsoil of this type:

Mechanical analyses of Dodgeville silt loam.

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.*
Soil.....	0.0	0.3	0.7	0.9	14.7	59.5	23.7
Subsoil.....	.0	.1	.1	.4	2.6	68.7	28.1

METHODS OF IMPROVEMENT FOR MARSHALL AND DODGEVILLE SILT LOAMS.

The areas of these soils, while differing somewhat in topography, are quite similar in chemical composition. Their analysis indicates between 1,300 and 1,400 pounds of phosphorus, 35,000 pounds of potassium, and 5,000 pounds of nitrogen in the surface 8 inches per acre. Their relatively large amount of nitrogen is due to the larger accumulation of organic matter which has taken place in these soils, due to their being in prairie rather than timber condition. It is probable that this organic matter has also tended to increase the phosphorus above that found in the Knox silt loam type. When first broken these soils showed a very high degree of fertility, and do still, except where poor systems of farming have caused the reduction of the active organic matter in the soil. In such cases even though the soil remains quite dark and has a good total supply of organic matter, this is in a resistant form in which it has been left by the oxidation of the more active vegetable matter.

The improvement of these lands demands an increase of active organic matter through the use of green manuring crops, particularly legumes, or large quantities of manure, as in the case of Knox silt loam. Owing to the fact that these soils, for the most part, occupy the higher areas of the ridge section of the county, they are less likely to receive lime in water percolating down from higher lands than in the case of the Knox soils; and for this reason, as well as on account of their larger amount of organic matter, show more or less acidity. This, however, is quite variable, and it is important that each farmer make the determination for acidity on each field. Where an acid condition is found to exist, ground limestone should be applied at the rate of from 1500 to 2000 pounds per acre.

On both of these types the dairy industry could well be developed to a greater extent. The supply of stable manure thus provided should be supplemented by green manuring crops, chiefly legumes, so that the supply of humus forming

material and active organic matter may be increased, and the productivity of the soil increased. Alfalfa should be grown to a greater extent, and the silo should be in more common use.

While neither of these soils have as large a percentage of steep lands as the areas of Knox silt loam, there are, nevertheless, some slopes on which erosion will take place unless the fields are properly handled. Wherever there is danger from erosion, the same means may be used for preventing washing as suggested for Knox silt loam.

CHAPTER III.

GROUP OF DARK COLORED BOTTOM SOILS.

WABASH SILT LOAM.*

Description.—The surface soil of this type, a depth of from 14 to 18 inches, consists of a brown to nearly black loam, which becomes quite silty in places. It is underlain to a depth of 36 inches or more by a black silty loam. Both soil and subsoil are subject to considerable variation, and there are no uniform areas of any considerable size. In places this type of soil contains a large amount of organic matter and is mucky; while in other places sand, gravel, and stones from the steep slopes adjoining have been washed down and have become mixed with the soil.

Extent and distribution.—Wabash silt loam is found as narrow strips of low land along most of the stream courses throughout the upland portion of the county. It varies in width from a few rods to nearly one-half mile. It has a total area in the county of 36,288 acres.

Topography and drainage.—The surface of this type is low and flat, usually having a gentle slope toward the stream along which it occurs. The type is subject to overflow, and the natural drainage is poor. Over the higher portions, some crops can be successfully grown, though there is always the possibility of losing a part or all of the crop as a result of high water.

Origin.—The material forming this type has been washed down from the higher land adjoining, carried varying distances by the streams and flood waters, and again deposited.

* In the future soil of this character will be classed as Wabash loam.

The loess-like material and also the weathered sandstone and limestone have contributed to the formation of the type.

Native vegetation.—the original growth consisted cheifly of willows, some ash, soft maple, and marsh grasses. A considerable portion of the type never supported a tree growth on account of the wet condition, but over such places a rank growth of coarse water-loving grasses was found.

Agricultural development.†—Much of this type of soil has poor drainage, and almost all of it is subject to one or more overflows each year and consequently can not be depended upon for cultivation. It is used almost exclusively for pasture and hay land, for which it is especially valuable. Occasionally a fairly well drained patch is cropped, corn doing especially well on it, and yields of 75 to 90 bushels per acre being reported. Hay will yield from 2 to 3 tons per acre. Owing to the narrowness of most of the areas and the low position of the land, it is doubtful if much of this type could be successively drained. Some of the broader expanses, where there is sufficient slope, could be much improved by installing tile drains.

WABASH LOAM.*

Description.—The surface soil of this type to a depth of 14 to 18 inches consists of a dark brown to black heavy loam or silt loam. The surface soil contains a large amount of organic matter and has a friable structure. The subsoil consists of a light-brown, or yellowish-brown, heavy loam, which usually grades into a silt loam below 24 inches. The silty material forming the type usually rests upon sand which may be reached at from 2 to 8 feet below the surface. In a few places of limited extent the underlying sand comes within a foot of the surface.

Extent and distribution.—The area of Waubash loam is of limited extent, and comprises a total area of only 4,160 acres.

† For methods of improvement of Wabash silt loam see page 30.
* In the future soil of this character will be classed as Wabash silt loam.

The largest tract in the county is found at the mouth of Underwood Creek directly west of Avoca. Along the bluff the silty material forming the soil in this area is from 5 to 8 feet deep, while along the border toward the Wisconsin River, it is frequently less than a foot deep. Other areas of smaller extent occur near Arena at the mouth of Rays Valley and Blue Mound Creek Valley. Some soil of this type occurs also along Sneed and Wyoming Creeks.

Topography and drainage.—The surface of Wabash loam is level or has a very gentle slope toward the stream along which it occurs. The portion of this type of soil in the Wisconsin River Valley near Avoca is higher and better drained than the remainder of the Wabash loam, and is not subject to overflow. Elsewhere, however, this soil is subject to overflow, and while it escapes flooding some years, there is always danger of having the crops damaged by high water. On the lower portions of soil of the type, the natural drainage is poor, and tile drains are necessary.

Origin.—The material forming Wabash loam soil has been washed from the higher land adjoining, and has been deposited by streams during times of high water. It is partly alluvial and partly colluvial, and the weathered material from the sandstone, limestone, and the loess have all contributed to its formation. Loess, however, has doubtless entered most largely into its composition.

Native vegetation.—The original growth consisted chiefly of willows, ash, soft maple, with numerous, open, wet tracts where only marsh grasses grew. The best drained tracts have all been cleared and put under cultivation.

Agricultural development.—This soil is very productive, yielding 60 to 90 bushels of corn, 25 to 50 bushels of barley and oats, and 1½ to 3 tons of hay per acre. Parts of it are subject to overflow, though not to the great detriment of crops.

In Wyoming, Hillside, and Blue Mound Creek Valleys this type requires drainage. It is very productive, but is apt here

to be a rather cold, late soil in wet years, though its natural drainage is slowly improving. Small grains, especially oats, produce rank straw growth, and are apt to lodge badly.

METHODS OF IMPROVEMENT FOR WABASH SILT LOAM AND WABASH LOAM.

These two types of soil have been formed largely by the deposition of silt from higher regions, and their chemical composition is determined by this. They have, on the average, approximately 2,000 pounds of phosphorus, 35,000 pounds of potash, and 5,500 pounds of nitrogen in the surface 8 inches of an acre. They are, therefore, among the richest soils of the state, so far as their chemical composition is concerned. During this process of formation a large part of the lime of the subsoil from which the Wabash silt loam and loam were derived was washed out, and the soils are, therefore, only moderately well supplied with this element, and will frequently be found slightly acid, so that for the continuous growth of clover, or alfalfa, it is desirable that tests be made for acidity. Where an acid condition is found to exist, from 1200 to 2000 pounds of ground limestone per acre should be applied.

The question of drainage is very important, and over a considerable proportion of the area of both of these types tile drains could be installed to advantage. It is probable that in a few places small dikes could be constructed to advantage, to protect the fields from flooding during times of heavy rains. Considerable damage is frequently done by erosion, especially in the narrow bottoms where the current during flood stages is swift. It is a difficult matter to prevent such erosion. Low walls are sometimes built, and brush and stones thrown into the channels to check the flow. Where there is an abrupt drop of several feet in the bed of the channel, a chute of boards is sometimes made to keep the channel from being cut deeper, and to prevent the sides from caving.

CHAPTER IV.

GROUP OF SANDY SOILS.

PLAINFIELD SAND.

Description.—Plainfield sand of this county is a loose brown sand of medium texture for 18 to 20 inches in depth. Below this it becomes lighter in color, till at about 30 inches it is a bright yellow sand, continuing without change to undetermined depths. The deposit has been found in wells to a depth of 50 feet. Frequently in the subsoil there is found a small percentage of smooth rounded pebbles mixed with the sand. In the subsoil, below 3 feet, layers of compact material a few inches thick are found, but these are seldom sufficient to affect moisture conditions.

The loose, incoherent nature of the sand renders it specially subject to drifting, and scattered through the areas are ridges piled up by the wind, which are mapped separately and discussed under the head of Dunesand.

Extent and Distribution.—Plainfield sand is confined to the Wisconsin River Valley along the northern boundary of the county. It occupies much of the valley bottom near the river, areas of meadow generally intervening between it and the stream. It is of comparatively small extent and occupies 9,920 acres, or 2 per cent of the total area.

Topography and Drainage.—The surface of Plainfield sand is level, and, owing to its looseness and depth, it usually has good drainage, the water table being 3 to 10 feet below the surface. South of the railroad, between Helena and Arena, water is occasionally found within 3 feet, and in a few places the surface is so wet as to approximate a marshy condition. In general, a

lack of moisture is apparent in the type and crops suffer from drought during portions of practically every growing season.

Origin.—Plainfield sand consists of stratified material which has been deposited during overflow of the river, probably during one of the glacial epochs when the volume of the water was considerably greater than at present. The coarseness of the sand, and lack of material finer than sand, is due to deposition in relatively swift currents.

Native vegetation.—The areas covered by Plainfield sand are locally spoken of as prairie land. The only tree growth which the type supported was a very sparse scattering of scrub oak. Wild grasses and sand burs constitute the greater portion of the native vegetation.

*Agricultural development.**—Only limited number of crops are grown on this Plainfield sand. These are corn, rye, and buckwheat. Rye succeeds best, though the yield is low. In a good year corn yields 25 bushels per acre; in dry seasons it is a complete failure. The yield of rye is 10 to 15 bushels, and of buckwheat 5 to 20 bushels per acre. Oats and barley have not been successful on this type of soil. It is very difficult to make improved grasses and clover profitable crops. Rye follows corn and is often sown on the stubble among the corn shocks. To lessen blowing by the wind, the surface is left rough and ridged as much as possible, as wind-blown areas are very difficult to control.

PLAINFIELD SANDY LOAM.

Description.—Plainfield sandy loam is a brown sandy loam, 16 to 18 inches deep, resting on a subsoil which becomes lighter in color and a little lighter in texture with depth, and passes usually at about 30 inches into a yellowish sand. The lower part of the soil section thus resembles that of the Plainfield sand. As the soil proper is more loamy, and has more body than the Plainfield sand, there is not much trouble from drift-

* For methods of improvement for Plainfield sand see page ——.

ing with this type. There have been included with Plainfield sandy loam, certain small areas, which, had they become more extensive, would have been mapped as a separate type. The soil in these areas is more loamy and sometimes quite heavy, though the soil is generally sandy. Most of this phase is found in the areas west of Avoca and at the mouth of Mill Creek Valley.

Extent and distribution.—Like Plainfield sand in this county, Plainfield sandy loam is confined to the Wisconsin River Valley. It is found in large areas more often nearer the bluffs of the uplands than the river. The largest area occurs in the immediate vicinity of Arena, where it extends for a distance of nearly eight miles as a narrow belt between the foot of the bluffs and the areas of Plainfield sand and marsh, bordering the river. In the northwestern part of the county near Avoca, the areas of this soil are rather small and detached, while farther east the tracts are larger. The total area of this soil in Iowa county is 4,864 acres.

Topography and drainage.—The surface of areas of Plainfield sandy loam is quite uniform, being nearly level. In parts of sections 12, 13, and 14, R. 5, T. 8, there is a plateau-like area, considerably above the level of the rest of the type. As a rule the type has good drainage. Crops sometimes suffer from drought during the latter part of the growing season.

Origin.—This soil is of alluvial origin and has been formed in the same manner as Plainfield sand. Its more loamy character is evidently due to the fact that deposition has taken place at some distance from the river, where the velocity of the currents were less than where the Plainfield sand was laid down. In places the upland streams undoubtedly have contributed some finer material in times of overflow.

Native vegetation.—It is said that this type of soil formerly had a sparse tree growth consisting of oak and soft maple, and considerable brush. The sand bur is a characteristic plant, as it is on the Plainfield sand.

*Agricultural development.**—Almost all crops grown locally succeed well on Plainfield sandy loam, although on much of the type in years of less than normal rainfall crops are likely to suffer from drought. Corn yields vary from 35 to 70 bushels, with an average of probably 45 bushels per acre. Oats are not a sure crop, but yield about 20 bushels in normal seasons, though in years of more than average precipitation yields as high as 30 to 35 bushels may be secured. Barley is seldom grown. Rye produces from 12 to 20 bushels with an average of about 15 bushels per acre. The yield of hay is not large, probably about 1 ton to the acre. Not much trouble is experienced in getting a catch crop of clover, and it will generally grow satisfactorily.

This type of soil is generally considered fairly desirable land, and the farms composed of it are usually in a prosperous condition. Dairying is important, though the farmers do not always depend entirely on this type of soil for pasture. Some farms on this type include areas of the Wabash soils or Knox silt loam, and these afford good pastures.

The following table gives the results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Plainfield sandy loam.

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.*
Soil.....	0.5	8.2	37.4	38.4	1.7	9.6	4.0
Subsoil.....	.3	7.5	41.8	41.0	1.3	4.0	3.8

BOONE FINE SANDY LOAM.

Description.—Boone fine sandy loam consists of a brown or light brown fine sandy loam to a depth of 8 to 10 inches. This is underlain by a fine sandy loam of about the same texture, but somewhat more compact, and also lighter in color. This material usually grades into a fine sand, which is found immed-

* For methods of improvement for Plainfield sandy loam see page 37.

iately overlying the sandstone rock from which the soil is derived. The type is subject to considerable variation both in texture and topography, though none of the variations were found to be of sufficient extent to be indicated on the soil map. The type frequently contains considerable silt which has been washed from the Knox silt loam, with which it is associated; and in such places this soil is heavier than typical. In other small areas there are patches of fine sand. In a few localities the type consists of a medium sandy loam. The soil is frequently shallow, and rock outcrops are quite common. Rock fragments may also occur throughout the surface soil, in places.

Extent and distribution.—Boone fine sandy loam is of comparatively small extent in area and occupies a total space of only 5,440 acres. The type is found principally in the bluff country in the vicinity of the Wisconsin River where Potsdam sandstone outcrops along the slopes. A few small patches occur in the southwestern portion of the area where St. Peters sandstone outcrops.

Topography and drainage.—The surface of the soil of this type varies from gently undulating over small tracts along the lower slopes and at the foot of the bluffs, to steep and rather broken land along the hillsides and ridges. On most of the area of Boone fine sandy loam, modern farm machinery could be used. The areas which are too steep are of comparatively small extent.

On account of the sandy nature of the soil and the topography of the region, the natural drainage is excellent. Where the soil material is thin, the type is subject to drought.

Origin.—This soil type comprises chiefly material resulting from the weathering of Potsdam sandstone, though there are a few places in the southwestern portion of the area where St. Peters sandstone has contributed to its formation. The lower lying tracts are also partly colluvial, and it is probable that the silt found in the soil has come largely from the loessial material forming the Knox silt loam.

Native vegetation.—The original timber growth on Boone fine sandy loam consisted chiefly of white, burr, and black oaks, with some hickory, maple, birch, and basswood. Practically all of the merchantable timber has been removed, and most of the type is under cultivation. On the steeper slope there is still a growth of timber, but it has little value.

*Agricultural development**.—Boone fine sandy loam is in general considered a fairly productive soil, but in dry years, crops are apt to suffer from drought, and particularly so on the ridges, where it is often thin and rather stony. Good crops are raised where the soil has sufficient depth and is properly managed, particularly with reference to conservation of moisture. It has the advantage as compared with the heavier silty soils in the ease with which it can be worked, and the early date at which it can be plowed in the spring. The relatively small extent and irregular distribution of this type make it unlikely that any single farm is composed entirely of it. It thus varies the soil conditions on many farms. On the better phases of the type good corn, grain, clover, and mixed hay are produced, with yields only slightly lower than those stated for Knox silt loam.

The following table gives the results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Boone fine sandy loam.

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.*
Soil.....	0.0	6.1	16.6	39.5	11.8	19.0	7.1
Subsoil.....	.0	3.2	9.6	30.0	15.6	28.0	13.5

DUNESAND.

Dunesand includes the light colored fine sand which has been blown into dunes by the wind. This soil is loose and open in

* For methods of improvement of Boone sandy loam see page 37.

structure and uniform in texture, throughout its occurrence. There is but very little organic matter in the surface, and no clay or silt particles are present to bind the sand grains together. The dunes are from 10 to 12 feet high, cover tracts of from 1 to 150 acres, and occur as small knolls and ridges with shallow intervening depressions. This Dunesand is found in the northern part of the county, in the valley of the Wisconsin River, where it is associated with Plainfield sand and sandy loam. The natural drainage is excessive, and the type is very droughty.

The material composing the Dunesand is of alluvial origin, but has been blown into knolls and ridges by the wind. When not protected by growing plants, the dunes are modified constantly by the action of the wind. Over portions of the dunes there is a scattering growth of scrub oak, and in some places there is a little grass, but most of the knolls and ridges are bare.

This type has very little value and may be considered non-agricultural. Where covered with trees, sometimes it serves as a wind brake for farm buildings; but where bare the dunes are a menace to surrounding fields, as high winds drift the sand quite rapidly, and adjoining crops may be badly injured by the fine, sharp particles. The sites of some of the dunes were formerly tracts of Plainfield sand or sandy loam, but the wind has brought many of these areas beyond control.

METHODS OF IMPROVEMENT FOR PLAINFIELD SAND, PLAINFIELD SANDY LOAM, BOONE FINE SANDY LOAM, AND DUNESAND*.

These types of soil have the chemical composition usually found in the sandy soils of Wisconsin. They have, on the average, approximately 1,000 pounds of phosphorus, 20,000 pounds of potassium, and from 1,000 to 2,000 pounds of nitrogen in the surface 8 inches of an acre. Their relatively small amount of organic matter, however, does not make even these quantities of the mineral elements, phosphorus and potassium,

* See Bulletin 204, University of Wisconsin Experiment Station, on "Improvement of Sandy Soils" and No. 230 on "Soil Acidity and Liming".

sufficiently available, so that methods of adding organic matter and nitrogen, chiefly through the growth of legumes, should be the starting point in their improvement. As a rule these soils will be found at least slightly acid, so that the use of some form of lime for clover and alfalfa is important, though some other legumes which do not require lime can be grown. Applications of from 1,500 to 2,000 pounds of ground limestone per acre will usually be found sufficient to correct the acidity.

In starting clover on these sandy soils, it is advisable to seed without a nurse crop, especially where the fertility is very low. In preparing the soil it should be plowed in the fall, or as early in the spring as possible, and a top dressing of ground limestone applied. The field should be harrowed at short intervals until about the middle of May, when about 15 pounds of seed per acre should be sown and covered to a depth of 2 to 2½ inches. The seeding should be followed by a roller to compact the soil around the seed, and the roller should be followed by a light harrow to roughen and loosen the surface, to check evaporation and blowing of sand by the wind. Where it can be secured, a top dressing of well rotted manure should be applied before the last harrowing. Where manure is not available about 300 pounds of acid phosphate, or ground, steamed bonemeal and 100 pounds of muriate of potash should be applied at the time of seeding. If only a small amount of manure is available it may be supplemented by ground rock phosphate, and this can be sprinkled over the manure in the spreader and applied at the same time. The second year the first crop of clover may be cut for hay, but the second should be plowed under as green manure to prepare the soil for cultivated crop.

Alfalfa may be started in the same way, only the soil should be inoculated with earth from an old alfalfa field. If for any reason the clover or alfalfa should fail, a crop of spring vetch, tare, soybeans, cowpeas, yellow lupine, or serradella may be grown as a green manuring crop, and plowed under. A rotation consisting of clover, potatoes, and rye or oats is one well suited to sandy soils. If a green manuring crop is plowed un-

der once during each rotation, and as much manure applied as the farm supplies, the soil can be maintained in a fairly good state of fertility.

Where the sand is apt to be blown by the wind the fields should be laid out in long narrow strips at right angles to the direction of the prevailing wind and cultivated strips should alternate with strips in grain or grass.

It will be very difficult and probably impracticable to raise crops on the Dunesand, but it would be desirable to have the dunes covered with some plant which would tend to check the blowing of the sand by the wind.

CHAPTER V.

GROUP OF MISCELLANEOUS SOILS.

LINTONIA SILT LOAM

Description.—The surface soil of the Lintonia silt loam type, extending to an average depth of 14 inches, consists of a light brown, or grayish, silt loam, having a friable structure, and containing only a small amount of organic matter. The subsoil consists of a light brown to yellowish brown silt loam, which gradually becomes heavier with depth and grades into a silty clay loam, or clay loam, at from 24 to 36 inches. In texture, structure, and color Lintonia silt loam is very similar to Knox silt loam, but differs from that type in topography and origin.

Extent and distribution.—Lintonia silt loam is of limited extent, occupying only 2,368 acres, or about 5 per cent. of the county. It is confined to the northern part of the county, and is found most extensively along Otter creek and Blue Mound creek, where it occurs in terraces of from 50 to 200 acres in extent.

Topography and drainage.—The surface of the type is nearly level with only a gentle slope toward the stream course along which it occurs. In some places of limited extent ravines have been cut through the terraces, and the surface made somewhat irregular and dissected by erosion. As this type of soil is usually well elevated above the present stream level, the natural drainage is good. In only a few instances in this county would tile drains be necessary.

Origin.—Lintonia silt loam in Iowa Count is largely of alluvial origin, though there is also considerable colluvial ma-

terial which is incorporated with it. Most of the type was deposited by the streams along which it occurs during an earlier geological period. Streams have subsequently cut down into this material and built strips of low overflow land which has been mapped as Wabash loam and silt loam. Practically all of the material in this type of soil was originally loess. This was washed from the upland country into the lower land by heavy rains carried away by the streams, and again deposited in its present position.

Native vegetation.—The original timber growth consisted chiefly of oaks and hickory, with some maple and basswood. Most of the timber has been removed, and the land put under cultivation.

Agricultural development.—Lintonia silt loam is a desirable soil, and all of it is available for cultivation. Its level surface makes washing a minor factor. The surface also favors the use of all kinds of labor-saving farm implements. In crop value the type is probably superior to Knox silt loam, especially for corn. Those areas mapped in Blue Mound Creek valley generally are more productive and compare well with Wabash loam. Where this type is well elevated and has good drainage, it seems to be adapted to alfalfa.

Methods of improvement.—The chemical analysis of Lintonia silt loam shows it to contain, on the average, slightly more of most of the essential plant food elements than occur in Knox silt loam which it very much resembles in texture, structure, and color. In the improvement and management of this type the suggestions offered for the Knox silt loam will also apply here, except as regards erosion.

The following table gives the results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Litonia silt loam.

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.*
Soil.....	0.0	0.2	0.4	1.0	13.2	73.6	11.2
Subsoil.....	.0	.0	.0	1.5	7.6	78.8	12.2

MUCK.

Description.—The type of soil mapped as Muck consists of decaying vegetable matter which is usually quite thoroughly decomposed, and with which there is incorporated a considerable amount of mineral matter. This soil is quite variable, however, and in places will be a Peat, while in other localities the Muck will have occasional bars of sand running through it. It has a dark brown or black color and ranges in depth from 2 to 20 feet, or more.

Extent and distribution.—The area of Muck is of comparatively small extent and occupies a total space of 2,432 acres. The largest body is a marshy tract bordering the river, northeast of Arena. It covers about 2 square miles and is about 2 to 4 feet above the level of Blue Mound creek. In Blue Mound Creek Valley there is an area of about 300 acres which is being tile drained. There is also a small tract at the mouth of Otter creek. This area has a thin covering of silty material, but it is too low to be drained successfully by gravity ditches.

Topography and drainage.—The surface of all the areas of Muck is level, and the natural drainage is deficient. Before crops other than wild hay can be grown, it will be necessary to install drainage systems. Over portions of the Muck this could be done profitably, while in other places it would not be practicable.

Origin.—In origin the Muck of this region consists of a mixture of decaying vegetable matter and mineral matter which

has been washed in from the higher land adjoining. In the Wisconsin River Valley it is usually underlain by stratified sand, while in the other stream valleys silt, and sometimes some clay, is found beneath it.

Native vegetation.—Most of the Muck areas are open marshes with only a rank growth of coarse grasses, but over a portion of the marshes there are a few willows, soft maple, and some other moisture-loving trees and shrubs.

Method of improvement.—Only a single analysis of the Muck from this county has so far been made, but this indicates approximately similar composition to that found in Peat soils of the Wisconsin River Valley farther north. These soils have an entirely different chemical composition from other, more earthy soils. They are extremely rich in organic matter and nitrogen, having from 8,000 to 12,000 pounds of nitrogen as compared with 2,500 pounds in the silt loam soils of the hill county to the south. They are, however, poorer in phosphorus and potassium than other soils are, and the availability of these elements is frequently quite low. Where the farm contains upland soils as well as marsh soil, manure should be applied to the upland soil which needs the nitrogen as well as the other elements, and commercial fertilizers containing only phosphorus and potash should be used on the marsh soils, since they will give nearly, if not quite, as good results as the manure will, on account of their very large supply of nitrogen. These soils are usually acid, but it is not necessary to neutralize the acidity by the use of lime, since ordinarily medium red clover and alfalfa would not be grown on these lands.

Drainage is the most important step in reclaiming the Muck areas, and, wherever this is practicable, drainage systems should be installed. The area in Blue Mound Creek Valley which is being drained will doubtless produce good crops, especially corn. Other tracts could also be reclaimed, but at present most of the areas are used only for cutting marsh hay and some for pasture.

MEADOW

Meadow comprises the low-lying, marshy areas immediately adjoining the Wisconsin River. These areas alternate in places with small tracts of Plainfield sand which could not be separated. The Meadow and Muck taken together cover a considerable proportion of the valley bottom.

The largest area of Meadow lies in the northwest corner of the county, where it covers 5 or 6 square miles. The soil material varies from deposits of white to yellowish, coarse sand and mottled, silty clay, deposited by the annual spring floods, to patches of mucky material too small to show on the map. Here and there are sloughs and wet spots which persist even in times of low water. The Meadow is sometimes wooded, though the greater portion of it has very few trees, as is the case north of Avoca.

This type, while unfit for cropping, serves as much needed pasture and hay land for the farmers living on Plainfield sand, which supports but a sparse growth of grass. Hay is brought up on the terrace of Plainfield sand and stacked there in dry weather.

Owing to its low-lying position, it is doubtful if any system of drainage would avail much, though open ditches would often give some relief. The soil is, therefore not very valuable for agriculture.

ROUGH STONY LAND.

Rough stony land consists of rock exposures, cliffs, and steep, precipitous land too rough to plow or cultivate profitably. It occurs largely along ravines and valleys within the main body of the Knox silt loam, practically none of it having been mapped within or adjacent to the Dodgeville or Marshall silt loams. Comparatively little of it occurs in the southern part of the county, but it is quite extensive in the northern part.

A large part of the rough stony land is covered with oaks, hickory, and some maple, though it is often cleared and used for pasture. Occasional patches too small to show on the map

FIG. 3. CHARACTERISTIC VIEW OF ROUGH STONY LAND.

This type includes rock outcrop, and steep rocky slopes which have but little or no agricultural value, and may be considered as non-agricultural.

FIG. 4. VIEW FROM THE HEAD OF A SMALL VALLEY, LOOKING TOWARD THE WISCONSIN RIVER.

This shows the steep rocky valley wall on the right which makes up part of the Rough stony land, and the lower slope upon which some of the steep phase of Knox silt loam may be found.

are cultivated. Where there are a few inches of soil it is usually silty, being the same material as Knox silt loam. Sandstone outcrops on many of the slopes, and the soil near by is likely to be sandy as a result of the disintegration of this rock.

Owing to the steep, rugged character of this type, its use is confined to pasture. It is largely allowed to remain in forest.

CHAPTER VI.

GENERAL AGRICULTURE OF IOWA COUNTY.

The agriculture of Iowa county dates back about 80 years. Lead had been mined in the county by the Winnebago Indians for some time prior to this, and most of the early settlers were drawn hither by rumors of rich deposits of ore. The first recorded attempt at farming was in 1829, when 40 acres of land in the town of Linden, in the west-central part of the county, were put under the plow. In the same year farms were opened in the town of Dodgeville. The first crops of wheat and oats in the county were produced on the farm at Linden in 1831 from seed secured in Illinois. A grist mill was established in 1830, 2 miles northeast of the present site of Mineral Point. Here small grain was ground into feed, and corn into meal; but flour was brought by team from Galena, Ill.

Wheat early became the most important crop, and it soon gave rise to an improvident system of farming, this crop being grown year after year, until the yields declined to a point where the profits were extremely small. The timber from the cleared lands was wasted and burned, because there were no sawmills in the interior of the county, and no good means of transportation to the river. Practically the only source of income on the farms was from the sale of wheat. In parts of the county much of the wheat land was later put into flax, until it also began to fail. The continued cropping of the land to wheat and flax caused it to become gradually less productive, and made it necessary to adopt a type of farming more profitable, and tending less to deteriorate the soil. This necessarily led to stock raising and dairying. With the advent of this change, 30 years ago, agriculture became more diversi-

fied, and farmers began to handle their soils more rationally and to put more manure on the land.

Where this better treatment has been intelligently carried out, the soils have gradually regained much of their original productiveness. This change was especially needed on Knox silt loam, which naturally has less organic matter than Dodgeville and Marshall silt loams or prairie, and which, owing to steeper topography, was subject to much erosion under the old type of farming. Most farmers now recognize that it is not advisable to plow the steeper phase of this type, but to allow such land to remain in pasture as long as possible. Iowa county is, now, distinctly a dairy county.

The United States census of 1910 gives the area devoted to wheat during the previous year as 1,111 acres, which produced 20,132 bushels or an average of 18 bushels per acre. The high tide in the production of wheat was about 1870 when the production was 760,165 bushels for the county.

The yield of corn for 1909 from 38,148 acres amounted to 1,272,498 bushels or an average of about 33.3 bushels per acre. The total production of corn and the average yields for this county have remained nearly stationary for the past 30 years.

The production of oats was not nearly as large for 1909 as was reported by the state census for 1905, though the difference may be due in part to unfavorable weather conditions during the latter year, rather than to a tendency to gradually reduce the acreage devoted to this crop. The yield from 41,433 acres in 1909 amounted to 1,314,454 bushels or about 31.7 bushels per acre, while the report of 1905 showed an acreage of 69,581 acres, with an average yield of about 30.4 bushels per acre.

The acreage of barley for 1909 was 9,812 acres, and the total yield 259,881 bushels, or an average yield of 26.4 bushels per acre. This is over 6,000 acres more than was reported for 1905.

With the decline in the production of wheat, beginning about 1870, flax growing increased until about 1880, when the yield for the county was 120,061 bushels. Since that time flax production has greatly declined, and in 1905 there were only

211 bushels reported. At present the crop is not grown at all on a commercial scale.

Rye is grown more extensively in the northern and eastern parts of the county than elsewhere, and the total yield of the county from 4,374 acres in 1909 was 43,700 bushels, or an average of about 10 bushels per acre. Buckwheat is comparatively unimportant. Tobacco was raised to some extent 25 years ago, but none is grown now. Potatoes never have been grown on a large commercial scale, but a sufficient amount is produced for home use. In 1909 there were 1,250 acres which produced a total yield of 137,044 bushels or approximately 109 bushels per acre. The small acreage is partly due to the fact that the prairie soils are somewhat heavy for potato growing, and also to the fact that much of Knox silt loam is steep and subject to erosion, which makes the growing of cultivated crops undesirable. These conditions will prevent Iowa county from ever becoming an important potato growing region. However, on the more level portions of Knox silt loam and over portions of the prairie soils, conditions are favorable to the production of more potatoes than are grown at present.

The hay crop of Iowa county for 1909 from 69,012 acres amounted to 95,127 tons, or nearly 1.4 tons per acre. Of this the major portion consisted of mixed timothy and clover. Over 26,000 acres of timothy alone were grown, but the amount of clover alone grown was less than 1,000 acres. Alfalfa is grown to a limited extent, and the acreage is gradually on the increase. Small amounts of sorghum and millet are also raised.

The trucking industry has not been developed in Iowa county on a commercial scale, though every farm has a home garden where small fruits and vegetables are grown for the use of the family. Sometimes there are small quantities of truck sold on the local markets.

But little attention is paid to fruit growing. Only small home orchards are found, and apples are practically the only fruit raised. Little or no care is taken as regards pruning, spraying, cultivation, etc. Soil of the Knox silt loam type is probably more favorably located for general fruit growing than soils of Marshall or Dodgeville silt loams, chiefly on ac-

count of the more desirable slopes which afford excellent orchard sites. The growing of apples could well be extended on this soil. Peaches do not succeed, as they are very apt to winter kill.

Dairying is the most important branch of agriculture practiced in the county, and this industry has reached extensive proportions. The production of cheese far exceeds that of butter. No milk is shipped out of the county as market milk. In 1905 there were 105 cheese factories, which produced 5,732,843 pounds of cheese; and in 1910 there were 128 factories, which produced 7,412,286 pounds of cheese. In 1905 there were 12 creameries, which produced 829,250 pounds of butter; and in 1910 there were only 6 creameries, with a total output of 513,577 pounds. As a matter of convenience some farmers prefer to patronize creameries rather than cheese factories, where milk has to be delivered daily, because they can separate the cream at home and deliver on alternate days, and have skim milk for calves and pigs. Butter production, however, is not apt to increase, as long as the price of cheese remains relatively higher than that of butter.

The character and breeding of dairy cattle is gradually receiving more attention. The first cattle kept were the native red cattle, and grade stock probably still predominates. The Holstein-Friesian breed is held in high favor, and there are more pure-breds of this breed in the county than of any other. In 1905 there were 29,605 milch cows in the county. This was an increase of 18% in 10 years, and of 60% in 25 years. In 1910 there were 34,559 milch cows. Out of every 100 head of cattle there are at the rate of 45.8 milch cows.

The raising of steers and beef cattle is not so prominent as it was a few years ago, though it is still important. Occasionally steers are brought from Chicago or other points to be fattened, and home grown stock is also finished for the market. This industry, however, has gradually declined as the dairy industry has developed. Hog raising is important, and it has gradually developed along with dairying. Poland-China seems to be the predominant breed, although there are also numerous herds of Duroc-Jerseys and Chester Whites.

The raising of sheep is not given much attention, and the number kept is gradually decreasing. In the northern half, and over all the rougher parts of the county, this industry might well be extended, since the steep slopes are better fitted for grazing than for cultivated crops, and since there is more of such land than is required for the number of cattle kept at present.

The question of crop rotation is given some consideration, and it is quite generally recognized that certain soils of the county are better adapted to some of the crops grown than are other soils. The methods of farming followed, therefore, differ slightly on the various soil types, and especially where there is a wide difference in the texture of the types. The predominant class of soil in the area is a silt loam, and while there are some variations in the methods followed throughout the silt loam regions, it may be said that in general the methods are quite uniform. The degree of slope, and the danger of erosion, is a factor which causes some modification in the usual methods followed.

Marshall silt loam, because of its level topography, high organic matter content, and greater depth, produces good crops of corn year after year without washing and without material decline in yield where fields are manured. For this reason the fattening of hogs and cattle is more extensively carried on in the west prairie section of the county, and cheese factories and creameries are least numerous there. In the eastern part of the county Dodgeville silt loam, as well as Knox silt loam in the northern part of the county, is much thinner; and the present prosperous conditions are due in large part to the growth of dairying in the last few years.

Knox silt loam almost invariably lies at such a slope that much of it washes badly during hard storms. Very little of it should be put into cultivated crops, two years in succession. Farmers state that, while the yield in bushels of oats and barley is much the same in these two soils, the grain on the Knox silt loam is heavier and of better quality. Better pasture is, also, claimed for the latter soil.

When sufficiently drained Wabash soils produce corn fully as

well as the Marshall silt loam. Especially good crops are raised on them in dry, early seasons. Grain, especially oats, is likely to lodge badly, and an excessive growth of straw is produced. The Wabash loam gives good yields of alsike and white clover. These soils are seldom acid, and alfalfa may be grown on selected areas with little trouble in getting a catch.

The sand prairie of the Wisconsin Valley bottom is cropped only to rye, buckwheat, and corn. The sandy loams there produce fair clover and also grain crops.

On both Knox and Marshall silt loams corn is planted on newly turned sod which has been manured. It is grown one or two years, followed by oats or barley one year, and the land then seeded to timothy and clover, which is allowed to remain three or four years. If the seeding does not catch well, oats or barley is sown again. When wheat or rye is introduced it usually follows oats or barley.

On the loose Plainfield sand of the Wisconsin Valley, rye follows corn, and buckwheat is introduced as found most convenient.

Deep plowing and careful tillage are generally practiced for all crops. Corn, the principal intertilled crop, is well cultivated. It is usually planted with check-row planters. Before it is up, the fields are usually harrowed lightly, which forms a mulch and arrests the growth of weeds. When the crop is well up, wheeled two-horse cultivators are used until the corn is too large for cultivating. The ears are often husked from the standing stalks, though frequently the corn is cut, shocked, and later husked. The corn and barley are used chiefly for feed. Much of the oats and some of the rye are consumed in the county, but a number of thousands of bushels are exported annually.

Here, as in most parts of the country, labor is scarce and hard to obtain at any price. Most of the farm work, thus, has, to be performed by the farmer and his family. When men are employed by the month they usually receive from $25 to $30 and board. When employed by the day, they receive $1.50 and board, and in harvesting from $2.25 to $2.50 and board.

About 78 per cent of the farms in the area in 1910 were operated by the owner; 14 per cent by cash tenants and approx-

imately 7 per cent by share tenants. The number of farms is gradually decreasing, and the average size increasing. In 1910 there were 1,965 farms containing on the average 185 acres per farm. Of this there is on the average 117 acres improved.

In general, the types of farming now established, and methods in common use seem well suited to the soils and present conditions in the county. Corn, the most important single crop of the county, could be materially increased in yield by more general attention to the selection and storage of seed.

Root crops for cattle feed and the use of silage should become more general as the dairying is increased. Alfalfa also should be more generally grown.

Alfalfa is not extensively grown in any part of the county, but has been tried with good success in small patches on Knox silt loam, Dodgeville and Marshall silt loams, Wabash loam, and to a slight extent on some of the better quality of sandy lands in the Wisconsin Valley. This crop ought to become more generally produced as farmers become acquainted with it. Excepting portions of the Wabash, the soils all have good surface and subsoil drainage. Knox silt loam in many places has not sufficient depth to make a desirable soil for alfalfa, but most of the type is amply sufficient as to depth. The following suggestions may be of use in growing this crop:

A deep soil, and one in a good state of fertility, with plenty of organic matter, is needed to start a good growth of alfalfa. In many places Knox, Dodgeville, and Marshall soils have become acid, through lack of proper cropping.

From 1,200 to 1,500 pounds of ground limestone applied to land previously well manured, and followed by thorough cultivation should produce a good seed bed for alfalfa on any of these soils. Inoculation will usually be found unnecessary if a pint of alfalfa seed be sown to the acre with cloves during the rotation previous to which alfalfa is seeded.

Wabash soils are not often acid, though they contain large quantities of organic matter. Lack of drainage is apt to be their only deficiency for alfalfa production. Where this crop is sown, a field with a distinct slope is desirable. Several good pieces of alfalfa seeding were noted on Wabash loam where no attempt at inoculation was made.

CHAPTER VII.

CLIMATE.*

Among the factors which influence the agriculture of a state, none is more important than the climate. The class of crops which can be grown is largely determined by the length of the growing season, and the amount and distribution of the rainfall. Any one of these factors may determine the type of agriculture which can be practiced to best advantage.

The distribution of rainfall over Wisconsin is remarkably uniform, the average yearly precipitation having a range of from 28 to 34 inches, while the mean for the State as a whole is 31 inches. This is a slightly heavier rainfall than is received by eastern England, northern France, most of Germany and Sweden, and the Dundee Valley. As compared with other portions of this country, Wisconsin has a total rainfall equaling that of central Oklahoma and Kansas, northern Iowa, Michigan, northwestern New York, or the Puget Sound Basin of Washington. But owing to its northerly location, the lessened evaporation probably makes the precipitation as effective as that of Arkansas, Illinois, or Virginia.

The local distribution of rainfall varies, however, from year to year, some sections receiving more rainfall one year and other sections more in other years. The variation is caused by the movement of cyclonic storms. The average rainfall for the entire state during the driest year was 21.4 inches. and for the wettest year 37 inches.

Of equal importance, in agriculture, to the total rainfall is its seasonal distribution, and in this respect Wisconsin is un-

* This chapter has been taken largely from Wisconsin Bulletin 223, on "The Climate of Wisconsin and Its Relation to Agriculture". This bulletin should be consulted for more information on climate.

usually fortunate, since about half of the total rainfall comes in May, June, July, and August, and nearly 70% from April to September, inclusive. June has the heaviest rainfall, averaging 4.1 inches, while July averages 4 inches and May 3.9 inches. The precipitation during the winter, on the other hand is slight; December, January, and February each averaging from 1 to 1.5 inches of rain and melted snow. The average rainfall for the state during the winter is 3.9 inches, during spring 8.3 inches, during summer 11.4 inches and during autumn 7.4 inches. Most of the rainfall occurs just preceeding and during the period of plant growth, thus being received by the crop at the most effective time. Wisconsin receives during the growing season, April to September, inclusive, an average of 21 inches, which is as much rain as is received during the same months by eastern Texas, Illinois, Ohio, or eastern New York. The small winter precipitation in Wisconsin, mostly in the form of snow, on the other hand, causes virtually no leaching of fertility from the soil, or erosion.

Another phase of rainfall distribution of great importance is its variation within a period of a few weeks. Frequently periods of drought and periods of unusually heavy rainfall occur, continuing for from one to four weeks, and occasionally longer. Observations taken at Madison over a period of 30 years, from 1882–1911, inclusive, show that there are, on the average, three ten day periods during each growing season when the amount of rainfall is so slight that crops on a reasonably heavy soil (Miami silt loam) actually suffer from the lack of moisture. In Iowa County, where the predominant soil is a silt loam, the conditions would doubtless be practically the same, for the area as a whole.

Iowa County lies within "the Southern Highlands", which is one of eight climatic sections within Wisconsin.

"This possibly new term is used to include the rough to rolling region, generally over 1000 feet in elevation extending from Clark county south to the Illinois line and lying between the Mississippi Valley on the west and the Wisconsin and Rock River Valleys on the east. It is characterized by a cooler temperature than the adjoining valleys, the summer tempera-

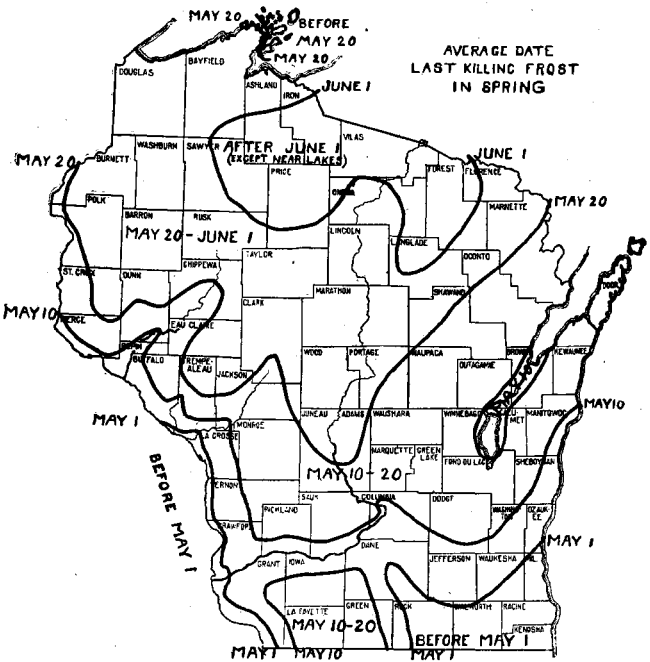

Fig. 5. Last Killing Frost in Spring.

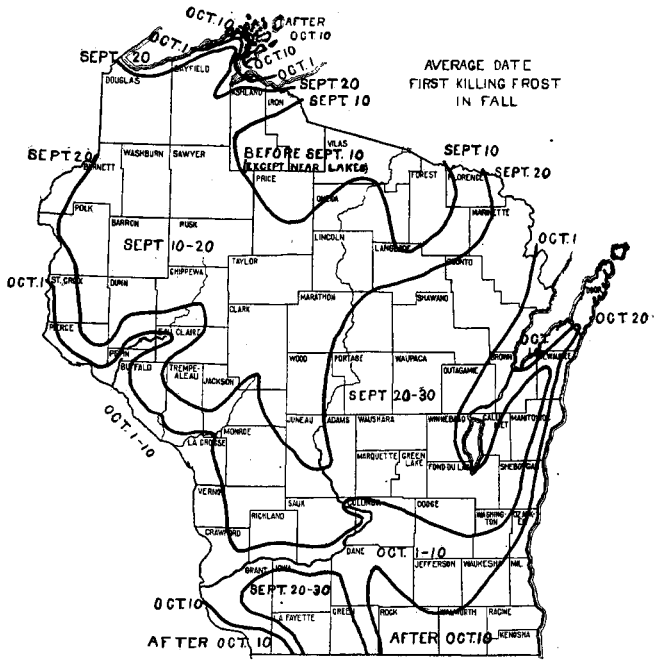

Fig. 6. First Killing Frost in Fall.

These maps have been prepared from the original monthly reports of the observers of the U. S. Weather Bureau for the past 12 years, supplemented by private records.

ture (66° to 69°) being similar to that along the Michigan shore, while the mean winter temperature is only about 2° higher than along the Superior shore. The growing season, averaging 145 days, is apparently twenty to thirty days shorter than the lower lands of the state in the same latitude, while in the river valleys and ravines in this section, the frost danger is still greater, the combined records at Darlington and Gratiot (in LaFayette Co.,) averaging only 120 days. Corn in exceptional years fails to mature, while grass and hay are the dominant crops. The use of land for pasturage is also encouraged by the topography and the heavier rainfall (averaging 34 inches.)''

By reference to figures 5 and 6, it will be observed that the average date of the last killing frost in the spring in the region including Iowa County is from May 1 to 10 in the northern part of the county along the Wisconsin River, and from May 10 to 20 in the southern part of the area, where the elevation is greater. The average date of the first killing frost in the fall in the same region is from Oct. 1 to 10 in the northern part, and from Sept. 20 to 30 in the southern part. From the data on these two maps the approximate length of the growing season for any part of the state can be readily determined.

No weather records extending over a long periol are available for points in Iowa County, but at Lancaster, about 15 miles west of the southwestern corner of the county, weather observations have been made covering a period from January 1, 1893, to December 31, 1903. The following table has been compiled from these records, and as the elevation of the station is 1,100 feet, the conditions are similar to those existing over most of Iowa County:

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

Month.	Temperature.			Precipitation.			
	Mean.	Mean highest monthly.	Mean lowest monthly.	Mean.	Total amount for the driest year.	Total amount for the wettest year.	Snow, average depth.
	°F.	°F.	°F.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
December	20	27	13	1.2	1.2	0.2	6.7
January	17	22	3	1.2	.7	.9	8.7
February	15	22	9	1.1	1.1	1.1	8.8
Winter	17			3.5	3.0	2.2	24.2
March	31	38	22	1.6	2.8	2.0	6.7
April	48	52	42	3.2	1.1	3.6	1.1
May	60	65	55	3.9	2.9	2.7	
Spring	46			8.7	6.8	8.3	7 8
June	68	71	63	3.6	1 3	1.5	
July	72	80	70	4.5	1.6	9.4	
August	70	75	66	2.4	.6	4.0	
Summer	70			10.5	3.5	14 .9	
September	61	68	56	3.3	3.3	4.8	
October	50	57	41	2.2	3.3	3.6	Trace.
November	32	41	28	1.5	1.3	1.8	4.5
Fall	48			7.0	7.9	10.2	4.5
Year	45			29.7	21.2	35.6	36.5

Average date of last killing frost in spring, May 8; and of first in fall, Sept. 29.

From this table it will be seen that the annual rainfall for this station averaged 29.7 inches, and that the average for the driest year is 21.2 inches. These data indicate that the precipitation is comparatively uniform and ordinarily sufficient for agriculture. The mean annual temperature is 45°, with a winter mean of 17° and a summer mean of 70° F. The average length of the growing season at this station is 143 days. From this table, and from the other records given, it will be

observed that there is considerable variation as to the occurrence of killing frosts within this portion of the state, depending largely upon the elevation.

SUMMARY

Iowa County, with an area of 754 square miles, is situated in the driftless area in southwestern Wisconsin.

The topography is that of an elevated to rolling plain in the middle of the county, becoming slightly hilly and rougher to the south; and deeply cut on the north, becoming rougher as the Wisconsin River is approached.

The drainage eventually reaches the Mississippi River, either by way of the Wisconsin and its tributaries on the north, or the Pecatonica to the south.

Four railroad lines traverse portions of the county, giving good transportation facilities.

The population of the county is 22,497 (1910), or 30 people to the square mile. It is well distributed over the entire county.

The soils are residual, loessial, and alluvial, the last lying along small streams and in the Wisconsin Valley. Thirteen types of soil are shown on the soil map.

Knox silt loam occupies about 51.3 per cent of the area of the county. It is especially subject to erosion when put into cultivated crops. It is well adapted to pasture, grain growing, and the dairy type of farming. This land sells at $35 to $100 an acre, depending upon the amount of rough land included.

Marshall silt loam is a prairie soil, especially adapted to corn growing, and live stock and dairy interests. There is very little rough land in this type, and it sells for $60 to $100, or more, an acre.

Dodgeville silt loam is not so well adapted to the cereals as Marshall silt loam, and is principally devoted to pasture and the growth of silage crops. Dairying is well developed on this type, butter, cream, and cheese being produced.

Boone fine sandy loam is of small extent and is found mainly along the bluffs of the Wisconsin River and tributaries, with a few smaller areas along the Pecatonica, in the southwestern part of the county. It produces good corn, small grain, and hay crops.

Wabash silt loam is an alluvial soil, often poorly drained and found in the smaller valleys and stream courses. The soil is variable: small portions are mucky. It is mainly used for pasture, though more elevated areas give good corn and hay crops.

Wabash loam is more uniform than the silt loam, is somewhat better drained, and is found in the wider stream bottoms and as an outwash deposit over the Wisconsin Valley sands. It is a very productive soil, usually benefited by tile drainage. It often produces 90 bushels of corn per acre, and sells at $70 to $100 or more an acre.

Plainfield sand occupies a large proportion of the Wisconsin Valley bottom. It is not a very valuable soil and is inclined to be droughty. It gives fair crops of corn, barley, and buckwheat in favorable years.

Plainfield sandy loam is the better type of sandy soil of the Wisconsin Valley bottom. It produces good grain crops and clover will grow on it.

Dunesand consists of irregular, generally small, areas of Plainfield sand which has been blown into ridges by the wind. This is hardly an agricultural soil: it is very poor and is generally kept wooded.

Lintonia silt loam is an alluvial soil found on elevated, well-drained, and level terraces along the sides of the larger stream bottoms entering the Wisconsin River Valley. It resembles Knox silt loam in texture and is slightly higher in agricultural value.

Muck is found closely associated with Meadow. In some of the larger stream bottoms some of it can be readily and profitably drained.

Meadow includes the marshy portions of the Wisconsin Valley adjoining the river. Part of it is wooded and part is clear and furnishes pasture and good crops of marsh hay.

Rough stony land consists of rocky cliffs and steep, stony hill land too rough to plow. It is found mostly within Knox silt loam type in the northern half of the county. Much of it is useful for pasture and forestry.

Agriculture dates back to 1830, wheat being the first important crop. With the decline of wheat production about 1870, dairy and live-stock interests developed. The county is now distinctly a dairy section. Corn is an important crop. Cheese, cattle, and hogs are important products. Lead and zinc are mined in the southern and western parts of the county. Alfalfa, root crops, and silage should come into more general use as dairying develops. About 78 per cent of the farms are operated by owners.

The climate is healthful, and the rainfall generally sufficient for all crops.

KEEP THE MAP.

The Experiment Station will publish bulletins from time to time dealing with the management of the different types of soil mapped, so that some way should be found by each person receiving a copy of this report to keep the map permanently. If the map is folded in such a way as to have the part you are interested in of a convenient size and then have a simple frame with glass made to hold it, it can be kept indefinitely. Since some of the colors fade after being exposed to strong light for a long time, it would be a good plan to have a protecting flap of dark cloth over the map when not in use.