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WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY

W. O. HOTCHKISS, Director and State Geologist.
A. R. WHITSON, In Charge, Division of Soils.

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

BULLETIN NO. 53B SOIL SERIES NO. 21

SOIL SURVEY

OF

ROCK COUNTY

WISCONSIN

BY

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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 dunes 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.

The textural classification is the most important since it has to do with the water holding capacity of the soil. It also determines the ease with which a soil can be worked, and has much to do with the crops to which the soil is best adapted.

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

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 gradation 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 example, 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, where the parent rock was largely sandstone, 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 soil class and the soil series 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 ROCK COUNTY, WISCONSIN

CHAPTER I.

GENERAL DESCRIPTION AND HISTORY OF THE AREA.

DESCRIPTION OF THE AREA.

Rock County lies in the extreme southern part of Wisconsin about midway on the Wisconsin-Illinois boundary line. Janesville, the county seat, is about 32 miles from Madison. The county has an area of approximately 706 square miles or 451,840 acres.

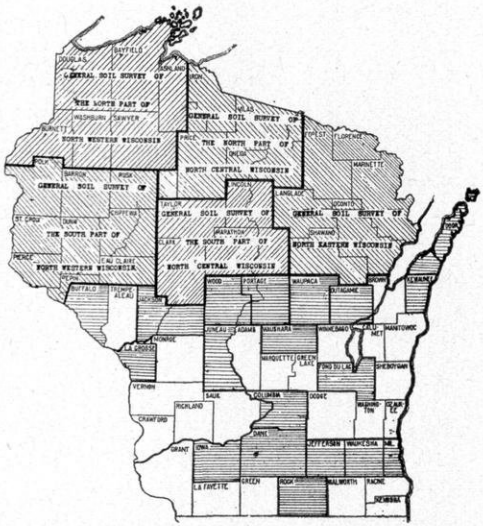


Fig. 1.—Sketch map of Wisconsin showing areas which have been covered by a soil survey.

The surface features of Rock County may be classed in four rather distinct divisions. The extent of each is shown in Figure No. 2. The first of these divisions is confined to the north-

ern part of the county and consists of the material which was most recently deposited by the glacial ice. It is known as the late Wisconsin drift. The southern limit of this region is marked by a low range of hills bordering an extensive level country. This range of hills is known as the "terminal moraine" and it enters the county at the northwestern corner of Union Township, extends in a southeasterly direction and passes into

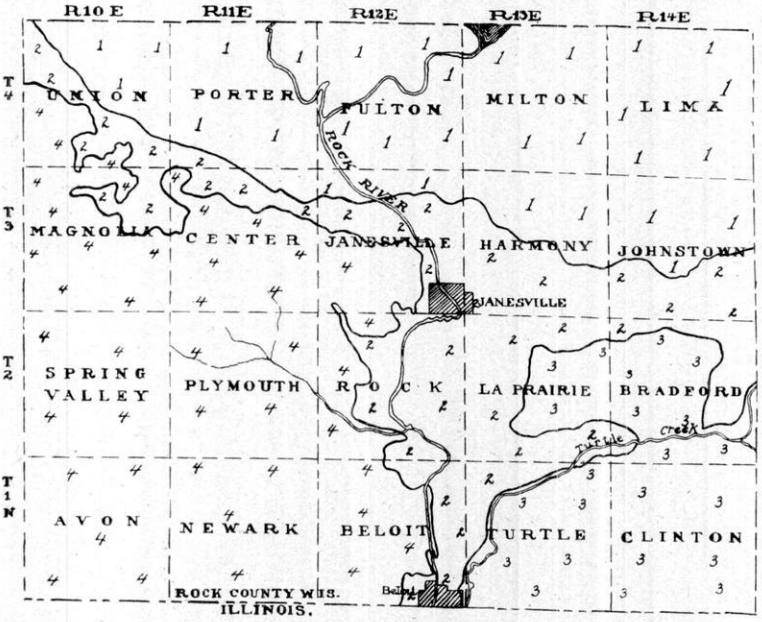


Fig. 2.—Sketch map of Rock County showing—
1. Region covered by late Wisconsin drift.
2. Level valley fill and outwash plains.
3. Region of deep pre-Wisconsin drift.
4. Region of shallow pre-Wisconsin drift.

Walworth County about one and one-half miles north of Johnston. The surface of this region to the north is for the most part gently rolling, although near the moraine it is somewhat broken by pot holes, gravel knolls, and winding ridges. In fact this whole region is now very much as it was shaped by the glacial ice, there being many kettle basins and undrained marshes. It is very interesting to note that this is the only portion of the county in which marshes occur away from streams, and stones and bowlders are also more plentiful than elsewhere.

The second division, known as the "Valley fill" or "outwash plain" is found immediately south of the late Wisconsin drift region. It is level, stone free, and is underlain by beds of sand and gravel. It extends entirely across the county from east to west, but its most extensive development is found in the towns of Johnstown, Harmony, Janesville, Rock, La Prairie, Beloit, and Turtle.

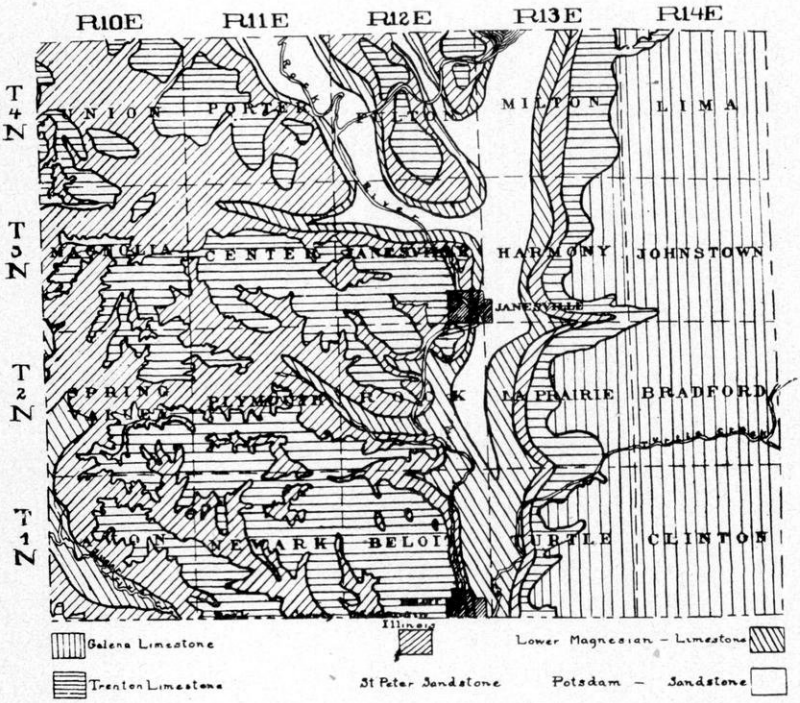


Fig. 3.—Sketch showing surface rock formations in Rock County.

The third region has a surface which is characterized by long, smooth, gentle slopes, and a soil section which is deep, in most places being over 100 feet to the bed rock. The surface is covered by a mantle of uniform silty loess-like material which is practically stone free. The region is much more thoroughly drained than the northern part of the county. This third division may be briefly described as being made up of deep, pre-Wisconsin drift material, which means that it is glacial material of much greater age than that of the late Wis-

consin drift. It is confined to the southeastern portion of the county, largely in the towns of Bradford, Clinton, and Turtle.

The fourth division occurs west of Rock River in the southwestern part of the county. This region was also gone over by the pre-Wisconsin ice sheet, but the glacial material left now forms only a very thin blanket, usually having a maximum thickness of 5 or 6 feet, and in numerous places being entirely lacking. The thin drift occurs in Magnolia, Spring Valley, and Avon Townships. Northwest of Janesville and east of Footville there is a small area over which the drift reaches a depth of from 40 to over 100 feet. The blanket of silty material common to the late Wisconsin drift, and to the older drift west of the Rock River, is seldom three feet thick and in many places entirely lacking in the southwestern portion of the county. Rock outcrops are also common throughout this region. As a rule the farming is not as highly developed in this part of the county as elsewhere, and land values average somewhat lower.

In regard to the topography of the county as a whole it may be said that the total area which is too steep for the growing of cultivated crops is very limited. Some of the land could be classed as rolling and hilly, but the major portion is gently rolling, with the equivalent of several townships in which the surface is level. The major portion of the county has an elevation of between 800 and 900 feet above sea level.

Rock County lies within the drainage basin of Rock River, which passes through the center of the county from north to south.

With the exception of Rock River, the streams are sluggish and meandering, flowing through considerable areas of poorly drained flood plains. The Rock River has cut into the old valley fill to a depth ranging from 30 to 120 feet. Outside of the valley-fill region its valley is 50 to 150 feet deep.

The first settlement in Rock County was made in 1835, on the present site of Janesville. The county was formed by an act of the Territorial Legislature of Wisconsin, on Dec. 7, 1836. The population as given in the 1920 census was 66,150, averaging 92.4 persons to the square mile.

SOILS.

The soils of Rock County have been derived largely from glacial material of various ages, from decaying vegetable matter and from the weathering of the under-lying rock formations. In the work of the soil survey in Rock County these various soil forming materials have been classified into soil series and soil types and the location, extent and distribution has been shown on the accompanying map. In all 11 soil series and 25 soil types* have been recognized.

The Carrington series includes the dark colored upland prairie soils which have been derived largely from glaciated limestone material. Part of this series lies within the region of recent glacial drift while part of it is included in the pre-Wisconsin drift region. This series is quite extensive and the soils have a high agricultural value. The types mapped are Carrington silt loam with a shallow phase, Carrington loam, fine sandy loam and gravelly loam.

The Miami series includes the light colored upland timbered soils where the material has been derived largely from glaciated limestone. This series also includes excellent agricultural land and with the Carrington series occupies by far the The types mapped are the Clyde silt loam and fine sandy loam.

*In comparing this issue of the soil survey report of Rock County with the edition published by the United States Bureau of Soils it will be noted there is some difference in the naming of some of the soil types. In the State report the types have been correlated with the soils as previously mapped within the State while in the report issued by the United States Bureau of Soils the types have been correlated with the soils as they occur in adjoining States. The following table gives the various soils to which different names have been applied in the two reports.

Type name in report of U. S. Bureau of Soils	Type name as published in the report issued by the State of Wisconsin
Bellefontaine gravelly loam	Miami gravelly loam
Bellefontaine fine sandy loam	Miami fine sandy loam
Bellefontaine loam	Miami loam
Bellefontaine silt loam	Miami silt loam
Miami fine sandy loam	Knox fine sandy loam
Miami loam	Knox loam
Miami silt loam	Miami silt loam, deep phase
Union silty clay loam	Baxter clay loam
Rodman gravelly sandy loam	Rodman gravelly loam
Waukesha gravelly sandy loam	Waukesha gravelly loam
Fox loam, light textured phase	Fox fine sandy loam

greater portion of Rock County. The types mapped in the Miami series include the silt loam, with a deep phase, Miami loam, fine sandy loam and gravelly loam.

The Clyde series includes dark brown to black soils with gray, drab or mottled subsoils and the material occupies low depressed areas in the upland or old lake basins and ponded valleys in the region of alluvial soils. These soils are all relatively low lying, natural drainage is poor and there has been a considerable accumulation of organic matter in the surface soil. When drained this series makes good agricultural land.

The soils of the Knox series include the light colored upland timbered soils in the unglaciated region or where the influence of the glacial ice was very limited as in the southwestern part of Rock County. The surface of this region is mostly rolling and the natural drainage is good. This material frequently rests on weathered limestone and the underlying rock sometimes comes within three feet of the surface. The lower portion of the subsoil may in some cases have been derived from the rock itself. The types mapped as belonging to this series are the Knox loam and fine sandy loam.

The surface soil of the Crawford series includes dark to nearly black surface soils with heavy brown or reddish brown subsoils which have been derived from the underlying limestone. The rock usually comes to within from one to two feet of the surface. The surface is rolling and the drainage is good. The clay loam is the only type mapped and its extent is very limited.

The Boone series consists of light colored upland timbered soils where the parent material has been derived from sandstone. These soils occupy gently to steeply rolling uplands and the drainage is good to excessive. The only type mapped in this county belonging to this series is the Boone fine sandy loam.

The Fox series includes light brown upland timbered soils in the glaciated limestone region where the material has been derived from glaciated limestone and re-worked and re-deposited by the action of water in the form of outwashed plains, stream terraces or filled in valleys. The subsoils are usually heavy but in the lower depth grade into sand or gravel. The surface is level or nearly so and the natural drainage is for the most part

good. The types in this county belonging to the Fox series are the silt loam, loam and fine sandy loam.

The soils of the Rodman series are light brown or reddish brown in color. The subsoils are of similar color but consist of beds of loose gravel and sand. The soils consist of material which was laid down under the ice sheets by running streams and occur chiefly as sharp hills and ridges known as Kames and Eskers. The surface is very irregular; pot-holes are quite numerous and the natural drainage is excessive. This class of land is of low agricultural value. The only type mapped is the Rodman gravelly loam.

The Plainfield series consists of light brown surface soils with light brown to yellow subsoils. The surface is level and the natural drainage is somewhat excessive. The soils are all of a sandy nature and have been deposited as stream terraces or outwashed plains. Plainfield fine sand is the only type mapped in the series.

The Waukesha series consists of dark brown to black upland prairie soils where the surface is level and where the deep subsoils grade into sand and gravel. The material is largely glacial debris which has been deposited by the water as terraces, filled in valleys or outwashed plains. The Waukesha soils include some of the finest agricultural land in the region and are very highly improved. The types mapped are Waukesha silt loam with a deep phase, Waukesha loam, sandy loam, gravelly loam and sand.

The Baxter series consists of light colored upland timbered soils where the material has been derived from the underlying limestone formation. The subsoils are usually brown or reddish brown and grade into the underlying limestone at a depth of 18 inches to 3 feet. The clay loam is the only type mapped in this series.

Peat consists of large deposits of decaying vegetable matter with which there has been incorporated a small amount of mineral matter. These deposits extend to a depth of two to ten or more feet.

The material mapped as Peat has been divided into two classes: that which is over 18 inches deep is called typical Peat and that which is less than 18 inches deep has been mapped as a shallow phase of Peat.

In the following pages of this report the various soils of Rock County are described in detail and their relation to agriculture is discussed. The distribution of the soils is shown on the accompanying soil map while the table below gives the name and the actual and relative extent of each kind of soil mapped.

AREA OF DIFFERENT SOILS.

Soil	Acres	Per cent
Carrington silt loam	67,712	19.1
Shallow phase	19,776	
Miami silt loam	63,160	13.8
Deep phase	37,056	8.1
Waukesha silt loam	21,760	
Deep phase	41,280	13.7
Clyde silt loam	52,672	11.5
Knox fine sandy loam	24,512	5.3
Peat	7,040	2.9
Shallow phase	6,208	
Miami gravelly loam	13,184	2.9
Waukesha loam	12,672	2.9
Sandy phase	256	
Fox silt loam	12,736	2.8
Carrington fine sandy loam	9,728	2.1
Miami fine sandy loam	9,344	2.0
Clyde fine sandy loam	9,280	2.0
Carrington loam	9,088	1.9
Baxter clay loam	7,424	1.6
Waukesha sandy loam	5,888	1.3
Fox loam	4,864	1.1
Boone fine sandy loam	4,672	1.0
Knox loam	3,712	.8
Waukesha gravelly loam	3,584	.8
Fox fine sandy loam	2,496	.5
Miami loam	2,432	.5
Waukesha sand	2,240	.5
Carrington gravelly loam	1,664	.4
Rodman gravelly loam	832	.2
Plainfield fine sand	748	.2
Crawford clay loam	196	.1
Total	458,240	

CHAPTER II.

GROUP OF SILT LOAM AND CLAY LOAM SOILS.

CARRINGTON SILT LOAM.

Extent and distribution. Carrington silt loam with its shallow phase is the most extensive and important soil in Rock County. It is found most extensively in the southeastern part of the county in La Prairie, Bradford and Clinton Townships. Other extensive areas occur in the central part of the county extending west from Janesville, and also in the northern part of the county, between Edgerton and Evansville. In all, there are over 100 square miles of this type within the county and it occurs in every township except Lima.

Description. The Carrington silt loam to 12 or 14 inches consists of a dark-brown or almost black, smooth silt loam, rich in organic matter. The upper subsoil is a dingy-brown silt loam, grading downward into a yellowish-brown silt loam. The lower subsoil is a yellowish-brown silty clay loam, grading into a silty clay which continues to a depth of 3 feet or more. The entire 3-foot section is almost free from gravel, stones and bowlders and is remarkably uniform in its loess-like structure and texture. Immediately below this loess-like mantle, which varies from 3 to 8 feet in thickness, the typical glacial till consisting of clay, silt, sand and gravel is encountered. The line of separation between this and the yellowish-brown silty clay is well defined, the upper part being free from bowlders and gravel and leached free of calcium carbonate, while the till is filled with stones and bowlders and is well supplied with calcium carbonate. Both Truog and litmus tests indicate that the surface soil is in an acid condition.

As mapped, the Carrington silt loam is subject to some variations. In the northern part of the county, in the region covered by the late Wisconsin drift, and in all the occurrences of the type west of Rock River and north of the late Wisconsin terminal moraine, there are numerous inclusions of a shallow

phase of the type in which the lower subsoil is a sandy clay or silty clay carrying some gravel. When this shallow condition is of sufficient extent it has been shown on the map as a shallow phase. Where the Carrington silt loam borders the Miami silt loam, it is somewhat lighter colored and contains less organic matter. Where is borders the Clyde silt loam the lower subsoil often shows yellow and drab mottlings. When gravelly areas occur within the soil or when rock outcrops are formed, appropriate symbols have been placed on the map to show these conditions.

Topography and drainage. The surface of this type ranges from nearly level to gently rolling. While there are differences in elevation on the prairie of about 200 feet the slopes are long and gentle so that modern farm machinery can be operated on very nearly all of the type and only in a few places are the slopes steep enough to make erosion a serious problem. The steepest portions of the type are west of Rock River. In most places, the natural drainage is good, but on some of the more level tracts, tile drainage would be beneficial. The soil retains moisture well, and resists drought as well as any of the other soils of the county.

Present agricultural development. Practically all of this soil is in farms and highly improved. Corn, oats, barley and hay are the leading crops. Alfalfa and wheat are grown to some extent. Tobacco and sugar beets are special crops.

For a discussion of the chemical composition and methods for the improvement of this soil see page 26.

Carrington silt loam, shallow phase. The surface soil of the Carrington silt loam, shallow phase, consists of a dark-brown to almost black, friable silt loam, comparatively high in organic matter. It usually contains some fine sand, and often a small quantity of gravel. The Truog and litmus tests indicate that the surface soil is in an acid condition. The subsoil consists of a rather friable, dingy-brown silt loam grading downward into a yellowish-brown silt clay loam which carries some fine sand and gravel. At about 20 to 30 inches a sandy clay or sometimes a sandy loam, is encountered. The deep subsoil grades into typical glacial till, composed of a miscellaneous mixture of clay, sand, gravel and bowlders. In many rather large areas in the old glacial drift region, lying south of the

late Wisconsin terminal moraine and west of Rock River, where the limestone is within 4 feet of the surface, the lower subsoil is a reddish-brown clay, carrying fragments of weathered limestone, from which it has originated. In places limestone fragments occur in both soil and subsoil. Where the type borders the Miami silt loam it is lighter in color and runs lower in organic matter than elsewhere, while bordering the Miami loam or fine sandy loam or the Carrington loam or fine sandy loam both soil and subsoil contain more fine sand. On some of the steep slopes the soil has been removed by erosion and the till bed is exposed, while in other places the clay loam subsoil comes to the surface. The phase as mapped includes small areas of Carrington loam and fine sandy loam.

The Carrington silt loam, shallow phase, is extensively developed in this county. Its principal occurrence is west of Rock River in the pre-Wisconsin drift region, and between Fulton and Cooksville in the region of late Wisconsin drift. The surface varies from gently rolling to rolling. In the area of late Wisconsin drift, in the northern part of the county, the surface is in many places interrupted by Kames or Eskers and other morainic hills, and on the whole is of a morainic character while in the region of pre-Wisconsin drift, west of the Rock River, the topography is almost entirely developed by erosion. On account of the sloping surface and the open nature of the soil and subsoil, the natural drainage is good. On some of the steeper slopes, where proper care has not been taken, destructive erosion has developed.

This is an extensive and important soil in Rock County. Probably 80 per cent of it is under cultivation, the remainder being devoted to permanent pasture. General farming in conjunction with dairying is the leading type of agriculture. Like the typical Carrington silt loam, this is prairie soil, and the native growth consists almost exclusively of prairie grasses.

Corn, oats, barley, hay and tobacco are grown successfully on this soil, but yields are somewhat lower than on the typical Carrington silt loam. The soil is handled and fertilized in the same way as the typical silt loam.

Land of this phase ranges in selling value from $100 to $200 an acre, depending upon the location and improvements, depth of soil, etc., while the typical soil frequently reaches a value of $300 per acre for the best farms.

For a discussion of the chemical composition and methods for the improvement of this soil see page 26.

WAUKESHA SILT LOAM.

Extent and distribution. The Waukesha silt loam with its deep phase is the most extensive and important of the alluvial soils in the county. The typical soil is much less extensive than the deep phase. The typical soil covers a total area of about twenty-five square miles. The largest areas are found northeast of Beloit, between the Rock and Turtle Rivers and immediately south of Janesville. Other smaller areas occur along the valley of Marsh Creek.

Description. The Waukesha silt loam to a depth of about twelve inches contains a comparatively high percentage of organic matter and some fine sand. The upper subsoil is a dark-brown silt loam, grading downward into a brownish-yellow silt loam or silty clay loam which contains a small amount of sand. At twenty-four to thirty-six inches a yellow fine sandy loam or sandy loam is encountered, quickly passing into a gravelly sandy loam and below this into stratified beds of gravel and sand. The type as mapped includes patches of Waukesha loam not sufficiently extensively to warrant separation.

Topography and drainage. The surface is level to very gently undulating, and the natural drainage is good. There are a few places where the underlying sand and gravel comes to within less than two feet of the surface when the soil suffers somewhat from extended dry spells.

Waukesha silt loam, deep phase. This is the most extensive and important of the terrace soils in Rock County. The deep phase covers a total area of about one and one-half townships. The largest area occurs in a belt from three to six miles wide, extending east from Janesville into Walworth County. This belt within the county is twelve miles long, and with adjoining soils of the Carrington series, is known as Rock Prairie. The soil of the Waukesha silt loam, deep phase, consists of a dark brown to almost black, smooth silt loam, twelve to sixteen inches deep, comparatively high in organic matter and markedly acid as shown by the Truog and litmus tests. The upper subsoil is a brown silt loam, grading into a yellowish-brown silt loam which often continues to a depth of three feet or more, but

in some places gives way to silty clay loam at about thirty inches. Both soil and subsoil are free from sand, gravel and bowlders but beds of gravel and sand occur at depths ranging from four to twelve feet, as may be seen on the sides of gullies. The deep phase has the same topographic features as the typical soil, but because of its depth and heavy nature of the subsoil, the drainage is somewhat deficient and tile drains could be installed to advantage over part of this soil. This would make possible getting on the land earlier in the spring and sooner after heavy rains.

As the silty covering over the sand and gravel is much deeper than the typical soil, and as it is free from coarse material, it has somewhat more the nature of wind blown material, and may be of loessial origin. The entire type is acid, and the acidity extends well into the subsoil.

Present agricultural development. The Waukesha silt loam with its deep phase averages the highest priced farm land in the country. It is practically all tillable and is all in well-improved farms. It is excellent farming land and is devoted to general farming and dairying. Corn, oats, barley and hay are the principal crops, corn occupying the largest acreage. Some wheat is also grown. Sugar beets and tobacco are special crops. This land has a selling value of from $150 to $300, depending upon the improvements, location, etc.

For a discussion of the chemical composition and the best methods for improving the soil, see page 26.

MIAMI SILT LOAM.

Extent and distribution. The Miami silt loam with its deep phase is one of the most extensive types of soil in Rock County. It covers extensive areas in the northern part of the county, and there is also an extensive area in the southeastern corner. West of Afton and between Brodhead and Evansville are other important tracts. Numerous smaller patches occur throughout the county.

The typical soil is all confined to the northern part of the county.

Description. The typical Miami silt loam to a depth of ten or twelve inches is a light-brown silt loam, often containing a small amount of fine sand and gravel, and being low in organic

matter. Truog and litmus tests show that the soil is somewhat acid. The upper subsoil is yellowish-brown silt loam, grading at eighteen or twenty inches into a yellow silty clay loam which contains considerable fine sand and gravel. At about twenty-four inches a sandy clay, containing some gravel, is encountered, and this continues to a depth of three feet or more.

The type is subject to considerable variation, especially in the depth of the silty covering and in the content of sand and fine gravel. In depressions between gravel knolls and ridges and in level areas the silt loam is deeper than typical, while on ridges, knolls and steep slopes the soil may be washed off, the sandy clay near the surface and occasionally exposed.

Topography and drainage. The surface of the typical Miami silt loam is characteristic of a glacial region, and varies from gently rolling to rolling. There are numerous morainic ridges, kettle holes, drumlins, etc. Between some of the higher elevations, there are areas of gently undulating land. Because of the surface features and the open characters of the subsoil, the natural surface and under drainage are both good, yet the soil is sufficiently heavy to retain moisture well.

Present agricultural development. This is an important type and fully eighty per cent of it is under cultivation. General farming with dairying is the chief type of agriculture.

Corn, hay, oats and barley are the leading crops, ranking in acreage in order named. Irish potatoes, wheat, rye, beans and alfalfa are grown in a small way and tobacco, peas, and sugar beets are special crops of importance. Tobacco is grown extensively about Edgerton and to some extent over the entire type. Near Evansville a number of farmers are engaged in growing peas for canning. Sugar beets are grown in the northern part of Rock County and are shipped largely to the factory at Janesville. There are a number of home apple orchards, but the trees are largely neglected and the fruit is usually of inferior quality.

The value of land of the Miami silt loam ranges from $100 to $250 an acre, depending upon the location and improvements.

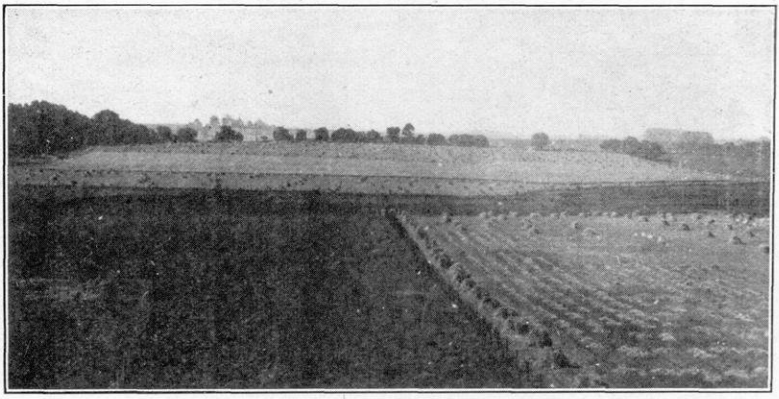
Miami silt loam, deep phase. The Miami silt loam, deep phase, to a depth of twelve to fourteen inches consists of a light brown, friable silt loam, low in organic matter. When dry, the surface material has an ashen appearance. Gravel, bowl-

VIEW OF MIAMI SILT LOAM.

Showing typical surface features of Miami silt loam as this type is found in Rock County.

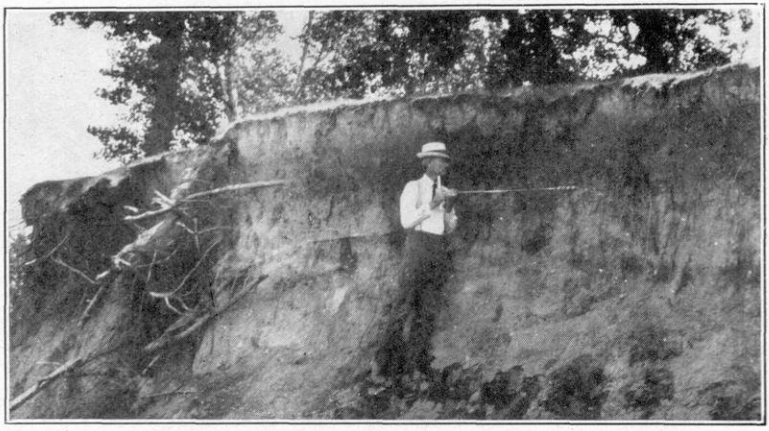
SOIL SECTION—MIAMI SILT LOAM.

Showing the unassorted glacial material forming the subsoil, and the thin layer of silty, stone free material which forms the surface soil.



VIEW OF MIAMI SILT LOAM, DEEP PHASE.

Showing the smooth topography and long gentle slopes characteristic of this soil. It is confined largely to the southeastern part of Rock County, and is excellent farming land.



SOIL SECTION OF THE DEEP PHASE OF MIAMI SILT LOAM.

The point of the auger marks the point of contact between the stone free loess-like surface section, and the underlying unassorted glacial drift material which contains considerable gravel and coarse material. The loess-like covering ranges from three to six feet in thickness.

ders and fine sand are noticeably less abundant than in the typical Miami silt loam, and are frequently entirely lacking. Tests show that this soil is somewhat acid, the strongest usually being on the ridges. This acidity frequently extends to below three feet. The subsoil consists of a yellowish-brown silt loam which becomes heavier with depth, grading at about twenty-four inches into a silty clay loam which at thirty-four to thirty-six inches often shows a slight mottling of gray. Both soil and subsoil have a very smooth feel and a loess-like structure. There is a sharp line of separation between the upper silty material and the underlying glacial till, which contains stones, bowlders and gravel. The gravel consists chiefly of limestone. This till bed is found at from thirty inches to five feet. In the southeastern part of the county this very silty covering is frequently 6 to 8 feet deep.

Where this phase borders the Carrington or Clyde soils the color at the surface may range from brown to dark brown. Where it borders the typical Miami silt loam it often contains some gravel at depths of 24 to 36 inches. Some areas of typical Miami silt loam and Clyde silt loam, too small in extent to warrant separation, are included with the phase.

The Miami silt loam, deep phase, is found in all but two of the townships in the county. The largest area, however, is in the southeastern corner of the area in Turtle and Clinton Townships. The surface ranges from gently undulating to gently rolling. Drainage is good except in the more gently undulating areas, where tile drains are needed. The surface is smoother than the typical soil and long gentle slopes are quite common. The soil retains moisture very well, and crops suffer less during long, dry periods than on most of the other soils of the county. The phase is not subject to destructive erosion.

This is one of the more productive soils of the county and about 90 per cent of it is under cultivation. General farming in connection with dairying is the leading type of agriculture. The small woodlots support a growth of bur oak, black oak, red oak, maple, elm, hickory and cherry. The same crops are grown as on the typical soil, and the farming methods are similar. Yields are slightly higher, and the selling price shows some difference, ranging from $150 to $250 an acre.

For a discussion of the chemical composition and methods for the improvement of this soil, see page 26.

FOX SILT LOAM.

Extent and distribution. This type occurs in comparatively large areas several miles north of Johnstown Center, west of Milton Junction and north of Janesville along Rock River. Small areas are found in almost all parts of the country.

Description. The Fox silt loam to a depth of ten to twelve inches, consists of a light-brown or grayish-brown, friable silt loam which has a whitish appearance when dry, owing to its very low content of organic matter. The material is almost free from sand and gravel, and has an extremely smooth feel. The upper subsoil is brownish-yellow silt loam, grading at sixteen to twenty inches into a yellow silty clay loam which may continue to a depth of three feet or more. In many places a silty fine sandy loam is encountered at any depth from twenty-two to thirty-six inches. It is underlain by stratified beds of sand or gravel.

Topography and drainage. The surface is level to very gently undulating, and the natural drainage is sufficient except where the underlying beds of sand and gravel are three feet or more below the surface. Bordering Clyde areas, the drainage is also frequently deficient.

Native vegetation. The original timber growth consisted of oak, elm, hickory and some ash and elm.

Present agricultural development. Corn, oats, barley, clover and timothy hay are the most important crops. Irish potatoes, sugar beets and tobacco are grown rather extensively in some sections. Very nearly all of this land is cleared and included in highly improved farms.

Land of the Fox silt loam has a selling value of $120 to $200 an acre, according to the location and state of improvements.

The methods suggested for the improvement of Miami silt loam will apply equally well to the Fox silt loam.

CHEMICAL COMPOSITION AND IMPROVEMENT OF UPLAND SILT LOAM SOILS IN ROCK COUNTY.

These soils are very similar in the texture, and structure of the surface and the upper portion of the subsoil section. They differ chiefly in color. The Waukesha and Carrington silt loams are dark colored prairie soils, and both are high in or-

ganic matter and nitrogen. Miami and Fox silt loams are light colored and are timbered soils low in organic matter. The types are so closely related that with few exceptions methods for the improvement of one will apply to the others.

The four elements of plant food with which the farmer is most concerned in his farming operations, and the ones which are the most apt to be deficient are nitrogen, phosphorus, potassium and lime or calcium. He should know the part which each plays in the development of the plant, and what are the best methods of maintaining an adequate supply in the soil.

The soil has been leaching for a large number of years, and has lost much of the lime which it may have contained. Varying degrees of acidity have developed over the entire region. The loss of lime from the soil is caused by two distinct factors, both of which are important. Crops require lime in their growth. A 5 ton crop of alfalfa requires 185 pounds of lime and 2 tons of red clover removes 61.6 pounds. A much larger amount is removed by leaching each year and these losses must be made up by the application of lime in order to maintain the fertility of this soil.

Tests show that the subsoil, especially of the deep phase of Miami silt loam is frequently deficient in lime to a depth of thirty-two inches or more. The deficiency frequently extends down to where fine gravel and coarse sand is found in the subsoil.

While it will be seen from tests that by far the greater part of this land shows some degrees of acidity it does not mean that all of the land is in immediate need of lime. Where such crops as alfalfa, sugar beets, tobacco, peas, cabbage and other garden crops are grown and where the acidity is medium from 2 to 3 tons per acre of ground limestone may be used with profit. Where a liberal supply of manure is available the need for lime will not be so great. The second application which may be needed after 4 or 5 years will be less than the first.

Where such crops as corn, clover and oats are grown with manure once during each rotation a smaller amount of lime will be needed. On parts of the farm where manure cannot be applied the lime can be used with profit on such soils and may be actually necessary for economic production. The greater need will usually be on the higher places, rather than on the lower slopes.

It has been quite definitely established that the need for lime in these soils runs practically parallel with the need of phosphorus. The use of lime alone will not make enough phosphorus available, and the use of a phosphate fertilizer will not supply the lime requirements of the soil. Either lime alone or acid phosphate alone will give increased yields, but neither alone will give as great an increase nor as profitable an increase as when both are supplied. In the improvement of these lands, therefore, provision for the use of both lime and a phosphate fertilizer should be made.

Phosphorus exists in all soils in Wisconsin in small amounts. Many of the best types in the state contain only 1,200 pounds to the acre eight inches deep, and this is in a form which becomes available to crops very slowly. Phosphorus is constantly being lost from the farm in crops, milk and in the bones of animals sold. It is well understood that when grain, hay, potatoes or other cash crops are sold, this element is removed from the farm. This element cannot be supplied from the air and in the long run the loss must be made up through additions of phosphorus fertilizer in some form.

Ten samples of Waukesha silt loam gave an average of 1,408 pounds per acre. In 16 samples of Miami silt loam the average amount of phosphorus present was 1,057 pounds per acre. The lowest amount found in any of the samples was 800 pounds per acre. The number of pounds of phosphorus in the soil, however, cannot be taken to indicate the immediate need for phosphate fertilizer. The system of farming followed, crops grown, type of soil and conditions relative to acidity are all important factors in determining the need for phosphorus. It should also be borne in mind that where soils are acid the amount of phosphorus which they do contain is not so readily available to plants as in soils which are not acid.

On good upland soil where dairying or general farming is practiced the use of 200 pounds of 16 per cent acid phosphate or 75 pounds of 44 per cent super-phosphate to the acre every four or five years will maintain the phosphorus supply. If much grain, potatoes or other crops are sold, more phosphate should be used.

On the farm of Roy Marshall at Elkhorn in Walworth County an application of one hundred pounds per acre

of treble superphosphate (44 per cent) on corn gave a yield of 15,570 pounds of silage while on the untreated plot the yield was 13,335 pounds per acre. In a test on the Station Farm at Madison, on the Miami silt loam soil a phosphate fertilizer applied at the rate of two hundred pounds per acre on oats gave a yield of 93.8 bushels while the untreated yield was 70.4 bushels. This was on land where the fertility was quite high. In another case where 500 lbs. of 16 per cent acid phosphate per acre was applied to prairie land which received both manure and limestone the yield of alfalfa was nearly doubled. In some of these cases the increase is small but it should be kept in mind that the fertilizer left over in the soil will be of considerably value to the following crop, especially clover.

On soils relatively low in fertility somewhat more phosphate should be used at first. This is especially true of the dark prairie soils which have grown corn or small grain a long time without the use of manure or other fertilizer.

If considerable amounts of bran or cottonseed meal are fed, which are relatively high in phosphorus, the supply of this element may be maintained. It would usually be necessary to feed at least one-half ton of bran or cottonseed meal to each cow on a dairy farm per year to maintain the phosphorus supply of the soil. Since comparatively few farmers do that some phosphate fertilizer should be used.

Potassium exists in these soils in large amounts, but in relatively unavailable form. Chemical analyses show that they often contain from 30,000 to 40,000 pounds an acre eight inches, while these same soils will contain only one-eighteenth as much phosphorus. On most soils of fairly heavy texture, when live stock is maintained, and the manure carefully used so there is considerable actively decomposing organic matter in the soil, a sufficient amount of potassium will become available from year to year to supply the needs of general farm crops. There are some crops that need relatively large amounts of potassium such as potatoes, tobacco and cabbage and they will often be benefited by some addition of potash in the form of commercial fertilizer.

Nitrogen is chiefly responsible for the dark green, healthy color and rapid growth of corn or other crops on well manured

land. It is important to have sufficient amounts in the soil, but when in excess it is detrimental for some crops. The quality of the grain may be injured by too much nitrogen. When the grain lodges the kernels do not fully mature.

Virgin soils contain large amounts of nitrogen but if they are cropped continuously to such crops as corn, oats and timothy without the addition of fertilizer material containing nitrogen the nitrogen supply is gradually exhausted and the yields are reduced.

The supply of organic matter and nitrogen in the prairie soils is considerably higher than in the light colored timber soils. Eight soils tested from the Waukesha silt loam contained an average of 4,500 pounds of nitrogen in the surface eight inches per acre. Carrington silt loam will average about the same. This amount is considered a very good supply. A question of importance in connection with the nitrogen of this soil, however, is its availability to plants, and in the soils which have been under cultivation for a long number of years, this nitrogen is somewhat inert, and when in this condition, decaying vegetable matter, green crops, or manure plowed under will give a more readily available supply of nitrogen.

The clover, alfalfa, peas and beans have bacteria on their roots that take the free nitrogen from the air and store it in the plant roots. This is the cheapest method of obtaining nitrogen and one which the farmers should use to the fullest extent. On the ordinary dairy farm at least one-fourth of the land under cultivation should be seeded to clover or alfalfa. This should be fed to stock or plowed under as green manure to insure keeping up the supply of nitrogen and organic matter.

A rotation with a legume plowed under will secure nitrogen and reduce danger from diseases, and when supplemented with phosphorus and potassium fertilizers the legumes thus treated will take the place of manure, which can then be used for other crops on the farm.

Certain crops such as tobacco, potatoes and vegetables are grown by farmers who do not keep much livestock and who do not rotate these crops with legumes. This is not a good practice.

CRAWFORD CLAY LOAM.

The Crawford clay loam consists of a blackish clay loam, clay, or sandy clay, passing at about 8 inches into a heavy dark reddish brown clay, which at 12 inches grades into weathered limestone from which the soil has been derived. Angular fragments of limestone and chert are scattered over the surface and mixed through the soil section in sufficient quantities to hinder or even prevent cultivation.

This type is confined to a few small areas along ridges and steep hillsides southwest of Orfordville. The total area will not exceed one square mile. The surface drainage is usually good.

Because of its small extent and the closeness of the limestone to the surface, the type is difficult to cultivate and it is unimportant in the agriculture of Rock County. Probably 75 per cent. of it is under cultivation. Corn, oats and hay are grown, and give fair yields.

The incorporation of vegetable matter will improve the texture of this soil and make it easier to cultivate. The steep slopes should be kept in permanent pasture, on account of washing.

BAXTER CLAY LOAM.

This type is not extensive. It is found only in the western part of the county in Magnolia, Spring Valley, and Avon townships with a few scattered areas in Newark township. The total area is less than ten square miles.

The surface soil of the Baxter clay loam is a light brown to brown silt loam to silty clay loam, containing a small amount of organic matter. At eight to eleven inches a reddish-yellow clay is encountered, grading at sixteen to thirty inches into the weathered limestone. Irregular limestone and chert fragments are often scattered over the surface, and are present in both soil and subsoil. On steep slopes the reddish-brown clay is often exposed at the surface. As mapped, this type includes many small areas of loam and silt loam. The loam variation consists of a light-brown loam, low in organic matter, underlain at eight to twelve inches by a reddish-brown, sandy clay loam, or sandy clay, which grades at sixteen to twenty-four inches into the weathered limestone. Limestone and chert fragments are often

present in both soil and subsoil, and are scattered over the surface. On the steep slopes where erosion has been active there are many exposures of reddish-brown clay. The loam is inextensive. It occurs in Spring Valley township, the western part of Newark township, and the northern part of Avon township. The surface is rolling or steep, and the surface drainage is good. Practically the same crops are grown, and the same yields are obtained as on the clay loam.

The surface is rolling to hilly. The type occupies steep slopes and sharp narrow ridges where erosion is serious, having developed numerous deep gullies and ravines. Because of the uneven surface features, the natural surface drainage is good.

The original timber growth consisted of several varieties of oak, maple, poplar, hickory and some basswood. Most of the merchantable timber has been cut.

Probably twenty-five per cent of this soil is cultivated; the remainder is used largely as permanent pasture. The heavy character of this soil and the rolling surface makes cultivation difficult. Methods for improvement of Miami silt loam will apply fairly well to this soil.

CHAPTER III.

GROUP OF LOAMS AND FINE SANDY LOAMS.

KNOX LOAM.

Knox loam is of limited extent and of minor importance in Rock County. It occurs only in small patches and is found chiefly in Newark, Avon, Valley and Plymouth Townships. The largest area covers less than one square mile.

The surface is a light brown loam with only a moderate amount of organic matter. This extends to about 8 to 10 inches where the material is usually lighter in color. A yellowish-brown sticky sandy loam or light clay loam is found at 14 to 18 inches, and this frequently becomes heavier with depth. It frequently grades into reddish-brown, heavy gritty material at about 2 feet and then rests upon limestone at 30 to 36 inches. In other places the subsoil is more sandy and the rock is not reached in the 3-foot section. In a few places the bed rock was found within 2 feet of the surface, but in most instances it was below 3 feet.

The surface is gently rolling, and the natural drainage is good. But little damage has been caused by erosion, but on the steeper slopes there is some danger of washing when fields are not covered by a growing crop.

This soil is all found within the region covered by the pre-Wisconsin ice-sheet, and a large part of it has been derived from the old glacial material. This glacial deposit, however, is thin, and in numerous places the subsoil has been derived from the weathering of underlying limestone. Some of the fine particles may be of wind blown or loessial origin. While coming in part from limestone material, the surface soil is usually at least slightly acid.

The native timber was hardwood, consisting of hickory, oak, maple, with some walnut.

This soil is mostly under cultivation and devoted to the general farm crops of this region. In crop yields and general pro-

ductiveness, and methods of farming practiced upon it, this soil is very similar to the Knox fine sandy loam.

For methods of improvement and chemical analyses of this soil, see page 44.

MIAMI LOAM.

The Miami loam is of very limited extent, and is confined to a few scattered areas in Porter, Milton, and Lima townships. The largest area of about one square mile is located about four miles northeast of Milton Junction. The total amount of this type in the county does not exceed two square miles.

The surface soil is a light brown loam to a depth of 8 to 11 inches, underlain by a yellowish-brown loam, grading at fourteen inches into a sandy clay loam, which becomes a reddish-yellow sandy clay, extending to a depth of over three feet. Fine gravel stores are frequently found in the subsoil, and some may also appear upon the surface. The type is quite variable, and includes patches of silt loam and fine sandy loam. The surface is gently rolling, and the natural drainage is good.

Most of the lime carbonate has been leached from the surface soil, and varying degrees of acidity have developed.

Practically all of the native timber has been removed, and most of the type has been placed under cultivation.

It is well suited to all general farm crops grown in this region. Because of its limited extent, few, if any, farms are located entirely upon it, and no methods peculiar to this soil have been devised. In the methods followed and yields obtained, this soil is very similar to the Miami fine sandy loam, which is found in much larger areas in Rock County.

For methods of improvement and for the chemical composition of this soil, see page 44.

FOX LOAM.

Extent and distribution. The Fox loam is well distributed in small areas throughout the western part of the county, with only a few areas east of Rock River in Turtle Township. The largest area occurs southeast of Evansville.

Description. The Fox loam consists of a brown loam, passing at about 10 inches into a heavy, yellowish brown loam or light sandy clay loam, which grades downward into a yellow-

brown or brownish-yellow gravelly sandy clay. At about 30 inches stratified beds of yellow gravel and sand are encountered. Litmus paper tests show that the surface soil is acid. In some places the beds of gravel and sand are within 20 inches of the surface, while in others they do not occur within the 3 foot section. Southeast of Evansville the surface soil is somewhat darker than typical, and the subsoil shows more or less mottling with yellow, brown and drab. There are some included areas, too small to map, of Fox silt loam and fine sandy loam and Clyde loam and fine sandy loam.

Small areas of a fine sandy loam variation are included with this type. The variation consists of about 10 inches of light-brown to brown fine sandy loam, underlain by pale-yellow sandy loam which extends to 12 or 14 inches, becoming heavier with depth. The pale yellow subsoil ranges from a heavy fine sandy loam to a sandy clay. In some places it extends to a depth of more than 3 feet, while in others a bed of stratified medium and fine sand or gravel is encountered at depths of 2 to 3 feet. This soil has a total area of less than 2 square miles, but is rather widely distributed over that part of the county west of Rock River.

Topography and drainage. The topography ranges from almost level to gently sloping or gently undulating, and the natural drainage is usually good except in the areas southeast of Evansville where artificial drainage would be beneficial. The soil is open and porous, and readily absorbs the normal rainfall.

Present agricultural development. Nearly all of this type is under cultivation, and is devoted chiefly to corn, oats, barley, rye, and hay. The methods of cultivation followed and yields secured are the same as on the Fox silt loam. The type is easy to cultivate, and a mellow seed bed can be readily obtained. The soil is deficient in organic matter, and is somewhat acid.

Methods of the improvement of this soil are discussed on page 44 of this report.

FOX FINE SANDY LOAM.

This soil, to a depth of about ten inches, consists of a loamy brown sand, underlain by a brownish-yellow loamy sand which at about 14 inches grades into yellow sandy loam, the latter continuing to a depth of more than 36 inches. There is usually some

gravel in the lower subsoil. In places the surface soil is a brown sandy loam, passing at about 10 inches into a yellow sandy clay loam which grades downward into a yellow sandy loam. In some places beds of gravel and sand are encountered within the 3-foot section.

The soil is found on the lower terraces along Rock River, on the higher terraces along Sugar River and Bass Creek, and on the outwash plain south of Evansville. The surface is level to gently undulating but drainage is well established.

In addition to the regular farm crops extensively grown in the region some buckwheat and Irish potatoes are also grown. The methods of cultivation and fertilization on this phase are essentially the same as on Miami fine sandy loam.

For a discussion of the chemical composition and methods for the improvement of this soil, see page 44.

KNOX FINE SANDY LOAM.

Extent and distribution. This soil is confined to the southwestern quarter of Rock County where it is quite generally distributed. It makes up fully half of Newark Township and a smaller proportion of adjoining townships.

Description. The surface soil to a depth of eight to ten inches consists of a light brown fine sandy loam containing a small amount of organic matter. It is underlain by a brownish-yellow fine sandy loam which usually grades into a sandy clay loam at from eighteen to twenty-four inches. This usually continues to a depth of three feet or more. The soil section is quite variable and in places the lower portion is more sandy than indicated above. In other places, the underlying rock may come within the three foot section, and this is overlain by a heavy reddish-brown clay. Rock outcrops are quite common, and over limited areas, all depths of soil over rock from a few inches to three feet are to be found.

Topography and drainage. The surface of most of this type is rolling with some areas which are only undulating to gently rolling. The natural drainage is good, and over the most sandy places it is inclined to be excessive. Erosion is a factor to be considered in farming this soil, and some damage has resulted to the steeper slopes from washing.

The greater part of the surface soil shows varying degrees

of acidity, the strongest acidity usually being where the soil section is the deepest.

Native vegetation. The native timber consisted largely of oak, hickory, and maple. Practically all of the merchantable timber has been removed, and the land placed under cultivation.

Present agricultural development. Approximately 80 per cent of this type is being farmed. It is an easy soil to cultivate; it warms up quickly in the spring, is well drained, and responds readily to fertilization. On the other hand, it is deficient in organic matter, has a rather limited supply of the mineral plant food elements and is not as retentive of moisture as the heavier soils. Average yields are lower than Knox or Miami silt loam. The chief crops grown are corn, clover and timothy for hay, rye, barley, potatoes, some tobacco, buckwheat, and a limited amount of alfalfa. A few apple orchards were seen, but fruit is not raised on a commercial scale.

Methods for the improvement of this soil are discussed on page 44.

MIAMI FINE SANDY LOAM.

Extent and distribution. This soil is confined to the northern part of Rock County, and the largest area occurs between Lake Koshkonong and the northeastern corner of the county, where it joins a larger tract in Jefferson County. A few other small patches occur scattered about the northern part of the area. In all, there are about twelve square miles of this soil.

Description. The Miami fine sandy loam consists of a light-brown fine sandy loam, low in organic matter, and usually in an acid condition, underlain at eight to ten inches by a brownish-yellow or yellow fine sandy loam, which gradually becomes heavier until a sandy clay loam or sandy clay is encountered at fifteen to twenty-four inches. This continues to a depth of three feet or more.

The type as mapped is not uniform. In numerous small areas, mainly along ridge crests or on steep slopes where erosion has carried away the surface soil, the fine sandy loam extends to a depth of only a few inches, and rests on yellowish sandy clay, while at the base of slopes, where washed-down materials have been deposited, the light-brown sandy layer extends to depth of ten to twenty inches, passing into yellow fine

sandy loam which sometimes continues to a depth of three feet, but usually gives way to a yellowish sandy clay in the lower part of the three foot section.

Topography and drainage. The surface ranges from gently rolling to rolling, and the natural drainage is good, frequently excessive in the most sandy places. On some of the steeper slopes erosion becomes a problem, and the surface has in places been washed away.

Present agricultural development. Fully 75 per cent of this soil is cleared and under cultivation, and this type has many points in its favor. It is well drained, works easily, warms up quickly in the spring and responds quickly to fertilization. Yields, however, do not average so high as on the loam and silt loam types, due to a lower water holding capacity and a somewhat smaller total supply of mineral plant food.

The crops grown are corn, clover and timothy, rye, barley, tobacco, potatoes, buckwheat, alfalfa, beans, wheat, and melons. There are a few apple orchards, but the industry is not developed on a commercial scale. Fruit is usually inferior in quality partly because but little spraying is done.

While stable manure is the chief fertilizer applied, the use of commercial fertilizers has been started, and phosphate fertilizers especially have given good results. Some liming has also been done with good results.

The lack of sufficient fertilization, crop rotations, etc., has caused a decrease in the productiveness of numerous farms on this soil, but this condition can be improved by following methods for the improvement of this soil as outlined on page 44.

BOONE FINE SANDY LOAM.

Extent and distribution. The Boone fine sandy loam occurs largely on slopes below outcrops of the St. Peters sandstone in the extreme western part of the county, in Newark, Avon, Spring Valley, and Magnolia Townships. The total area amounts to less than eight square miles.

Description. The Boone fine sandy loam to an average depth of eight to ten inches, consists of a light-brown to brown fine sand or fine sandy loam, very low in organic matter and in an acid condition. The subsoil is yellow fine sandy loam which becomes heavier with depth and gives way at twenty to twenty-

four inches to a yellow sandy clay, the latter continuing to a depth of three feet or more. Fragments of sandstone are sometimes present in both soil and subsoil. In some places especially near the base of slopes, the surface soil is a light brown or brown fine sand passing at about ten inches into a yellow fine sand, which may continue to twenty-four to thirty inches before a yellow fine sandy loam is encountered. On the slopes, immediately below sandstone outcrops, irregular fragments of sandstone are scattered over the surface and mixed throughout the soil in sufficient quantities to hinder cultivation.

A sandy phase of this type occurs in Sections 30, 31 and 32, Newark Township, and Section 36, Avon Township. Both soil and subsoil are more sandy than typical, and only in a few places was sticky material found in the subsoil. In a few places, small sand dunes have been formed by the wind. This sandy area would have been mapped as Boone fine sand had it been of sufficient extent.

Topography and drainage. The surface varies from gently sloping to steep and drainage is always sufficient and often excessive. On the steep slopes there is considerable damage from washing, deep gullies having developed in a number of places.

Present agricultural development. About 30 per cent of the type is cultivated, and the remainder is in timber and permanent pasture. In the early season when there is plenty of moisture the pasture is fair, but later in summer during dry weather, the grasses dry up and pasture is poor. Corn, oats, rye, buckwheat and some hay are grown but average yields are rather low. The soil is deficient in organic matter, and also in the mineral plant food elements, and requires special treatment to secure best results. Methods suggested for its improvement are given on page 44.

Farms on this land have a selling value of $50.00 to $75.00, depending upon amount of clearing, the topography, location, and improvements.

WAUKESHA LOAM.

Extent and distribution. This type covers a total area of a little more than half a township and is one of the important prairie types of soil in Rock County. It is found chiefly in La

Prairie and Rock Townships. Smaller tracts occur east of Leyden in Janesville Township and along both sides of Rock River just north of Beloit. Smaller patches occur near Evansville and at intervals along Turtle River.

Description. The soil of the Waukesha loam consists of a dark-brown to black loam, high in organic matter, underlain at 10 to 12 inches by a dark-brown sandy clay loam which takes on a dingy-brown color at about 18 inches and passes at 30 inches into a bed of gravelly sand which continues to a depth of 3 feet or more.

As mapped this type is somewhat variable. The surface soil of included areas ranges from almost a sandy loam to a silt loam. The subsoil may be a sandy loam, passing into beds of sand or gravel at 12 or 15 inches, or it may be a dark-brown loam or heavy sandy loam to a depth of 3 feet or more. In La Prairie and Rock Townships much of the type is heavier approaching a silt loam, and patches of Waukesha silt loam are included. In places these inclusions are so numerous that it is difficult to determine whether the loam or silt loam is the predominating type.

Topography and drainage. The surface of this soil is level to gently undulating, except along terrace escarpments where there is frequently a zone of from 100 to 400 feet wide where the surface is steep and broken. Many of these escarpments are very gravelly and have been mapped as Waukesha gravelly loam. Others have a sufficient covering of soil over the gravel so that they cannot well be classed as a gravelly loam type. The differences in elevation between terraces range from ten to fifty feet and more.

Over all of this soil drainage is well established and over much of the type it is inclined to be excessive, especially where beds of sand and gravel are within eighteen inches of the surface.

Native vegetation. This is a prairie soil and the original vegetation consisted largely of prairie grasses. Some timber was found along the Rock River and other streams and bordering some of the upland soils, but by far the greater part of it was treeless.

Present agricultural development. Next to the Waukesha silt loam, this is the most extensive of the valley-fill and terrace

types. Almost all of it is under cultivation, devoted to general farming in conjunction with dairying. Corn is the principal crop, and oats the second most important crop. Barley, rye, Irish potatoes, buckwheat, hay, sugar beets and tobacco are successfully grown.

Waukesha loam, sandy phase. The surface soil of the Waukesha loam, sandy phase, consists of a dark-brown to almost black fine sandy loam, comparatively high in organic matter, and very acid according to litmus tests. It is underlain at about twelve inches by a dingy-brown, fine sandy loam which grades downward into a brownish-yellow sandy clay loam. At twenty-four to thirty inches stratified beds of gravel and sand are encountered.

This phase is inextensive, being confined to the valley-fill area northeast of Beloit. The surface is gently undulating, but the drainage is usually excessive. About the same crops are grown, and similar yields are obtained, as on the Waukesha sandy loam, but the soil is considerably heavier than that type. The methods of improvement are similar to those suggested for the typical Waukesha loam.

For a discussion of the chemical composition of this soil and methods for its improvement, see page 44.

CARRINGTON LOAM.

Extent and distribution. Carrington loam is found most extensively in Beloit and Newark Townships; though a few scattering areas are also found in most of the townships in the west half of the county. The largest continuous areas which are in the town of Beloit cover 3½ square miles.

Description. The soil of the Carrington loam is dark-brown to almost black, friable loam, 3 to 12 inches deep, comparatively high in organic matter. The upper subsoil is a dingy-brown loam to light clay loam, passing at about 17 inches into a yellowish-brown sandy clay, the latter continuing to a depth of 36 inches or more. Considerable gravel is present in both soil and subsoil and bowlders are common. In many places the underlying limestone is encountered in the 3-foot section and in such situations a gritty red clay carrying fragments of weathered limestone, overlies the rock. There are many small inclusions of Carrington fine sandy loam and silt loam, and in places

the fine sandy loam areas are so numerous that it is difficult to determine the predominating type. On some of the steep slopes the surface soil has been removed by erosion and the sandy clay loam or sandy clay subsoil is exposed. Where this type borders the Miami soils it is lighter in color than typical.

Topography and drainage. The surface of this type is for the most part gently rolling with some included tracts which are rolling. Modern farm machinery can be used to good advantage on practically all of the type and the natural surface and under drainage is excellent. Where the rock comes close to the surface the soils are somewhat draughty. On some of the steeper slopes, gullies have been formed, but with proper caution in cultivation and crop selection, these can be prevented. There are no marshes in the region where this soil occurs.

Native vegetation. This type is a prairie soil, and the most extensive native vegetation was prairie grass. In places there was a scattered tree growth, but never enough to class this as a timbered soil.

Present agricultural development. Probably 80 per cent of this type is cultivated. The remainder supports a growth of prairie grasses, and is used for permanent pasture. General farming in conjunction with dairying is the chief type of agriculture, with oats, corn, barley and hay as the leading crops. Tobacco is the only special crop grown.

The acid condition of the soil often prevents the growing of clover and alfalfa. As a whole, the methods followed are very similar to those practiced on Carrington silt loam under which type description a fuller discussion will be found.

For a discussion of the chemical composition and methods for the improvement of this soil, see page 44.

CARRINGTON FINE SANDY LOAM.

Extent and distribution. Except for a few small areas in the town of Fulton and a limited area west of Evansville, the Carrington fine sandy loam is confined to the southwestern part of the county. The largest unbroken area is in the town of Beloit with other important tracts in the northern part of Newark and less important patches in several of the adjoining towns.

Description. The Carrington fine sandy loam, to a depth of about 10 inches is a dark-brown to almost black fine sandy loam, high in organic matter. A small quantity of gravel and sometimes limestone and chert fragments are scattered over the surface and mixed with the soil. Litmus paper tests indicate that the soil is in an acid condition. The upper subsoil is usually a yellowish brown fine sandy loam, grading at 16 to 20 inches into a sandy clay loam or sandy clay, which often extends to a depth of 3 feet or more. In many places, however, the underlying limestone is within the 3 foot section and from 4 to 6 inches of reddish-brown, rather plastic sandy clay, containing particles of decomposed limestone, usually overlies the rock.

Topography and drainage. The surface of this type ranges from gently rolling to rolling, with most of it being rather rolling. The slopes are not steep, however, and modern farm machinery can be used on practically all of it. Because of the loose porous nature of the subsoil and the broken character of the underlying rock the natural drainage is excellent. On the lighter portions of the type, the drainage is somewhat excessive. This condition also prevails where the limestone is found near the surface.

Natural vegetation. This is also a prairie soil, and the natural vegetation included only a few scattering trees. The chief growth was prairie grasses.

Present agricultural development. About 80 per cent of this type is under cultivation and devoted to general farming. It is considered a fair soil and easy to work, but is not equal in productiveness to the Carrington silt loam. The general farm crops common to the regions are grown, and tobacco is also raised to some extent. The heavier phases of the type are especially well suited to tobacco. Potatoes are also grown more extensively than on the heavier soils of the county. In general it may be said that the same methods of farming are followed as on the silt loam type. Land values range from $75 to $150 per acre, depending upon location, improvement, depth of soil, etc. The acid condition of the soil is frequently the cause of failure with clover and sometimes prevents the growth of alfalfa.

Methods for the improvement of this soil are discussed on page 44.

CHEMICAL COMPOSITION AND IMPROVEMENT OF LOAMS AND FINE SANDY LOAMS.

In this group of soils there are ten separate types all of which are of minor importance individually but collectively the group is important since it covers a total area of 80,844 acres or about 18 per cent of Rock County. These soils are somewhat lighter in texture than the silt loams but where general farming is carried on practically the same methods of improvement can be followed as outlined for the silt loam soils on pages 26-30.

While there is some variation in the texture, structure and color of the types of soil in this group there is a sufficient similarity so that general methods of improvements discussed here will apply to the entire group.

Tests and observations which have been made on these soils indicate that practically all of the types are in need of lime. The dark colored prairie soils show a greater need than the light colored soils. There are a few exceptions to this need and these are found where the underlying limestone comes close to the surface as it does in a few places in the western part of the county. Frequently, however, the soil will be in an acid condition even when the limestone is within one foot of the surface.

The supply of organic matter in the dark colored types such as the Waukesha and Carrington loams and Carrington fine sandy loam is somewhat greater than the light colored types but in older cultivated soils this organic matter is in an inactive form so that the introduction of decaying vegetable matter will greatly aid in the improvement of these types regardless of color.

The supply of phosphorus in these loams and fine sandy loams is lower than in the heavier types and these soils show a marked deficiency in this element. The actual number of pounds of phosphorus which these soils contain, however, is not a true index of the actual need of this element. Some of the soils which show a small total amount do not respond as well to an application of the phosphorus fertilizer as do the types which have a large amount present so that the behavior of the crop is a more important indication of the need of phosphorus than the chemical analysis.

Regarding the supply of potassium in the soil the total amount is approximately 25,000 pounds per acre or fully 20 times as

much as the supply of phosphorus. Where general farming is conducted and where there is maintained a good supply of vegetable matter in the soil this will doubtless be sufficient. Where special crops are raised which require a large amount of potassium this element may be supplied to advantage in the form of a commercial fertilizer.

The principal characteristics of these types is that they hold somewhat less water than heavier soils do and they warm up more quickly in the spring. This together with the readiness with which they can be worked adapts them to truck and special crops, the growing of which requires more hand labor than is involved in the growing of staple crops. It is necessary to give them somewhat more attention to maintain fertility partly because of the fact that they are lower in fertility than the heavier soils but more because of the fact that these special crops require a higher degree of fertility to produce satisfactory yields. When these soils are used for the production of special crops their fertility can be maintained either through the use of rather heavy applications of stable manure or through the use of a rotation in which a legume is grown as the means of securing the necessary nitrogen and organic matter while the other elements, chiefly phosphorus and potassium, are supplied in commercial fertilizers. When this latter system is followed one-third or one-fourth of the land should be sown to a legume such as clover or soy beans which have large powers of gathering nitrogen from the air, and a part of the phosphorus and potassium should be used for the growth of different green manuring crops. The fertility used in this way will become available for the succeeding crops through the decomposition of the legume when plowed under and the remainder of the fertilizer to be used should be applied on this ground at the time of fitting it for the succeeding crops.

CHAPTER IV.

GROUP OF SANDY AND GRAVELLY SOILS.

MIAMI GRAVELLY LOAM.

Extent and distribution. The Miami gravelly loam is confined to the north half of the county, and is well distributed throughout the region covered by the late Wisconsin drift. The most continuous area occurs west and southwest from Evansville, and is nearly seven miles long and from one-fourth to one-half mile wide. There is a large number of very small areas of this type.

Description. The Miami gravelly loam to a depth of six to ten inches is a light-brown to brown loam, carrying considerable gravel. The subsoil is a yellowish-brown to reddish-brown, friable gravelly loam or gravelly clay loam. Many small areas of gravelly fine sandy loam, fine sandy loam, loam, and silt loam are included with the Miami gravelly loam. North of Johnstown and Johnstown Center the inclusions of Miami silt loam are so numerous that it is difficult to determine whether it or the gravelly loam is the predominating type. Beds of gravel frequently occur in the deep subsoil.

Topography and drainage. The surface varies from gently rolling to broken and hilly, with numerous hummocks, kettle basins, and ridges. Except in the depressions the natural drainage is very good and often excessive. The surface is such that practically all of the modern farm machinery can be used. A possible exception would be bordering kettle holes which are all of small individual extent.

Native vegetation. The original timber consisted chiefly of oak, hickory, and maple, but most of the merchantable timber has been removed.

Present agricultural development. About 20 per cent of the Miami gravelly loam is under cultivation and utilized for growing of corn, oats, rye, and clover. In 1919 there were 2,002 acres of alfalfa in the county, and a large part of it is produced

on this type of soil. Crop yields are about the same as on Miami fine sandy loam.

The portion of the type not cleared is utilized chiefly for pasture, and on account of the rolling nature of much of the type, it is best suited to permanent pasture. This will prevent serious erosion.

Chemical composition and improvement. The Miami gravelly loam is somewhat variable but corresponds quite closely with the Miami loam and Miami silt loam in its chemical composition. It differs from these types chiefly in the presence of gravel mixed with a subsoil which is usually more open and porous. Its topography is also somewhat more broken so that the natural drainage is in all cases excellent. The gravel occuring with the type is almost entirely limestone gravel, and the type as a whole contains more lime than any of the other types of this series.

The supply of nitrogen in this soil is rather low and the supply of phosphorous is only fair. The potassium supply is sufficient for all of the ordinary farm crops.

In the improvement of this soil it is important that organic matter should be supplied and that the phosphorous content of the soil should be increased. Because of the high lime content, especially of the subsoil, this type is especially adapted to alfalfa, and by growing this legume, a large amount of organic matter can be readily secured. This soil, as a matter of fact, is probably better suited to alfalfa than any of the other types in the county. Alfalfa, however, is a strong feeder on phosphorous, and even though there should be available a good supply of stable manure, this should be supplemented by a phosphate fertilizer. Acid phosphate gives excellent results and may be applied along with manure or it can be applied with a fertilizer attachment to a grain drill at the time that the small grain is seeded. About 300 pounds (16 per cent) per acre is a good application.

As this type is quite rolling in places, it is frequently subject to erosion, and it is therefore desirable to keep the surface covered with a growing crop as much as possible. When alfalfa is being grown, it is well, therefore, to keep it as long as a good stand can be maintained. On breaking up alfalfa corn can be grown for one year followed by a small grain, after which the field may again be seeded to alfalfa.

RODMAN GRAVELLY LOAM.

The surface soil of the Rodman gravelly loam, extending to an average depth of about ten inches, is a brown gravelly sandy loam, passing through a brownish-yellow gravelly sand loam which at about fifteen inches becomes more yellowish. Below this the gravel content rapidly increases. Stratified beds of gravel and sand are commonly encountered in the three foot section, and below this is usually a mass of stratified gravel and sand of undetermined depth.

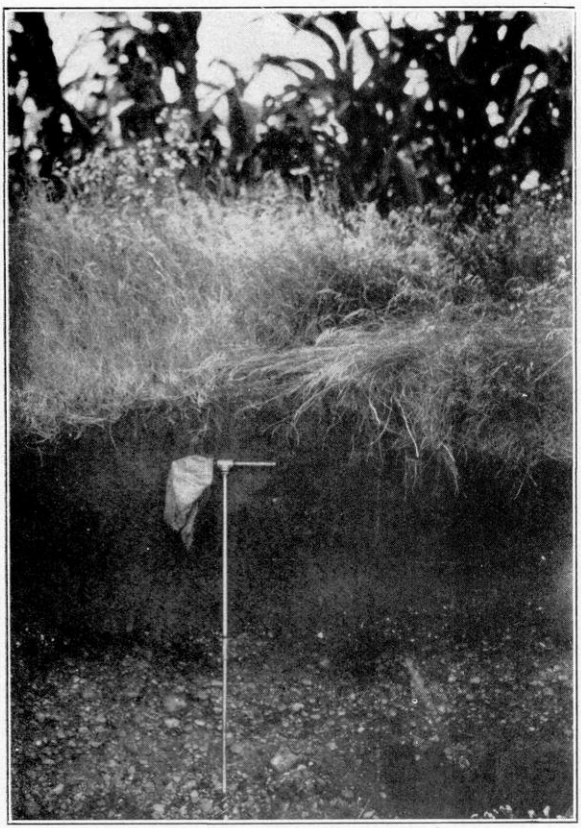
This type is of limited extent and occurs only in Janesville Township, on the steep terrace escarpment along the east side of Rock River. The drainage is excessive, and the type is not under cultivation.

This type is quite similar to the Miami gravelly loam in the general character of its soil section, except that the depth to the underlying beds of gravel is less in this type. It is, therefore, more droughty. It also has a rough surface, and is extremely bumpy and irregular in topography. Its general composition is very similar to the Miami gravelly loam. This type can best be utilized for grazing since most of it is too steep to be used for cultivated crops. It supplies good pasture in the spring and early summer, but this usually dries up in midsummer unless there is a well-distributed rainfall. This land should be kept in permanent pasture.

CARRINGTON GRAVELLY LOAM.

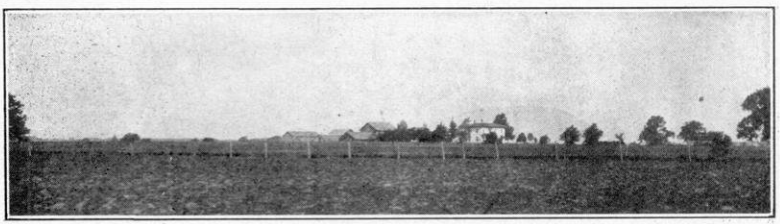
Extent and distribution. The Carrington gravelly loam is confined to a number of small areas scattered throughout the larger areas of the Carrington soils west of Rock River and in Milton and Fulton Townships. The largest area of about one-half square mile is east of Footville in Plymouth Township.

Description. The Carrington gravelly loam to a depth of about seven inches is a dark-brown, gravelly sandy loam, high in organic matter. This is underlain by a yellowish-brown, gravelly sandy loam, which becomes heavier with increase in depth, until a gravelly sandy clay is encountered at about twenty-four inches. This often continues to a depth of three feet or more. Crystalline bowlders are common, both on the surface and in the subsoil, and in many places, especially on



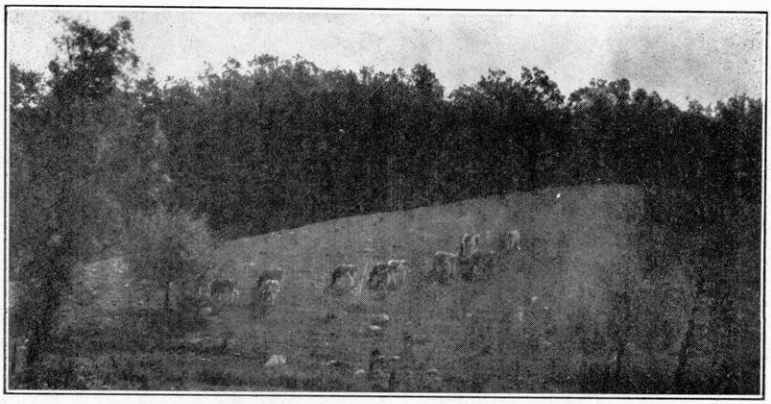
SOIL SECTION IN WAUKESHA SILT LOAM.

Showing beds of stratified gravel lying below about three feet of very silty material, which forms the surface soil and subsoil.



VIEW ON CARRINGTON SILT LOAM.

This view shows the typical surface features on the level prairie land mapped as Carrington silt loam. The level areas are also typical of the Waukesha silt loam.



VIEW OF RODMAN GRAVELLY LOAM.

The rough, broken areas of this soil are best suited to grazing and forestry.

300 lbs. acid phosphate
Yield 87 bushels

No treatment
Yield 69.5 bushels.

Oats on black prairie land at Dodgeville, Wis., 1918. The prairie lands of Rock County respond in a similar way to the use of phosphate fertilizers.

kames and eskers, stratified beds of gravel and sand are encountered in the three-foot section. In such cases the surface soil of gravelly sandy loam passes at about seven inches into yellowish-brown gravelly sandy loam, which grades downward into the beds of gravel and sand. Most of the gravel is limestone.

Topography and drainage. The surface is ridgy and very broken. Where the type occurs in the region of the late Wisconsin drift near Fulton, it contains numerous kettle basins, but the areas in the pre-Wisconsin drift are thoroughly drained by streams. Much of the type is found as kames and eskers which belong to either the late Wisconsin or the pre-Wisconsin drifts. The drainage is everywhere sufficient, and in many places excessive.

Present agricultural development. The type is of little importance, only about 20 per cent of it being under cultivation. The remainder is in permanent pasture. The chief crops grown are corn, oats, barley and hay. Yields are fair but somewhat lower than on the fine sandy loam. The surface soil is acid in most places and liming is necessary for the best success with clover and alfalfa.

WAUKESHA GRAVELLY LOAM.

The surface soil of the Waukesha gravelly loam is a dark-brown to almost black, gravelly sandy loam, 8 to 12 inches deep. The subsoil is a brownish gravelly sandy loam, becoming brownish yellow at about 16 inches. At 20 to 30 inches beds of stratified sand and gravel are encountered. As mapped, the type includes some small areas of gravelly loam.

The Waukesha gravelly loam occupies steep valley slopes along Turtle Creek, Rock River and numerous tributaries which have cut their way back into the areas of valley fill. The drainage is excessive and the type has no agricultural use except as permanent pasture.

CHEMICAL COMPOSITION AND IMPROVEMENT OF CARRINGTON AND WAUKESHA GRAVELLY LOAMS.

Since the soil of these types is extremely gravelly in its character, has a steep surface, and therefore unsuited to a large degree for the growing of cultivated crops, it will probably not be advis-

able to attempt to improve it as is the case with other types. It is utilized at present to a certain extent for grazing, and this is doubtless the best practice to follow upon it. During the spring and early summer when there is a large amount of moisture present, it supplies fair pasture, but later in the season the grass dries up. In many places the steep slopes would in themselves prevent the growing of cultivated crops. The type may be considered as being of low agricultural value, and as it is of limited extent, it is of minor importance. Where small tracts of Waukesha loam are included their improvement may be directed along lines suggested for that type.

PLAINFIELD FINE SAND.

This soil is of limited extent and of minor importance in Rock County. Its total area does not exceed 1,000 acres, and it is found in a few small tracts in Milton Township and along Taylor Creek and Sugar River, in Spring Valley, and Avon Townships.

The surface soil to a depth of eight inches consists of a light brown fine sand which contains only a small amount of organic matter. This is underlain by a yellowish fine sand which extends to a depth of three feet or more. Part of the type which occurs in Spring Valley and Avon Townships is somewhat coarser in texture than typical but there is not a sufficient amount of this to warrant mapping another type. Gravel is sometimes found in the subsoil.

The surface of this soil is flat to very gently undulating, and the natural drainage is excessive. The soil is inclined to be droughty although the water table comes closer to the surface than in the upland soils.

Approximately 40 per cent of this soil is cleared and under cultivation. The remainder is in brush, and second growth timber, and is used to some extent for pasture. Most crops common to the region are grown but average yields are low. The soil is deficient in organic matter as well as in the mineral plant food elements. The texture of the soil is such, however, that its productivity can be successfully improved.

To improve this type legumes should be grown, and to succeed with these it may be necessary to use commercial fertilizers. For this purpose a mixed fertilizer will be best, and a

2-10-4 will be well suited to this sandy soil. About 200 or 300 pounds per acre should be used. When clover is well established, a second crop may be plowed under to supply the needed organic matter. Where acid, the soil should be limed before best results can be expected from the mixed fertilizers. The use of lime will help to insure the success of clover. By following a short rotation in which a legume is grown and a part of it plowed under, and by supplying the mineral plant food elements through commercial fertilizers, very good crops may be secured. A rotation consisting of clover, corn or potatoes followed by a small grain is well suited to this soil.

WAUKESHA SANDY LOAMS.

The total area of this soil does not exceed five and one-half square miles. It is found chiefly in Beloit and Rock Townships on terraces bordering Rock River. It also occurs in the southwestern part of the county as a terrace along Sugar River.

The Waukesha sandy loam to an average depth of about eleven to thirteen inches consists of a dark-brown to almost black sandy loam underlain at about sixteen to twenty inches by a brownish-yellow sandy clay loam. This becomes lighter in texture with increasing depth until a yellowish sandy loam is encountered at about twenty-eight inches, grading quickly into a gravelly loamy sand, and at about thirty-six inches into stratified beds of gravel and sand. Litmus paper tests indicate that the surface soil is acid.

As mapped, this type is somewhat variable. The surface soil of included areas ranges from sand to loam. The stratified beds of gravel and sand are within eighteen inches of the surface in some places, while in others they are not encountered in the three-foot section.

The surface of this type is level to undulating and the natural drainage is good, and because of the coarse open nature of the lower subsoil, it is frequently excessively drained and becomes droughty.

The type was orginally prairie and did not support a growth of timber. Prairie grasses made up the native vegetation.

Practically all of this type is devoted to general farming in conjunction with dairying. Potatoes are grown more extensively than on the heavier soils and fair yields are usually se-

cured. Yields of general farm crops are somewhat lower than on the Waukesha loam and silt loam and the type is of lower agricultural value.

Methods followed are practically the same as on Waukesha loam but are not those best suited to the building up of the fertility of this type. The best methods for the improvement of this kind of soil are discussed below.

WAUKESHA SAND.

This type covers a total area of about three square miles and is confined almost entirely to the terrace along the north side of Sugar River between Brodhead and Avon in Avon Township.

The surface soil is a dark brown loamy sand fourteen inches deep grading into a yellowish-brown loamy sand which at about twenty-four inches becomes more of a yellow color, and is loose and open in structure.

The surface is level or very gently undulating and the natural drainage is excessive, this type suffering from drought every season. Some of the surface irregularities appear to be due to wind action. Along fences there are frequently low drifts of sand. North of Avon there is a small area occupying a slope below outcrops of sandstone. This is probably not of alluvial origin. The soil is mostly of alluvial origin, and was deposited by the streams when the waters were much higher than at present, probably during glacial time. Much of the material originally came from sandstone, and is now in an acid condition.

This is a prairie or semi-prairie type, there having been but very little scattering timber upon it. About 75 per cent of it is now being cultivated. It is devoted to general farming, but owing to its droughty nature and low content of plant food, average yields are low. The supply of organic matter is limited, and the methods of farming followed upon it are not such as tend to increase the supply of humus.

CHEMICAL COMPOSITION AND IMPROVEMENT OF WAUKESHA SANDY LOAM AND WAUKESHA SAND.

These soils are quite similar and may be discussed together. The sandy loam covers a total area of nearly 13,000 acres while

there are less than 2,500 acres of the sand. The sandy loam contains more clay and is a somewhat better soil than the sand.

The nitrogen supply is only a little more than half that found in Waukesha silt loam and the phosphorus is also lower than in the heavier types. The potassium is about two-thirds that in the silt loam. Analyses of Waukesha sand in other areas indicate that its supply of plant food is lower than that of the sandy loam. It will be noticed, however, that the plant food content of these dark colored sands is higher than that of the light colored, light texture soils.

In the improvement of these soils the first step is to supply the lime which is needed. This will require from 2 to 3 tons of ground limestone per acre. This should be applied to a plowed field and disked or harrowed into the soil to insure thorough mixing and an intimate contact between the soil grains and the limestone.

The management of these soils to maintain the fertility will depend to a considerable extent on the crops grown and on whether or not stock is maintained to which the produce of the farm is fed. When dairying or other live stock farming is practiced it will be less difficult to maintain the supply of the essential elements of plant food—phosphorus, potassium and nitrogen. But even when stock is maintained it is very probable that the moderate use of some form of phosphorus fertilizers will be found profitable, and some means for increasing the organic matter in addition to the use of stable manure should be made use of as far as practicable. The growth of a crop of soy beans or clover, occasionally, to be plowed under as a green manuring crop, will be found very profitable in its effect on the succeeding crop of corn or grain.

When these soils are used for the growing of potatoes or other special crops to a considerable extent the use of commercial fertilizers containing phosphorus and potassium will be found necessary to maintain the soil productivity. Clover or some other legume must be grown regularly in the rotation to maintain the nitrogen and organic matter, and part or all of this should be plowed under. It is often desirable to use the commercial fertilizers containing phosphorus and potassium in order to secure a good growth of clover and there is little loss in so doing, since essentially all of the phosphorus and potas-

sium applied to the soil for the clover becomes available to the succeeding crop through the decomposition of the organic matter.

While the use of commercial fertilizers containing phosphorus and potassium is desirable in the management of these soils it must not be considered that this is an indication that they have less value than heavier soils which are relatively higher in these elements, for the growth of potatoes and other special crops. The fact that these soils become dry and warm early in the season makes them less subject to local frosts and the finer tilth which they develop fit them especially well for the growth of potatoes and some other root crops, since they are practically free from checking and cracking. The cost of the fertilizers is a comparatively small part of the total cost of growing these crops. Sandy loam soil is well adapted to the commercial growing of potatoes, and whenever possible the sandy loams should be selected for this crop in preference to sand types. A good rotation for the sandy loam soils consists of small grain, clover, potatoes or corn. For further suggestions on the management of these soils and for information regarding source and use of fertilizers consult Bulletins 204, 230 and 341 of the Experiment Station.

CHAPTER V.

GROUP OF POORLY DRAINED SOILS.

CLYDE SILT LOAM.

Extent and distribution. The Clyde silt loam is one of the best soils in Rock County. It occurs principally in the southeast corner of the county, but many areas ranging from a few acres to several hundred acres are found in the flood plains of streams and in shallow basins in the upland in all sections of the county.

Description. The Clyde silt loam consists of 12 to 14 inches of dark-brown to black silt loam, very high in organic matter. The subsoil is a dark-gray silt loam, mottled with drab and yellow, passing at about 24 inches into a mottled brownish-yellow or drab, silty clay loam which may continued to a depth of three feet or more.

The type as mapped is not uniform. The surface 1 to 8 inches in many cases consists of peaty material. In flood plains a zone of peaty material, ranging from 1 to 10 inches, may be encountered in either the upper or lower subsoil. Occasionally along streams the black silt loam has been deposited over loam and fine sandy loam, while in other instances the surface material to a depth ranging from 1 to 10 inches is a light-brown silt loam, underlain by black silt loam or peaty silt loam, due to wash from adjoining high land.

Topography and drainage. The surface of this soil is low lying, flat or basin like and the natural drainage is poor. It usually has a very slight slope toward the drainage way along which it occurs.

Native vegetation. The original timber growth consisted of elm, ash, soft maple, willows, some sycamore and a little bur oak. Most of the merchantable timber has been cut, but in a few places there is still timber of good quality chiefly where the type has not been drained.

Present agricultural development. This is the strongest soil of the county. It is especially adapted to corn. Grasses make

a very rank growth. Small grains are not equal in quality to that produced on the light-colored silt loam soils of the upland. Alsike clover, timothy, sugar beets and cabbage do well. Peas are grown to some extent, but run too much to vines to give best results. When sufficiently drained the Clyde silt loam is without question the best corn land in the state.

The most common system of cropping consists of growing hay for one or two years, after which corn is grown for two years, a small grain crop being then usually sown, after which the field is again seeded to timothy or timothy and alsike.

The selling price of improved land of the Clyde silt loam ranges from $150 to $300 an acre, while unimproved areas range from $75 to $150, depending upon the location and drainage possibilities.

Chemical composition and improvement. Clyde silt loam is one of the four most extensive and important soils in Rock County. This type of soil has been formed largely from drying up of marshes and occurs associated largely with Miami silt loam which was formed by the grinding of glacial ice on limestone. These low lands have received the wash of lime from the uplands for centuries, and the type, therefore, contains at present more lime than do most of the upland soils. It is seldom in need of lime.

The total supply of mineral plant food elements is large and where the soil is typically developed, the elements are usually found to be well balanced. Over some areas the surface is somwhat mucky in character and in these localities the supply of phosphorus and potash is relatively low. This soil contains approximately 10,000 pounds of nitrogen in the surface soil, about 2,000 pounds of phosphorus, and from 30,000 to 40,000 pounds of potassium. The most marked feature of this type is the fact that the potassium in many cases is of low availability and crops, especially corn, sometimes turn yellow at an early stage and make poor growth. In such cases the use of some form of potash or strawy horse manure is necessary to remedy this condition. This ordinarily develops in patches of from one to several acres in extent.

The phosphorus supply is usually ample for a number of years after drainage. Such land as this must be manured eventually or commercial fertilizers containing potash must be used.

There is relatively a much larger supply of nitrogen than phosphorus and potassium. For this reason it is a good practice to use the manure on the upland soils which are deficient in nitrogen and apply mineral fertilizers to the low land when these are needed. In many cases which show a marked need of potassium during the first few years of cropping, usually where the soil is high in organic matter to a depth of a foot, this lack of potassium frequently disappears after a few years of cropping as a result of the settling of the surface so that deep plowing mixes up some of the soil high in potash.

The first step in the improvement of Clyde silt loam is that of course of drainage, and when thorough drainage is established this type is considered to be one of the best corn soils in Wisconsin.

CLYDE FINE SANDY LOAM.

Extent and distribution. This soil is not extensive, but it is found in various parts of the county. It is most extensive in the flood plains of Coon, Bass, North Branch and March Creeks. There are also small areas in the flood plains of Rock River and Turtle Creek at Beloit.

Description. The soil of the Clyde fine sandy loam is a black or dark-brown fine sandy loam about ten to twelve inches deep, containing considerable organic matter. In places there is a two to eight inch layer of peaty material at the surface. The subsoil is a dark-drab fine sandy loam which becomes lighter in color with depth. At twenty inches a drab or gray fine sandy loam is encountered, passing into a sandy clay loam at about thirty inches. The subsoil is variable. In some places it consists of fine sandy loam to a depth of three feet or more, while in others a sandy clay is encountered at about eighteen inches, continuing to a depth of three feet or more. In all cases yellow mottlings are common throughout the subsoil.

A coarser variation of this type, having the texture of a sandy loam is recognized. The soil to a depth of ten or twelve inches consists of a dark-brown or black sandy loam, very high in organic matter. The upper subsoil is a dark drabbish-gray sandy loam, passing at about twenty inches into a drabbish-gray slightly gravelly sand, which continues to a depth of three feet or more. The principal occurrence of this soil is in the

flood plain of Sugar River, in the southwest corner of the county. Small areas are found along Taylor Creek and its tributary near Brodhead. The land is flat and poorly drained, and very little of it is under cultivation, its chief use being for hay and pasture.

Topography and drainage. The surface of this soil is all low and flat, and most of it is subject to overflow. On account of its position the water table is close to the surface, and the natural drainage is poor.

Native vegetation. The native growth on this soil consisted of swamp oak, willows, elm, ash, soft maple, sycamore, sumac, and alder. In open places coarse marsh grasses were abundant.

Present agricultural development. By far the greater part of the land is still in an undrained condition, and most of it is now unsafe for growing cultivated crops. Grass for pasture and hay are the chief returns from this soil at present. Where open ditches have been dug, fair yields of corn and small grains and tame hay are being secured, but not over five per cent of the type is improved.

Chemical composition and improvement. This soil is somewhat variable in its physical properties. Its supply of nitrogen, phosphorus, and potash is somewhat smaller than in the silt loam, but it contains more organic matter than do the light colored upland soils and contains a fair amount of phosphorus and potash. In its improvement drainage is the first and most important step. When this has been supplied, this soil is well adapted to the growing of general farm crops, but it is also well suited to special truck crops. Where favorably located, it should be devoted to these special trucks crops rather than to the growing of general farm crops. When well drained, it warms up readily, is easy to cultivate and therefore very desirable for the growing of crops which require intensive cultivation.

PEAT.

Peat, as mapped in Rock County, consists of vegetable matter in various stages of decomposition, mingled with varying proportions of mineral matter. It typically consists of black or dark-brown, fibrous to rather finely divided vegetable matter, mixed with a small amount of fine sand and silt. The

depth ranges from 1½ to 20 feet, averaging about 4 feet. The greater part of the Peat is quite fibrous, but in a number of places it is fairly well decomposed, so that it can be molded by the hands. When dry this well decomposed Peat somewhat resembles a black, carbonaceous clay. In areas of sandy soils Peat is frequently underlain by sandy material while in regions of heavy upland soils the underlying material is clayey in character. Most of the areas of peat are underlain by material as heavy as a loam, or heavier. The largest areas underlain by sand occur along Coon Creek in Newark Township. Probably 95 per cent of the remaining areas are underlain by heavy material.

Peat occurs most extensively in the marshes of Lima and Milton Townships, along Allen Creek south of Evansville, along Bass Creek between Forestville and Afton, and on Coons Creek. Smaller areas are scattered west of the Rock River.

The surface is low, level and very poorly drained. During early spring some of the marshes are entirely covered with water, but later in the summer many areas of Peat are sufficiently dry and firm to bear the weight of farm animals, so that they can be pastured or cut for hay where there is a growth of wild grasses. In the area covered by the Late Wisconsin morains the Peat beds largely occupy old lake basins, ponded valleys, kettle basins, glacial sloughs, and other depressions in the uneven surface developed by the glacial ice sheet, and small bodies are also developed in the flood plains of streams. In the remainder of the county, most of which is covered by pre-Wisconsin drift, the Peat beds are confined wholly to stream flood plains.

Peat has been formed through the growth and partial decomposition in the presence of water of a rank vegetation, the black or dark-colored material being formed largely from grasses and sedges, and that having a brown color chiefly from sphagnum moss. About the margins of the larger marshes, and over the greater part of the smaller ones, varying quantities of mineral soil from the adjoining higher land have been washed in and incorporated with the vegetable matter. Although the greater part of the Peat occurs within the region where the upland soils are made up in part of limestone material, some of it is in an acid condition. This is usually the case in the center

of the larger marshes, while many of the smaller ones are not acid.

The native growth in the Peat marshes consists of several varieties of grasses and sedges, arrowhead, cat-tail, various reeds and rushes, and sphagnum moss. On a few marshes tamarack is found.

Only a small percentage of the peat beds of Rock County have been ditched and reclaimed. Where thoroughly drained and properly handled, they produce good yields of corn, mixed timothy and alsike, oats, potatoes, onions, celery and cabbage. The potatoes are not of as good quality as these grown on sandy soil, and small grain is likely to lodge and be of somewhat lower grade than where grown on upland soil.

Peat, shallow phase. The shallow phase of Peat consists of 8 to 18 inches of black or dark-brown vegetable matter in varying stages of decomposition, mixed with more or less sand, silt, or clay. The phase is developed in small areas in the southeastern and northeastern townships of the county, along Waukoma, Allens, Marsh, Bass, Coon, Norwegian and Taylor Creeks, and Sugar River.

In topography, drainage, and character of vegetation this phase is similar to the typical Peat.

Some of the marshes are underlain with clay, clay loam, or silt loam at a depth of only 12 to 15 inches. When these are first drained there is often a marked need of potash fertilizer or barnyard manure for a few years, but later this need partially or entirely disappears. This seems to be due to the settling of the mucky layer upon being drained and worked, permitting the underlying material, which contains a good supply of potassium, to become mixed with the organic material so as to supply plants with potash.

AGRICULTURAL VALUE AND DEVELOPMENT OF PEAT.

The amount of marsh land occurring in Rock County so well located with reference to market and transportation facilities makes it important to consider its agricultural possibilities quite fully. At present only a very small proportion of the peat soil in this county is improved.

The question of the actual value of marsh land is one which depends on several factors. In the first place, the farmer whose

land is largely upland and well drained can use a small amount of marsh land to very much better advantage than can the farmer whose land is essentially all marsh land. But probably the most important factor determining the value of marsh land will be the crops which can be grown on it. This depends on two factors, first the degree of drainage, and second the danger from frost. When only the main outlet and lateral ditches have been installed, in the great majority of cases hay crops are the only ones which can be safely grown, and the character of the hay will also depend a good deal on the character of the drainage. In the case of peat land underlain by sand the drainage by well-constructed and sufficiently deep ditches 40 to 80 rods apart will, in most cases, give adequate drainage for this purpose. When the peat soil is underlain by silt or clay, however, ditches not more than 20 rods apart will be necessary and these must lower the water in the ditch to a point 4 or 5 feet below the surface during part of the growing period. When tilled crops, such as corn, cabbage, or potatoes, or small grains are to be grown, the drainage must be more certain, and over the greater portion of our marsh lands this will mean the installation of drainage systems in the form of either open lateral ditches or of tile not more than 10 and often not more than 5 rods apart on the average.

Another factor which must be considered in comparing marsh and upland soils is that of fertility as determined by chemical composition. Marsh lands are abundantly supplied with organic matter containing nitrogen, but are relatively low in the elements phosphorus and potassium. The marsh lands of Rock County are rarely in need of lime since the acidity which ordinarily develops in marsh land is kept neutralized by the lime carried down from surrounding uplands. Some of the marshes in the southwestern part of the county show some need of lime. In the eastern part of the county the peat is seldom acid. Stable manure can be used for fertilizing marsh land, but it contains large amounts of nitrogen, which the marsh soil does not need and is relatively low in phosphorus and contains but a moderate amount of potassium. Moreover, weeds so commonly carried into the land with stable manure are especially hard to eradicate on this class of soil. Ordinarily, therefore, it is more satisfactory to use commercial fertilizers containing phosphorus and potassium on marsh soils than stable manure. At any rate this is

true when the farm contains some upland soils as well as marsh land, since the stable manure can be used on the upland while the commercial fertilizers are secured for use on marsh land.

Marsh lands are more subject to early fall and late spring frosts than are uplands, partly because of the fact that the cold air developing in contact with the soil as the latter loses its heat by radiation during the night, flows down and collects over the lower land, and partly because the loose, spongy nature of the peat soil prevents the heat of the sun from penetrating so that all except the mere surface is cool, and this loses its heat quickly at night, therefore increasing the tendency to frost. This loose character of the soil can be somewhat improved by the use of a heavy roller which firms the soil and so gives it better heat conductivity. This tendency to frost reduces somewhat the availability of marsh land for tender crops, but in Rock County, potatoes and corn on marsh lands are seldom injured by frost.

The large water-holding capacity of marsh soils together with their large quantity of nitrogen makes them suitable for crops, making strong growth of stock or leaf. Among the staple crops, hay and corn are best suited to such land. Special crops such as cabbage, hemp and sugar beets also do well, but these will require larger amounts of potassium and phosphorus fertilizers. The degree of drainage must also be considered in selecting the crop to be grown. Timothy and alsike clover for hay may be grown on marsh land having insufficient drainage to be adapted to corn or other crops requiring tillage.

DRAINAGE.

In Rock County there are 75,200 acres of land which may be classed as poorly drained, and which must be provided with open ditches or tile drains before cultivated crops can be safely grown from year to year. This includes 52,672 acres of Clyde silt loam, 13,248 acres of peat, and 9,280 acres of Clyde fine sandy loam. In addition to these soils, there are places on the level prairie and also in the light-colored terrace soils where the lands are somewhat deficient in drainage, and where tile drains can be used with profit. It is safe to say that there are approximately 100,000 acres of land in Rock County which could be profitably improved by drainage.

The three soils mentioned above are, for the most part, unimproved, or are used only for grazing or for the production of wild or tame hay. The Clyde silt loam, when drained, makes one of the best types for corn in southern Wisconsin, and to have it in its present undrained condition is an economic loss. The peat is less valuable, but its improvement by drainage will greatly add to the producing possibilities of the county. The Clyde fine sandy loam is a good trucking soil when drained. Practically all of these lands can be successfully drained, and every farmer having poorly drained land should develop a plan by himself, or with his neighbors, for the improvement of these idle acres.

Where any area of low land includes part of several farms, the owners can form a drainage district and sell bonds to pay for the improvement. In this way, the cost of drainage can be spread over a number of years, and paid for from the products of the improved acres. Assistance in the development of such projects can—and, in fact, must—be secured from the state authorities who pass upon the practicability of the project before the court permits the organization of the district.

Since over sixteen per cent of the land in Rock County is failing to do its duty because of poor drainage, and since well-drained land adjoining is worth from $100 to $300 per acre, it would seem that the improvement of such land would be a matter of vital concern to the county as a whole. If this land were all in corn and properly handled, it would yield at a conservative figure over three million bushels per year.

For a more detailed discussion of the problem of drainage, see Bulletins Nos. 284 and 309, Wisconsin Experiment Station.

CHAPTER VI.

GENERAL AGRICULTURE AND CLIMATE OF ROCK COUNTY.

The system of agriculture followed at present consists of general farming with dairying as one of the most important and profitable phases. The chief crops grown in the approximate order of their importance are corn, hay, oats, barley, wheat, rye, tobacco, alfalfa, potatoes, sugar beets, peas, cabbages, beans and other miscellaneous truck crops. There are over 1,550 silos in Rock County, and nearly half of the corn is used as ensilage. The heavy soils of the Clyde series, when well drained, and the black prairie soils make the best corn land in the county.

The hay consists chiefly of clover and timothy. Medium red is the most popular clover. Some difficulty is experienced in getting and keeping good stands of clover, due in part to winter killing, and in part to an acid condition of the land, which is unfavorable to the growth of clover and other legumes. Hay is grown on practically all soils of the county, but does best on the heavier types.

Oats and barley are grown chiefly as feed for stock on the farm, but some is sold and shipped each year to the large market centers.

The growing of wheat decreased greatly after 1880, but during and after the late war, the acreage greatly increased. In 1918, a favorable year, the average yield was about thirty bushels per acre. Since then both acreage and yields have been considerably less. In 1919, the yield was fifteen bushels per acre.

Alfalfa is justly increasing in favor, and the acreage is gradually increasing, which is encouraging, as this is an excellent feed and a good soil builder. Tobacco is an important special crop. Through the practice of heavy fertilization of this crop on the same field year after year, other parts of the farm are robbed of their fertility for the sake of the tobacco patch. To equalize the distribution of manure, the tobacco field should be

rotated to different parts of the farm, and the crop should be grown in rotation with other crops.

The growing of sugar beets, while limited at present, could well be extended when the crop insures a profit, since there is a factory at Janesville. They do well on practically all of the heavy types of the area. Peas for canning seem to be best on Miami silt loam, although they are successfully grown on most upland types of the area.

Dairying is the most important branch of farming. The Holstein is the predominating breed, though the majority of the cows are grade stock of good breeding. In 1919 there were 37,914 milk cows in the county.

There is some feeding of steers for the Chicago market, but this is much less common than dairying. Hogs are raised extensively in conjunction with dairying and also with feeding cattle. On January 1, 1920, there were 69,960 hogs in the county.

ADAPTION OF CROPS TO SOILS.

It is recognized in a general way that different soils are adapted to different types of farming. The gravelly loam types are mostly too rough for the growing of general farm crops, and farmers realize that they are best adapted for pasturage. It is a well-known fact that crops on low-lying land are most susceptible to frost. All the farmers are beginning to recognize differences in the adaptation of soils to certain crops and varieties, and the majority are guided in a measure by such knowledge, but few carefully select their fields on soils best adapted to a particular crop. It is generally considered that corn does best on the heavy Clyde silt loam, and it is well suited to all the heavier, dark colored soils, such as the Carrington and Waukesha silt loams. On these dark soils, high in organic matter, small grains are apt to lodge, and the quality of the grain is not so good as on the light colored, heavy types. Peas do best on the Miami silt loam and Fox silt loam chiefly on account of the high lime content, while potatoes of the best quality are grown on the sandy and fine sandy loam soils. The sugar content of beets grown on the Carrington silt loam, Waukesha silt loam, and Clyde silt loam is lower than that of beets grown on the Miami silt loam and Fox silt loam, but the yield

is enough higher to give a little better net return. Tobacco is grown most extensively on the Miami and Carrington silt loams, both being well adapted to the crop. The choicest land for tobacco seems to be near areas of Carrington fine sandy loam where a little fine sand is mixed with the Carrington silt loam. The lighter textured soils are considered the best for trucking. It must be recognized, of course, that when a crop is well suited to a certain soil, that crop cannot be grown on it to the exclusion of other crops, because rotations must be followed to insure keeping up the fertility of the soil. For example, on good corn land, corn should not be grown every year on the same field. It may be grown two years in succession, however. When the land is not so well suited to it, corn may be grown only one year in the rotation.

METHODS.

The tendency throughout Rock County is toward better methods of cultivation, fertilization and seed selection, and as a result, yields are being increased. Where the soil is droughty but not subject to erosion, fall plowing has been found helpful in the conservation of moisture. Often the heavy sod soils are plowed in the fall. It is customary to apply stable manure to land that is to be plowed for corn, but if the land is plowed in the fall the manure is often hauled out during the winter and scattered over the plowed surface. When stubble land is plowed in the late summer, manure is frequently applied before plowing. Where tobacco is grown, it receives practically all of the manure, and the field soon becomes the richest on the farm. It is easier to use the same field year after year than to change the crop, and tobacco has often been grown in the same field for from five to ten years, and in some instances for fifteen years. This condition can be improved by following a rotation of tobacco with other crops as outlined on page — under the discussion of rotations. Throughout the county most of the farmers plan to seed their land to grasses at least once every four or five years.

FARM EQUIPMENT.

The farm buildings, including the dwellings, are generally large and substantial. The barns usually have a stone or con-

crete foundation. Most of the dairy farms have a silo. The fences are good, many of them being of woven wire. The work stock consists of draft horses of medium to heavy weight. Modern farm machinery is in use throughout the county. There are a number of traction engines used for plowing as well as for other farm work. Machines for thrashing grain travel about the country serving the farmers soon after harvest. There are also numerous co-operative thrashing outfits owned by the farmers themselves.

FARM TENURE.

The 1910 census reports the number of farms in the county as 3,787, comprising 95.9 per cent of the total land area. The average size of the farms in 1910 was 116 acres, of which ninety-five acres, or 81.8 per cent, was improved. The percentage of farms operated by owners was 66.8 per cent, by tenants 32.4 per cent and by managers .8 per cent. The 1920 census shows practically the same figures. Ordinarily where the landlord supplies the work stock and tools, he received two-thirds of the crop. Where the tenant supplies these in addition to his labor, the landlord receives one-half or one-third of the crop.

FARM VALUES.

The selling price of the better farming land ranges from $125 to $300 an acre, depending on the quality of the soil, the topography, the improvements and the accessibility of markets. The highest priced lands, excluding farms near the cities and towns, are the level to gently rolling, heavy soils, especially the silt loams. The more rolling areas of heavy soils, together with the sandy loams, range in valuation from $75 to $125 an acre, while the areas of deeper sand types and some areas subject to overflow are valued at $40 to $75 an acre.

IMPROVEMENTS IN METHODS OF FARMING.

There are about 100 farmers in Rock County who have had their farms examined by the State Soils Laboratory, and are now following instructions received for the improvement of their soils. This line of work has brought a soil expert to each farm, and careful examination has been made of the soil and subsoil.

Samples have been collected for chemical analysis, and observations made as to the methods of cultivation, fertilization, etc., followed. Upon the completion of the chemical work, reports are made for each farm, outlining methods for the permanent improvement of the soil on each farm. It has been found that through this line of work, practically all of the black prairie soils are acid and in need of varying amounts of lime. The phosphorus supply has also been found to be limited on most farms. On the light-colored soils, there has been found to be a deficiency in the nitrogen and organic matter supply and also in the amount of phosphorus found in the soil. As a rule the acidity is not so marked in the light-colored soils as on the prairie lands.

As a result of instructions which have been given through this service, the use of ground limestone has materially increased, and commercial fertilizers are used to a greater extent and with greater effectiveness than before this service was inaugurated by the Agricultural College.

The soils department of the university, through its extension specialist has started numerous co-operative fertilizer and lime demonstrations in Rock county. Farmers throughout the region are gaining much valuable information from these tests, which help to make every farm more productive.

Through the work of Wisconsin Experiment Association the importance of using good seed grains has been emphasized, and farmers are now paying more attention to the selection of their seed grains, with the result that both yields and quality have gradually increased. There are a number of farms within the county which make a business of raising pure-bred pedigreed seed grain.

CROP ROTATIONS.

It is quite generally understood that the continuous growth of one crop on the same field takes fertility out of a soil more rapidly than does a rotation of crops. One of the most important farm practices, therefore, from the standpoint of maintaining fertility, is the rotation of crops on a basis suited to the soil, climate, farm, and market conditions.

One reason why a crop rotation is beneficial is that different crops require different amounts of the various plant food ele-

ments found in the soil. One crop will remove a large amount of one element from the soil, and the next crop, if it be the same kind, will suffer for the lack of that element. If some other crop which does not draw as heavily on that particular plant food is rotated with the former, a certain balance in available plant food is reached.

When cultivated crops are grown continuously there is a greater loss of organic matter or humus from the soil than is the case when properly rotated. The use of legumes in rotations is of particular value since when they are well inoculated and turned under they not only support organic matter to the soil, but they also increase the nitrogen content.

In any program of permanent soil improvement, therefore, one should adopt at the outset a good rotation of crops, including a liberal use of legumes, in order to increase the organic matter of the soil either by plowing under the legume crops and other crop residues, or by using as food and bedding practically all crops raised and returning the manure to the land with as little loss as possible. No one can say in advance what will be the best rotation for any farm because of the wide variation in farms, farmers, and the prices of farm produce.

It is of great importance that in selecting crops to grow, careful consideration be given to the question of climate. This is about the only factor which the farmer absolutely cannot control. A poor soil may be improved, better markets may be found, and better labor secured; but the farmer is powerless to change climatic conditions. He must, therefore, select such crops as are suited to his climate.

The soil is also a factor of great importance. As a general rule, small grain crops do better on heavy than on light soils, and the same is true of grasses grown for hay. On the other hand, the same variety of corn requires a shorter season for maturity on light than on heavy soil. Rather light soils and those of intermediate texture are better adapted to potato growing and root crops. Therefore, on light soils a greater acreage should be devoted to cultivated crops than on heavy types.

Shipping and marketing facilities must also be considered in planning a rotation. The farmer located on a sandy loam farm close to a railroad station or home market will often find it profitable to include potatoes in his rotation. If he is located

six or seven miles from a station, the profits from growing potatoes will be much lessened. It will then pay him better to raise more corn for stock feeding, and to convert his crops into dairy products which are less bulky, and which for the same bulk have a greater value.

Some of the other things which we should keep in mind regarding a good rotation are that it helps to control weeds. It also aids in controlling plant diseases, and serves to check insect pests. Following a good rotation increases the humus supply in the soil, and insures maintaining a good amount of available nitrogen in the soil. It helps to distribute the labor efficiently throughout the year. A good crop rotation means that the proper crops will be grown at the proper time and in the proper place, and this will aid in keeping the soil in proper sanitary condition. It will also increase net returns from each acre, and greatly improve the general appearance of the farm.

Following are a few suggestions which will apply to farms in the corn belt and they may serve as outlines to be modified according to varying conditions:

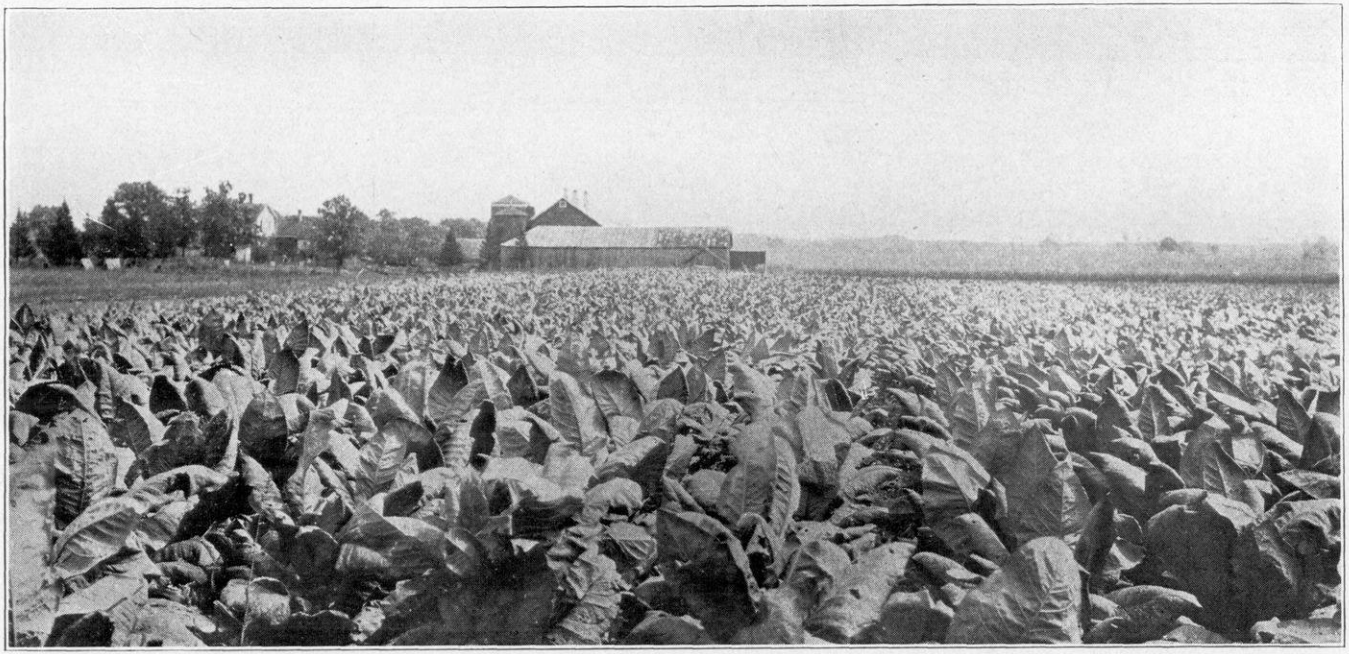
Six-Year Rotation.

1st year. Corn.
2nd year. Corn.
3rd year. Wheat or oats (with clover, or clover and grass).
4th year. Clover; or clover and grass.
5th year. Wheat (with clover); or grass and clover.
6th year. Clover; or clover and grass.

Five-Year Rotations.

1st year. Corn.
2nd year. Corn.
3rd year. Small grain with clover.
4th year. Clover.
5th year. Wheat with clover.

1st year. Corn.
2nd year. Small grain with clover.
3rd year. Clover.
4th year. Wheat with clover.
5th year. Clover.



VIEW SHOWING COMBINATION DAIRY AND TOBACCO FARM.

These two lines of farming are extensively developed in northern Rock and southern Dane Counties. In some sections tobacco growing is gradually giving way to the more extensive development of the dairy industry.

1st year. Corn.
2nd year. Cowpeas; or soybeans.
3rd year. Wheat with clover.
4th year. Clover.
5th year. Wheat with clover.

Four-Year Rotations.

1st year. Wheat.
2nd year. Corn.
3rd year. Oats with clover.
4th year. Clover.

1st year. Corn.
2nd year. Corn.
3rd year. Wheat or oats with clover.
4th year. Clover.

Three-Year Rotation.

1st year. Corn.
2nd year. Oats or wheat with clover.
3rd year. Clover.

In some of the rotations suggested it may be desirable to substitute rye or barley for wheat or oats. When clover is mentioned, it is meant to include the various clovers used, such as red, alsike, or sweet clover. The value of sweet clover is coming to be more appreciated and its importance in a crop rotation program may well be emphasized.

Tobacco can well be grown on the same field for from two to three years, followed by two years of corn and one of small grain seeded to clover. Phosphate fertilizer should be used to supplement manure. A second crop of clover can be plowed under and thus save some manure for other parts of the farm. Tobacco is grown chiefly on Miami and Carrington silt loams. A small amount of fine sand in these types seems to be a desirable characteristic.

The growing of peas for canning is important in some sections, and this crop may be introduced into the rotation very readily. A four-year rotation may consist of small grain, clover, a cultivated crop, followed by peas. This may be made a five-year rotation by adding timothy and cutting hay two years.

The growing of sugar beets is also an important industry, and beets may also be introduced into the rotation without difficulty. It is best not to have the beets follow or precede the corn, but the crop may follow barley or other small grain. Beets can be grown very successfully following tobacco since tobacco land is in a high state of fertility, and since the beets use a somewhat different combination of plant foods than does the tobacco, and draws more upon the subsoil.

A three-year rotation is popular on many of the dairy farms. It consists of grain seeded to clover, and the clover followed by corn or some other cultivated crop. Much the larger portion of the corn in this region is put in the silo to be fed to dairy animals. The clover is made into hay, and fed to stock. It is often possible to get two crops of medium red clover in one season. The second crop may be cut for hay, or may be pastured. Pasturing is advisable on well-stocked dairy farms. This three-year rotation may be lengthened into a four-year rotation by the addition of timothy so that hay can be cut two years instead of one year, or the land can be pastured the second year instead of cutting for hay.

Potato raising when properly managed is a profitable industry in many parts of the state. Although good crops may be grown on heavy clay soils, the sandy loams are especially well adapted to potato production. For best results, this crop should be grown in rotation with other crops, and should always follow a legume of some kind. Potatoes should not follow corn or corn potatoes, as both crops draw heavily on the fertility of the land. In the rotations which have been given, potatoes can be planted as one of the cultivated crops. It is better to apply manure to the clover crop rather than just before planting to potatoes, for scab is more common when potatoes are planted on freshly manured land. The three-year rotation just described is excellent for sections where potatoes are grown extensively, the potatoes taking the place of corn. As a rule cropping to potatoes oftener than once in three years is not recommended.

LIMING.

Part of the land on practically every farm in Rock County is in need of lime. All of the soil types on the prairies show an acid condition which is usually slight to medium in degree.

The subsoil of the prairie types also show some acidity to a depth of from two to three feet. The light colored upland soils are usually slightly acid at the surface, but as soon as the gravelly or gritty layer in the subsoil is reached the material is calcareous and contains lime.

The soils which are least in need of lime are the Clyde series and the peat soils.

The degree of acidity is quite variable and each farmer may find a wide variation in acidity on his farm. Failure of clover and alfalfa is usually a sure, and one of the best, indications of the need of lime. About two tons of ground limestone per acre is the usual application. The amount to be used, however, may vary with the character of the soil and the crop to be grown. Such crops as alfalfa, sweet clover, peas, cabbage, onions and lettuce have a high lime requirement. Clover, garden beans, barley, hemp, turnips and radishes have a medium lime requirement, while vetch, white clover, oats, rye, blue grass, potatoes, sorghum and others have a low requirement for lime. As a rule the heavy types of soil which are acid need more lime than the sandy types showing the same degree of acidity.

Ground limestone is doubtless the most economical form of lime which can be extensively utilized in Rock County. Lime should be applied previous to planting the crop which is to be benefited. It should be applied to plowed land and thoroughly worked in by harrowing. Either fall, winter or spring applications may be made on heavy soils, but on light soils spring application is preferable.

The best way to apply lime is with a regular spreader made for this purpose, and there are a number on the market. A manure spreader may also be used by first putting in a thin layer of manure and spreading the limestone evenly on top of the manure. Where several farmers are so situated that they can work together, a lime spreader may be secured jointly for this purpose.

After making a first application of two tons per acre, it is not likely that another application will be needed for four to six years, and the need should be determined by the story which the crops themselves tell.

It should be remembered that most acid soils are also deficient in available phosphorus, but applying lime will not add to the

total amount of phosphorus in the soil. The need of phosphorus may be so great that but little result will be secured from liming until phosphorus is also added. Frequently the application of phosphorus alone to an acid soil will result in larger increases than the use of lime alone, and for this reason it is important that both deficiencies should be corrected to secure the most economical production.

DISTRIBUTION OF LIME, COMMERCIAL FERTILIZER AND MANURE.

Phosphate or other fertilizers or lime should be uniformly distributed, so that some will be near every plant. Ground limestone is applied at the rate of from 2,000 to 4,000 pounds or more an acre, while with phosphates and other fertilizers the amount applied for staple crops is usually from 75 to 400 pounds. It is difficult to construct a machine which will satisfactorily distribute both fertilizer and limestone, although such machines are on the market and also others for distributing each separately. The fertilizer distributor may be a part of a grain drill or a separate machine. The machine for distributing ground limestone should be provided with a double agitator so as to secure continuous feeding.

End gate seeders which will distribute proper amounts of either fertilizer or ground limestone fairly well are available.

When a fertilizer distributor is not available the acid phosphate or other fertilizer may be spread evenly over the manure in the manure spreader, and so receive a very fair distribution. This method will give very good results until such time as a grain drill with fertilizer attachment can be purchased. The amount to be applied on each spreader load must be calculated so the right amount per acre will be applied. An old drill or seeder may also be used to distribute the fertilizer going ahead of the grain drill.

The care and use of the manure produced is an important factor in the management of dairy and stock farms. The chief advantage of these types of farming is that the proper use of the manure or other waste products makes it possible to maintain profitable yields with comparatively little purchased fertilizer. But it is only when intelligent care is taken that this result is possible. Much of the available plant food in manure is readily soluble in water, so that if the manure is exposed to the rain

in flat or shallow piles, a considerable part of its value is lost. This affects nitrogen and potash especially. It is important also to recognize that a large portion of these elements is in the liquid part of the manure and that it is necessary, therefore, to use bedding or absorbents freely to prevent a considerable loss. This is particularly true of potash, about 60 per cent of which is contained in the liquid manure.

Ordinarily the best practice is to haul the manure directly to the field. When this is not practicable the pile should be kept compact, well trodden and moist as it can be through the use of a slightly saucer-shaped manure pit, from the outer sides of which the ground slopes away so as to prevent water washing into the pit itself. In this climate the use of shelter is of doubtful importance, though where more rains occur, particularly in the winter, a shed roof is very helpful.

The rate and frequency with which manure is applied depends in part on the character of the soil on the farm. On lighter soils more frequent applications of smaller amounts are desirable than on heavier soils. Five or six loads per acre every third year are desirable on the sandy loams, while eight to twelve or more every fourth or even fifth year may be used to advantage on heavier soils.

CLIMATE.

Almost all of Rock County is included within the Rock River Basin, which is one of the eight climatic provinces in Wisconsin. This province has the longest growing season of any in the State, averaging about 170 days, which is as long as that of central Illinois, longer than that of central Indiana or Ohio, and about equal to that of the Valley of Virginia and that of central Maryland. Weather Bureau records taken at Beloit indicate that at that station there is a growing season of 181 days free from frost.

The mean annual temperature for Rock County is 47.3° F. The winters here are colder than along the lake, and the spring and summer are warmer. This section is the best corn area in the state. The temperature of the Rock River Basin in summer is similar to that of northern Illinois, Indiana, Ohio, and southwestern Pennsylvania, while in winter it is comparable with that of southern Vermont, northern Iowa, and southern Montana.

On seven summer days, on the average, each year the thermometer may go as high as 90° F., and during five winter mornings on an average it may fall to 10° F. below zero or lower. The highest temperature recorded in the county is 105° F., and the lowest 27° below zero. Such extremes are of rare occurrence and of short duration.

Records at Beloit show that the average date of the last killing frost in the spring is April 20, while the latest date of killing frost recorded is May 20. The average date of the first killing frost in the fall is October 18, while the earliest date of killing frost recorded is September 20.

The average annual rainfall of 32.71 inches is normally well distributed throughout the year, and especially during the growing season when most needed. The average for the three spring months is 8.54 inches, for summer 11.31 inches, and for fall 7.38 inches. It is true, however, that during July and August there are occasional dry spells, during which crops actually suffer from the lack of moisture. Dry spells may occur in the fall also, but as the crops reach, or approach maturity, a reduction in the supply of soil moisture is not so serious a matter as when the plants are making the main part of their growth. While these dry spells frequently cause a reduction in the yields, they have never been so severe as to cause even an approach to a crop failure.

In the following table are shown the more important climatic data as compiled from the records of the Weather Bureau station at Beloit:

TABLE SHOWING MEAN, ANNUAL, AND SEASONAL TEMPERATURE AND PRECIPITATION AT BELOIT, WIS.

(Elevation of Station, 750 feet.)
(Length of record, 17 years.)

Month	Mean temperature	Highest temperature	Lowest temperature	Mean precipitation	Average number of days with .01 inch or more of precipitation
m mf					
December	24.0	58.0	—25	1.89	6
January	20.4	59.0	—27	1.88	17
February	19.9	59.0	—24	1.71	6
Winter	21.4	59.0	—27	5.48	29
March	34.2	80.0	— 4	2.21	5
April	47.5	84.0	18	2.77	6
May	58.7	91.0	27	3.56	7
Spring	46.8	91.0	— 4	8.54	18
June	68.0	98.0	36	4.05	9
July	72.9	105.0	45	3.65	7
August	70.6	97.0	42	3.61	8
Summer	70.5	105.0	36	11.31	24
September	63.6	94.0	23	3.39	5
October	50.8	86.0	13	2.08	7
November	36.9	69.0	— 4	1.91	5
Autumn	57.1	94.0	— 4	7.38	17
Mean Annual	47.3	105.0	—27	32.71	77

Average length of growing season, 181 days.

SUMMARY.

Rock County is situated in the extreme southern part of Wisconsin. It has an area of 716 square miles, or 458,240 acres.

The county lies entirely within the drainage system of Rock River. The topography ranges from level or gently undulating in the prairie sections to hilly and broken in the other parts of the county.

Rock County was established in 1836. Settlement began in 1835. The population in 1920 was 66,150. The cities within the county have made large growth. Janesville grew from 13,894 in 1910 to 18,293 in 1920, and Beloit grow from 15,125 in 1910 to 21,284 in 1920.

The entire county is well provided with both railroads and public highways. All sections are well settled.

The soils in Rock County are derived from glacial drift, from the underlying rock formations, and from water-laid materials. Ten soils series including twenty-two types in addition to peat are recognized.

The Miami series, which is the most extensive in the county, consists of light-colored, timbered glacial soils carrying considerable limestone material. The silt loam occurs in large areas, and is well adapted to all the farm crops common to the region. It is considered the best soil in the county for peas. The loam and fine sandy loam, while not equal to the silt loam, give good results in general farming. The latter is well suited to truck crops. The gravelly loam is inextensive, and is mostly in pasture.

The Carrington series comprises dark-colored, upland prairie soils derived from glaciated limestone material. The silt loam is extensively developed, and constitutes one of the best agricultural soils in the state. The loam and fine sandy loam are good general farming soils. The gravelly sandy loam is mainly in pasture.

The Knox series is comprised of light-colored, forested upland soils derived in part from limestone, and in part from windblown material mixed in places with old glacial material. These

soils are well suited to general farm crops where the soil is deep and the surface is not so sloping that wash and gullying interfere.

The Baxter series is light-colored soil derived from the underlying limestone, and has been influenced but very little by the addition of other materials. The clay loam is the only type mapped.

The Crawford clay loam is dark-colored, upland prairie soil derived from limestone. It is not an extensive soil, and is used for general farming. Fair yields are obtained.

The Boone fine sandy loam is a light-colored forested soil derived from the weathering of sandstone, in this county chiefly from the St. Peter's sandstone. It is of fair agricultural value.

The Clyde series consists of dark-colored soils within the glaciated limestone region, originating through the influence of poor drainage and the accumulation of organic matter acting on the original glacial till of the basins, or on accumulations of water-laid material washed into and deposited on the floors of the basins. The silt loam, which is extensively developed in Rock County, is one of the best corn soils of the state when properly drained. Small areas of the fine sandy loam are also found. The Clyde soils give good yields of corn and oats.

The Fox loam and silt loam are light-colored forested soils occurring mainly in glaciated limestone regions and occupying outwash plains or stream terraces. They are well adapted to the general farm crops.

The Waukesha series comprises dark-colored, prairie soils derived from reworked glacial material, and deposited as outwash plains or terraces. The silt loam is an extensive soil constituting some of the best land for general farming in Rock County. Tobacco and sugar beets are special crops which do very well on this soil. The loam, sandy loam, and sand, ranking in importance in the order named, are used for general farm crops and to some extent for truck crops. The gravelly loam has a steep surface and is of limited value.

Peat consists of vegetable matter in various stages of decomposition, mingled with varying proportions of mineral matter. The drained and reclaimed peat makes good farm land when properly fertilized.

The agriculture of Rock County consists of general farming

in conjunction with dairying. The principal crops are corn, oats, barley, clover, timothy, alfalfa, rye, buckwheat, and wheat. A number of special crops are grown, including tobacco, potatoes, sugar beets, peas, and cabbage. Hog raising is developed rather extensively, and some beef cattle are fed.

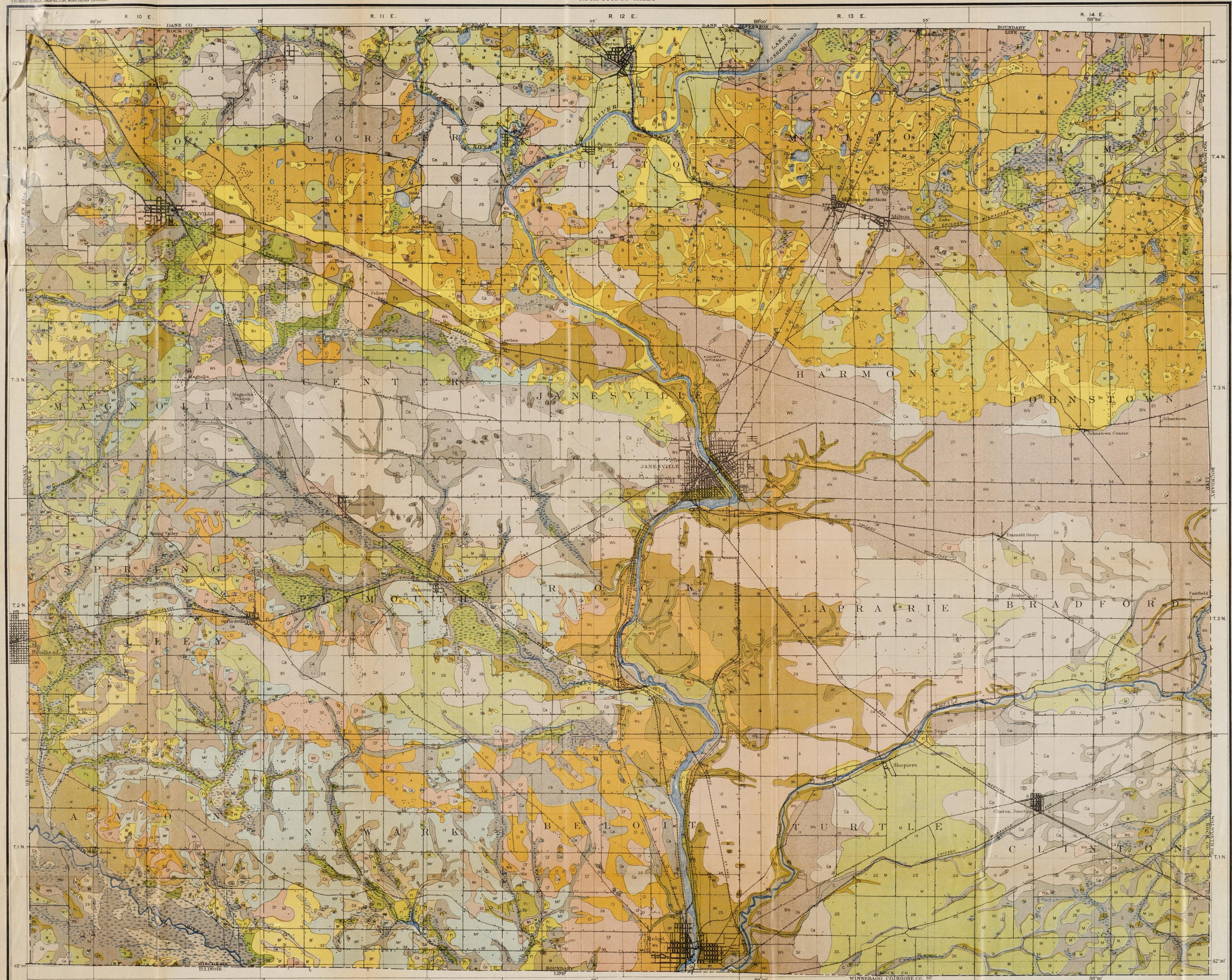
Land values range from $40.00 an acre on the sandy and more broken acres to $300 in the most highly improved sections.

The climatic conditions are favorable for general farming and dairying. The mean annual temperature is reported at Beloit as 47.4° F., and the mean annual precipitation as 32.71 inches. There is a normal growing season of 170 days for the general region of Rock County, but at Beloit records show a growing season of 181 days free from killing frosts.

U.S. DEPT. OF AGRICULTURE
BUREAU OF SOILS
MILTON WHITNEY, CHIEF
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY
THOMAS D. RICE, INSPECTOR, NORTHERN DIVISION.

SOIL MAP
WISCONSIN
ROCK COUNTY SHEET

STATE OF WISCONSIN
GEOLOGICAL AND NATURAL HISTORY SURVEY.
W.O. HOTCHKISS, DIRECTOR.
COLLEGE OF AGRICULTURE, UNIVERSITY OF WISCONSIN.
CHAS. R. CRANDALL, DEAN.
A.R. WHITSON, IN CHARGE SOIL SURVEY



LEGEND

Miami gravelly loam — Bo	Knox fine sandy loam — Mf
Miami fine sandy loam — Bs	Knox loam — Ml
Miami loam — Bl	Miami silt loam — M (Deep phase)
Miami silt loam — B	
Boone fine sandy loam — Bf	Plainfield fine sand — Ps
Carrington gravelly loam — Cg	Rodman gravelly loam — Rs
Carrington fine sandy loam — Cf	Baxter clay loam — Ul
Carrington loam — Cl	Waukesha gravelly loam — Wg
Carrington silt loam — Ca	Waukesha sand — W
Ca — Shallow phase	Waukesha sandy loam — Ws
Clyde fine sandy loam — Cs	Waukesha loam — Wl
Clyde silt loam — C	Wl — Sandy phase
Crawford clay loam — Cc	Waukesha silt loam — Wk
Fox loam — Fl	Wk — Deep phase
Fox fine sandy loam — Fl	Peat — P
Fox silt loam — Fs	P — Shallow phase

CONVENTIONAL SIGNS

CULTURE *(Printed in black)*

City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort.
Secondary roads and Trails
Railroads Steam and Electric
Bridges, Ferry
R.R. crossings, Tunnel
Ford, Dam
School or Church, Creameries, Cemeteries
Mine or Quarry, Mine dumps, Made land
Bluff, Escarpment, Rock outcrop and Triangulation station
Stony and Gravelly areas
Soil boundaries
Boundary lines
Boundary lines
Boundary lines
U.S. township and section lines

RELIEF *(Printed in brown or black)*

Contours, Depression contours
Prominent Hills, Mountain Peaks
Sand, Wash, and Sand dunes
Shore and Low-water line, Sandbar

DRAINAGE *(Printed in blue)*

Streams
Lakes, Ponds, Intermittent lakes
Intermittent streams
Springs, Canals and Ditches, Flumes
Swamp, Salt marshes
Submerged marsh, Tidal flats

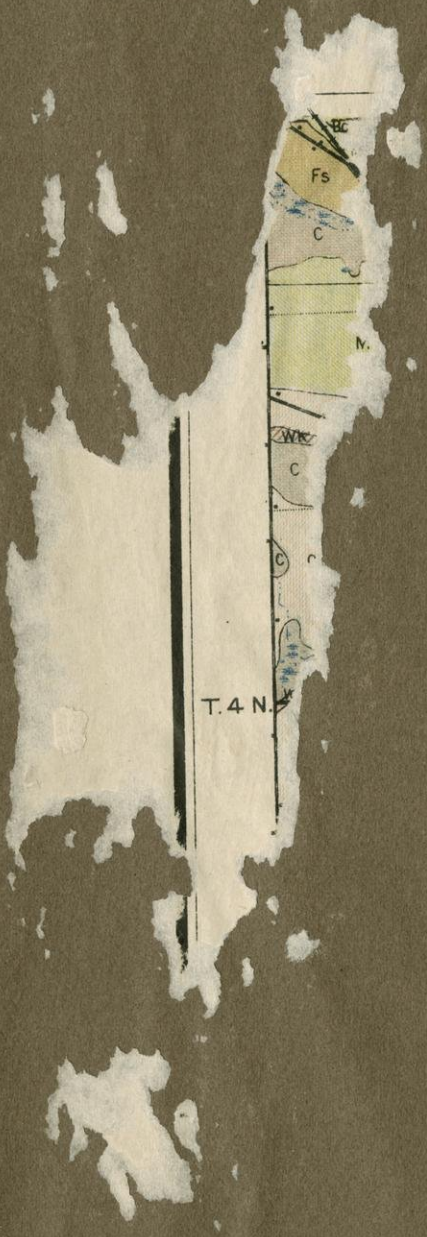
The above signs are in general those used on maps. Variations from the usage appear in some maps of earlier date.

Soils surveyed by W.J. Geib, in charge, Guy Conrey, and W.M. Gibbs, of the Wisconsin Geological and Natural History Survey, and Arthur E. Taylor, of the U.S. Department of Agriculture.

BASE MAP FROM U.S. GEOLOGICAL SURVEY SHEETS

Scale 62500 — 1 0 1 2 3 Miles

SNYDER & BLACKLEY.


BC
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T. 4 N.