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. 54B SOIL SERIES NO. 24

SOIL SURVEY

OF

JACKSON COUNTY

WISCONSIN

BY

A. R. WHITSON, W. J. GEIB. AND T. J. DUNNEWALD OF THE WISCONSIN GEOLOGICAL AND NATURAL HISTORY, SURVEY, AND A. L. GOODMAN, G. W. MUSGRAVE AND C. B. CLEVENGER OF THE U. S. DEPARTMENT OF AGRICULTURE, BUREAU OF SOILS.

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

PUBLISHED BY THE STATE
MADISON, WISCONSIN
1923

TABLE OF CONTENTS

CHAPTER V.

CHAPTER VI.

CHAPTER VII.

CHAPTER VIII.

ILLUSTRATIONS

PLATES AND FIGURES.

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 cooperation 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.

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 Between 20–50% 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 graduation in texture of otherwise uniform material, such a group is called a *soil series*. It corresponds to the family which is made up of different individuals having the same parentage. The Miami series, for ex-

ample, 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 sandy and gravelly loams. 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 with 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 JACKSON COUNTY WISCONSIN

CHAPTER I

DESCRIPTION OF AREA

Location and boundaries.—Jackson county is located in the west central part of Wisconsin, and has an area of approximately 978 square miles or 625,920 acres. It is bounded on the north by Clark and Eau Claire counties, on the east by Wood and Juneau, on the south by Monroe and La Crosse, and on the west by Trempealeau county. It has an extreme length east and west of forty-two miles. The eastern portion of the county is only eighteen miles wide, while the western two tiers of townships give the county a width of thirty-six miles.

Topography.—The surface features of the Jackson county fall into two very distinct divisions. The approximate boundary between the different zones is marked by the Black River from the southwestern corner of the county to a point three miles north of Black River Falls. From this point northward, the Chicago and Northwestern Railway Line marks the dividing line. The county to the west consists of a series of valleys and narrow ridges which give the region a hilly to broken topography. To the east the surface is nearly level.

Geological History.—In the early geological history of the region there was a smooth initial surface underlaid by limestone, with sandstone in turn beneath it. The lower Magnesian limestone which originally covered this region has practically all been removed by erosion, and remnants of the elevated plain-like surface have been reduced by weathering and erosion to very narrow, winding irregular ridges on which the outcroppings of sandstone are frequent. In but few cases in the county is there any tillable land on the narrow crest of these high ridges.

The headward streams from one drainage system have interlocked with adjacent systems so that the divides are crooked, rocky ridges. This gives the west half of the county a rolling, rugged appearance, the greatest irregularity of surface being along the western extremity of the county and becoming less pronounced going eastward to the Black River.

The eastern portion of the county consists of a very extensive sandy plainlike region where the surface is nearly level and from the floor of which there arise numerous cliffs of sandstone more resistant than the bulk of the underlying rock. These mounds form a conspicuous feature of the landscape.

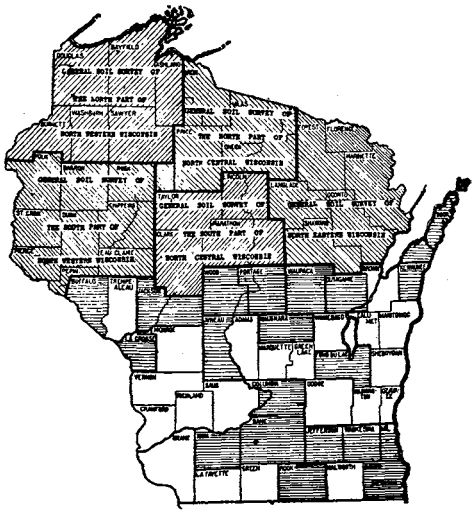


FIG. 1. SKETCH MAP SHOWING AREAS SURVEYED IN THE STATE.

Much of the eastern portion of the county within this sandy plain is low and poorly drained, and includes extensive marsh areas made up largely of peat. These marshy areas are most extensive in the extreme eastern tier of townships where over from 75 to 80 percent of the land area is marsh.

Throughout the marshy tracts and within the regions where shale layers occur with the sandstone as well as along the first bottoms of streams, the natural drainage is deficient. Elsewhere the natural drainage is good.

Water courses.—The Black River which enters the county near the center of the north side and leaves at the southwest

corner, receives the drainage waters from the greater part of the area. From the east it receives the drainage waters from the East Fork of the Black River, Morrison Creek, Perry Creek, Robinson Creek and others, while from the west it receives Halls Creek, Town Creek, Roaring Creek, and Douglas Creek. The extreme western border of the county drains westward chiefly through tributaries of the Trempealeau and Beef Rivers into the Mississippi. From the southeastern portion of the county some of the drainage water reaches the Wisconsin River through the Lemonweir River and its tributaries.

Settlement.—The first settlement in Jackson county was made in 1818 or 1819 when a saw mill was erected on Town Creek, but this was not permanent. The Indians did not cede away their right to the region until 1838, and in 1839 the first permanent settlement was made on the present site of Black River Falls. The Mormons bought a mill here in 1843 which they operated for part of two years. Later a Mormon settlement was established at Knapp in the country to the east of Millston. Jackson County was established in 1853, and the village of Black River Falls was incorporated in 1866.

Black River Falls, with a population 1,796 in 1920, is the county seat of Jackson county and also the largest city. It is situated on the Black River near the center of the county, and is a distributing center, market and shipping point for a large territory. Merrillan, Hixton, Taylor, Hatfield, Pray, and Millston are smaller railroad towns. In 1920 Jackson county had a population of 17,746.

Railways.—Two railway systems traverse the county. The Chicago and Northwestern Line crosses the area from the southeast to the northwest passing through Millston, Black River Falls, and Merrillan. From Merrillan a branch runs northeast through Neillsville, Marshfield, and Wausau, to Green Bay. From Fairchild, just above the north county line a branch extends west to Mondovi in Buffalo county. The Green Bay and Western Railway crosses the county from east to west passing through Pray, Hatfield, Merrillan, Hixton, and Taylor. The southwestern corner of the county is more remote from railroad facilities than any other section of the area, but this has not prevented the development. In fact this is one of the best improved and most highly prosperous farming communities in the

county, and centers about the inland town of Melrose which is connected with Black River Falls by stage.

Highways.—The main dirt roads throughout the western part of the county are usually graded and kept in good condition, as the predominating soil material usually makes a good roadbed, but hills are numerous and grades are frequently steep; so heavy hauling is difficult. Throughout the sandy portion of the county most of the roads are very sandy, but in some instances shale or clay, where available, has been used in improving the highways with very satisfactory results.

Other improvements.—At Hatfield there is a large dam across the Black River just above the rapids, and this forms an extensive reservoir known as Lake Arbutus. A power house is located several miles south of the dam, and from here the electric power is carried over high tension transmission lines to La Crosse and other points.

Nearly all parts of the county are supplied with rural free delivery service, and telephones are in common use.

Markets.—The towns within the area afford markets and shipping points for the farm produce raised. From Black River Falls to Madison, it is 127 miles and to Milwaukee 209 miles. It is 250 miles to Chicago, and 152 miles to Minneapolis, Minnesota.

Farm equipment.—The farm buildings and equipment in the Knox silt loam and Boone fine sandy loam and loam country are generally modern and up to date in all ways. In the vicinity of Melrose and the north side of the Trempealeau River valley, large barns and silos, electric lights and water supply systems are common. A number of farms use tractors, although the amount of steep and rough land precludes the use of some types of tractors for field work.

In the more sandy districts, farm buildings are generally less pretentious, occasional abandoned farms are seen, and equipment and machinery are of a less complete order. Although there are sometimes very good buildings and equipment on sandy farms, the general condition of these is usually a fair indication as to the fertility of the soil or the profitable nature of the farming done.

Farm tenure and labor.—Of the 2577 farms is Jackson county reported by the United States census of 1920, the greatest number, 991, lie between 100 to 175 acres in size, 622 farms were 50 to 99 acres in size, and 425 were 175 to 260 acres in size. Moderate to large size farms are the rule, although where special crops are grown exclusively the farms are often much smaller. 86.3 per cent of the farms are operated by owners, 12.7 per cent by tenants, and 1 per cent by managers.

Labor on farms is generally American born, obtained from the immediate locality. Prewar wages were from $30 to $40 per month with board, although during the last few seasons as much as two times this price has been paid due to war conditions. In general, farm help is scarce and the special crops such as tobacco and cucumbers have been reduced in acreage on many farms because of the labor shortage.

Land values.—Farm land ranges greatly in price. The best land in the well developed Knox silt loam country often sells for $100 to $200 an acre, and an occasional wooded poorly located piece can be bought for $35 to $40. In the east half and the sandy districts, wild land may be had for $5 to $20 per acre and partly developed land for from $20 to $40 per acre. Values in all parts of the county vary greatly depending upon location, lay of the land, improvements, soil, and the manner in which fertility has been kept up. The producing capacity of farms in each district varies even on the same soil according to the methods followed, and the personal equasion of the farmer must always be considered in passing upon the value of a farm.

SOILS

Jackson county lies almost entirely within the unglaciated portion of Wisconsin, and in its geological formations, soil conditions, and topography, it is representative of large areas in the central and southwestern parts of the state.

Throughout nearly all of the county the uppermost rock consists of Potsdam sandstone. Over the western portion of the area this rock outcrops in numerous places forming the steep rocky slopes of valley walls, isolated mounds or long narrow ridges where the rock has been more resistant to processes of weathering. In the eastern portion of the county there are also

numerous isolated mounds of sandstone which, as indicated elsewhere, form a conspicuous feature of the landscape.

The outcrops of this rock determine the classification, and make up a considerable portion of the type mapped as Rough Stony Land.

Granitic rocks form the bed rock formation along the Black River from Black River Falls north. In the immediate vicinity of City Point, in the extreme eastern part of the county, the surface rock is also granite.

From the standpoint of soils, the whole county may be considered as being unglaciated, but along the extreme northern border of the county, there are various indications of glaciation. These are chiefly glacial bowlders and gravel in places. No pronounced moraine is found there. The glaciation represented is Pre-Wisconsin, and because of its extreme age and that its action along the southern border was very feeble, the influence on the present-day soils is not sufficient to recognize in our soil classification of Jackson county.

The surface of nearly all of the western portion of the county is covered to a depth of from less than two feet to over ten feet, with a mantle of extremely silty material which is undoubtedly loess. It is extremely silty at the surface, the clay content gradually increasing with depth, and in cuts a laminated structure is often observed. This material is supposed to have been deposited by action of the wind, following early glacial periods. It is extremely fine in texture having a smooth feel like flour.

At one time this entire western portion of the county was doubtless covered with this material, which has been removed by erosion in places, especally where the deposit was thin, and the underlying sandy material or sand rock was exposed.

In the survey of Jackson County, the various soil forming materials have been classified into ten soil series and nineteen soil types, not including peat and rough stony land. In a number of instances phases of types have been recognized. The soil series, which correspond to the family groups, are not shown on the map, which accompanies this report, and the series are described here only briefly. The individual soil types, however, are shown on the map, each being indicated by a distinct color. It is the soil types in which we are especially interested since the type is the unit in mapping and classifying soils. Following is a complete list of the soil types mapped in the county, and

the series or family group to which each type belongs. Following this general discussion of the soils will be found a full and detailed description of all of the types, together with statements covering the present uses of the soils and methods through which each type can be best improved.

The soil derived in part from the loessial blanket and partly from decomposed shale has been classified as Knox silt loam. This is the most extensive soil in southwestern Wisconsin. No other type was mapped in this series.

Along stream valleys throughout the western part of the county, some terraces or benches occur where the soil is rather heavy, and where it has been derived from the uplands and redeposited by water. There soils are of the Lintonia series, and include the silt loam only.

The Bates series comprises dark-colored upland soils in the loessial region where the original timber was thin or sparce and where a semi-prairie condition prevailed. The silt loam was the only type mapped.

In the stream bottoms of the western part of the county where the soils are dark-colored and rather heavy in texture, the Wabash series has been mapped. The types Wabash silt loam and loam were found.

On many of the slopes in western Jackson County and over extensive tracts in the eastern part of the area, the material forming the soil has been derived directly from the weathering of the Potsdam sandstone. This material has been classified as the Boone series, and the types Boone loam, fine sandy loam, fine sand, with several phases were indicated on the soil map.

In a number of places, especially in the north central and northeastern portions of the county the Potsdam sandstone has a shaly phase associated with it, and from the weathering of this material has come the Vesper series of soils. The surface is level, the soils are shallow over the shaly rock, and usually contain varying amounts of clayey material in the subsoil from the shale, which makes a tight subsoil and poor drainage. The types mapped are Vesper silt loam, fine sandy loam, and sandy loam.

Along Black River and its tributaries are extensive tracts of alluvial land now found as terraces well above present flood flow. The soil is light-colored and light in texture, and has

been classified as the Plainfield series. The types mapped are Plainfield sandy loam, sand, and fine sand.

Throughout the eastern portion of the county are numerous areas of marsh border soil which are dark-colored, low-lying, and naturally poorly drained, and where the soils are of a sandy nature, partly residual and partly alluvial, and aways acid. These soils are placed in the Dunning series, and have been classed as Dunning sand.

The first bottom light-colored soils subject to annual flooding have been classified as Genesse, and the types silt loam, fine sandy loam, and fine sand were mapped. Extensive areas of peat were also mapped, and this consists of decaying vegetable matter in various stages of decomposition, with which there is mixed a small amount of fine earth, but seldom enough to permit the use of the term Muck.

The following table shows the actual and relative extent of each soil type, and in the following pages of this report each type is fully described.

AREAS OF DIFFERENT SOILS

Soil	Acres	Per cent	Soil	Acres	Per cent
Boone fine sand	111,744		Boone loam	22,400	3.5
Level phase	14,656	20.1	Plainfield fine sand	18,880	2.9
Poorly drained phase	2,176		Wabash silt loam	7,808	1.2
Knox silt loam	73,920	18.9	Wabash loam	7,488	1.2
Steep phase	47,296		Genesee silt loam	7,296	1.1
Peat	89,536	15.7	Vesper silt loam	4,800	.8
Shallow phase	10,752		Genesee fine sandy loam	3,072	.5
Boone fine sandy loam	54,400	8.5	Bates silt loam	2,624	.4
Rough stony land	42,496	6.6	Lintonia silt loam	2,368	.4
Vesper fine sandy loam	40,000	6.2	Vesper sandy loam	2,368	.4
Dunning sand	37,888	5.9	Plainfield sandy loam	1,536	.2
Plainfield sand	35,136	5.5			
			Total	640,640	

CHAPTER II

GROUP OF HEAVY SOILS

KNOX SILT LOAM

Extent and distribution.—The Knox silt loam all lies west of the Black River. This is an important and extensive type of soil in Jackson County, the towns of Melrose, Franklin, Garden Valley, Albion, Irving, Currian, and Northfield being made up largely of it.

Description.—The surface soil of the Knox silt loam consists of twelve inches of a grayish-brown or buff-colored silt loam, having a friable structure and a smooth feel. While there is present a small percentage of fine and very fine sand, but few coarser grains are found. The lower portion of the soil usually is of a yellowish color, but on drying, the surface becomes ashen in appearance. As a whole, the texture of the material is very uniform, but varies somewhat in depth. The subsoil consists of a heavy, yellow silt loam, grading into a silty clay loam at eighteen to twenty inches, and usually becoming a light chocoate brown color at thirty to thirty-six inches. It is compact, and is uniform throughout its entire extent, except as indicated in the phase described below. The underlying rock lies from four to ten or more feet below the surface.

The most important variation in this soil has been designated as the steep phase on account of its steep slopes and rough, uneven topography. This phase is described in greater detail following the description of the typical soil.

Minor variations in the typical soil occur, chiefly on the narrow ridges, where the surface soil has in places been removed and the heavy subsoil exposed. In such places the depth to the underlying rock is also less than over the more extensive areas of this soil, and in some instances it can be reached with a three-foot auger. On some of the lower slopes, the wash from the adjoining higher land has accumulated to a small extent,

and the surface soil in such places is somewhat deeper than the average. On some slopes the soil is somewhat darker in color and contains more organic matter than typical. While a number of such minor variations occur, this soil—as a whole—is remarkably uniform.

Topography and drainage.—The Knox silt loam occupies a section of country which consists of a series of hills and ridges. The typical Knox silt loam is found occupying the tops of these hills and ridges where the surface is nearly level to gently rolling, and also the more gentle slopes where erosion is not a serious problem, and where all ordinary farm operations can be carried on without difficulty. On the steeper phase, the fields are subject to erosion, and in some places deep ravines and gullies have been formed, causing considerable damage. Practically all of this phase can be cultivated, though some of it is sufficiently steep to make the operation of farm machinery difficult. Erosion is the most serious problem to be considered in the cultivation of the steep phase. On account of the uneven character of the surface, the natural drainage is good. The type is quite retentive of moisture, and suffers from drought only during long dry spells.

The topography is such that drainage on this soil is almost always efficient, and only in isolated spots will the drainage ever need to be improved.

Origin.—The Knox silt loam in Jackson County lies directly over sandstone rock which underlies all the ridges and knolls at from two to ten feet beneath the surface. The surface soil is partly of loessial origin, having been deposited as fine dust by winds from the south and west in past geological ages. It is often noticeable that slopes which would be exposed to such winds are but thinly covered with the silt loam or the soil is sandy while in the lee of hills and ridges, the silt loam surface soil is often deeper than ordinary. This soil is also derived in part from shale associated with the sandstone.

Most of this soil shows varying degrees of acidity; so much so that difficulty in getting alfalfa started will generally be experienced unless the soil is limed, heavily manured, and inoculated.

Native vegetation.—The natural timber on this soil in Jackson County consisted mainly of white, black and bur oaks, with

some white birch, basswood, maple and white pine. Most of the soil having fairly level or undulating topography has been cleared and cultivated for many years. A large part of the steep phase is still timbered as are a few of the more isolated forties which are not steep. The timber is mostly second growth oaks, poplar, and white birch.

Present agricultural development.—The principal crops grown at the present time and the average yields obtained are as follows: Corn, 40 to 45 bushels; oats, 35 to 45 bushels; barley, 30 to 35 bushels; wheat, 20 to 25 bushels; and hay 2 to 2½ tons per acre. Oats are grown more extensively than any other grain crops. The acreage of barley is smaller than that of oats and the acreage devoted to wheat is still less. The quality of the small grains grown on the Knox silt loam is excellent, and this soil is generally held to be a better grain soil than any of the other soils of Jackson County. Corn, on the other hand, does not do so well on this type as on the darker-colored soils of the Wabash or Bates series, though the crop is successfully grown where ever this soil occurs. Most of the grain and corn grown is fed to stock on the farms, though elevators at Hixton, Fairchild, and Taylor, and numerous grist mills still ship much oats and barley and some wheat. Where the land is well farmed, but little trouble is experienced in growing clover. When the snowfall is light, the alternate freezing and thawing of the ground sometimes kills out clover. Pasturage, in general, is excellent, being scant only in very dry weather, or on shallow slopes or knolls exposed directly to the sun.

Buckwheat, rye, and sorghum are produced on this soil, but their acreage is never large. Alfalfa is successfully grown by very few farmers though the acreage will no doubt be gradually increased, as the crop provides excellent feed, which is of great value, especially to the dairy farmers. Potatoes are grown for home use on practically every farm, but seldom on a commercial scale. Tobacco is grown to some extent, but the crop is generally grown on lighter soil. Beans and peas are not extensively grown on this type. Garden crops, such as strawberries, tomatoes, lettuce, radishes, and cucumbers, and bush berries all do well and are grown for home use, but seldom on a commercial scale.

Fruit growing is not an important industry; though most farms have a few fruit trees, and there are a few fairly large orchards.

Farm buildings are generally in good condition, and silos are rapidly coming into general use especially in the towns of Albion, Springfield, Hixton, North Bend, and Alma.

Large numbers of cattle, hogs, and calves are raised and sold as a part of the business of dairying. Stock buyers located at Fairchild, Black River Falls, Hixton, Taylor, and Humbird operate over adjoining territory.

The rotation of crops most commonly practiced is that of a small grain crop with which clover and timothy are seeded, hay being cut for two years after which the land is plowed for corn.

When wheat is grown, it may take the place of the second grain crop. Hay may be cut for two years or the field may be pastured one year after being cut for hay the first year. On the steep slopes corn is sometimes omitted from the rotation because the land is more apt to erode when in an intertilled crop than when in a grain crop or in grass. The steepest slopes which are used are often kept in grass for the greater part of the time, though some attempt to cultivate crops on land of this character is made. Stable manure is usually applied to the sod to be plowed for corn.

Nearly every farmer produces enough potatoes for home use and many have some to sell each year. The yield is usually about 150 bushels per acre. The soil is not as well adapted to this crop as some of the other types, especially the sandy loams, though the quality of the potatoes grown is fair.

Tobacco was at one time more extensively cultivated than at present. It is generally grown on the same field for four years in succession, but during the first two or three years the yields are best. The fields must be heavily manured, and this is often done at the expense of the remainder of the farm. Tobacco usually follows potatoes or corn, and is often followed by wheat. The yieds secured range from 1,000 to 1,600 pounds per acre. Since the crop requires careful attention and considerable labor, the acreage devoted to it on any farm is comparatively small.

Alfalfa is being tried by a few farmers, and some have secured a good stand without inoculating the soil. In order to secure the best results, however, the soil should be inoculated and liming is also necessary, since the type is slightly acid.

View showing typical crops and topography in Knox Silt Loam country north and west of Hixton, Jackson County. This soil is good grain land.

Binding grain on a rolling portion of the Knox Silt Loam. Land slightly steeper than this is mapped as Steep Phase where measures to prevent erosion or washing of the soil are necessary.

Trucking and small fruit growing are not carried on to any great extent; though the ordinary garden vegetables and berries are grown for home use, and limited quantities are marketed in the near-by towns. There are a few small apple orchards, though the fruit industry has not received special attention on this soil.

KNOX SILT LOAM—STEEP PHASE

Extent and distribution.—The steep phase of the Knox silt loam occurs in all parts of the county intimately associated with the main type, and frequently grades into it in such a way as to make the drawing of a definite boundary line difficult. It occupies steep slopes generally about the heads of small streams heading in the areas above the rough stone land. On these slopes, which form the more or less steep sides of the valleys, the silt soil is subject to erosion and careful methods are often necessary to prevent destructive gulch formations while these slopes are under cultivation. When the steep slopes are not wooded, or in pasture, or covered by a growing crop to protect them, the soil washes badly, and ditches are quickly and deeply cut into the hillsides. When erosion has once started in this way, it is difficult to check; so methods of prevention are very important.

Description.—In general physical appearance and character, the soil of the steep phase is essentially like the typical soil, the basis of separation being one of topography. As a whole, the color and texture of the soil may be slightly lighter than the typical soil, and the average depth to rock is less. Because of its steep, broken character, this phase has a lower agricultural value than the typical soil.

Drainage.—The natural drainage of the steep phase is good except in small areas along the slopes where springs and seeps may occur. The greater part of it is so rolling that too large a percentage of the rainfall runs off, and crops often suffer from lack of moisture.

Origin.—The Knox silt loam, steep phase, has practically the same origin as the typical soil, though as a rule there is less depth to bedrock, and chert fragments occur on the surface and through the soil mass in greater abundance.

Native vegetation.—The original timber growth consisted of the same trees as on the typical soil, oak predominating. Most of the standing timber outside the bottom lands is now found on this phase, and on the rough stony land with which it is associated, though a considerable proportion of the steep land is cleared, and is either in cultivation or pasture land.

Present agricultural development.—The same crops are grown on the steep phase as on the typical soil, but less corn and other intertilled crops are grown and more of the land is in grass and pasture than on the main type. The ordinary yields of all crops are somewhat lower. Because of the steep character of the surface, the phase is more difficult to work than the typical soil. The steepest portions of the phase are now in timber or pasture land, and the remainder is devoted to general farming.

LINTONIA SILT LOAM

Extent and distribution.—This soil occupies part of the highest levels of the terraces bordering the Black and Trempealeau Rivers. The soil quite closely resembles the Knox silt loam in texture and color, but differs from it in topography, origin, and the position which it occupies.

Description.—The surface soil of the Lintonia silt loam to an average depth of ten inches consists of a brownish-gray, friable silt loam, which becomes lighter colored on drying and frequently has a whitish appearance. The quantity of organic matter present in the surface soil is comparatively small, and this accounts in part for the light color of the material. A slight acid condition has developed in places in the surface soil, as indicated by the litmus paper test. The subsoil consists of a yellowish-brown or buffcolored silt loam, which usually becomes somewhat heavier and more compact with depth, and at twenty-four to thirty inches may be a silty clay loam. Below this depth there is often a considerable quantity of fine and very fine sand, and this mixture extends to a depth of three feet or over, and grades into stratified fine sand with layers of gravel in the lower depths.

Topography and drainage.—The surface of the Lintonia silt loam is usually level or nearly so, frequently having a gentle slope toward the stream channels along which it occurs. The

type occurs as terraces or benches usually rather narrow, but extending along the streams for considerable distances. The part adjoining the upland rises slowly and frequently grades into the Knox silt loam so gradually that the boundary line must be arbitrarily placed. As this type is found chiefly at the foot of higher lying slopes, which are often very steep, large quantities of water must pass over the terraces during heavy rains, and as a result deep ravines are frequently formed. The original timber growth consisted chiefly of oak, with some hickory and a few other species. Most of the timber has been removed. In the ravines there is now a second growth of sumac, hazel, and other brush.

Origin.—The material composing the type is largely of alluvial origin and was deposited during glacial periods when the melting ice sheets to the north greatly increased the volume of water flowing down these rivers. It is probable that the surface material, especially close to the foot of the bluffs, is partly colluvial, having been washed down the steep slopes from the Knox sit loam areas, which are always found at higher elevations.

Present agricultural development.—Practically all the type is put to some agricultural use, and most of it is cultivated regularly. The crops generally grown and the yields obtained are: Corn, 45 to 50 bushels; oats, 25 to 40 bushels; barley, 30 to 35 bushels; and hay, 1½ to 2 tons per acre. Potatoes are grown on the type to a small extent for home use, but seldom on a commercial scale. The usual rotation consists of corn followed by a small grain, either oats or barley, or sometimes by one year of each of these crops, and then by clover and timothy mixed, seeded with the grain, the field being cut for hay one or two years, before returning to corn. The stable manure is usually applied to the sod to be plowed under for the corn crops. The methods of cultivation, fertilization, and treatment are practically the same as those practiced on Knox silt loam. The soil is not difficult to cultivate, and where the areas are of sufficient size to form fields or the larger part of a farm, this terrace soil may be considered one of the most desirable types in the county.

BATES SILT LOAM

Extent and distribution.—This type of soil is all found in one locality. It covers four to five square miles of land just north and west of the town of Alma Center. The soil is nearly level to undulating, occupying part of valley flat and extending up adjoining slopes and includes small knolls and elevations. There is sufficient fall so that the drainage is generally good, although where the land is quite level, the drainage is deficient in places.

Description.—The surface soil of the Bates silt loam to a depth of ten to fourteen inches consists of a dark-brown silt loam containing a high percentage of organic matter. Its high percentage of silt and organic matter gives the soil an extremely smooth feel. Litmus paper tests indicate an acid condition over most of the type. The subsoil consists of a brown or buff-colored silt loam, which gradually becomes heavier in texture and lighter in color, and at twenty-four to thirty inches consists of a yellowish-brown, compact, heavy silt loam or silty clay loam. In spots where the drainage is deficient, the subsoil shows a slight mottling of light gray or drab. This heavy subsoil extends to a considerable depth, and the soil section will probably average seven to eight feet in thickness.

Origin.—The silty material composing this type of soil may be of residual origin from a shaly phase of the Potsdam sandstone formation, or more probably, loessial material. It differs from the Knox silt loam principally in its higher organic matter content.

Native vegetation.—The type as a whole is generally spoken of as "Oak openings" having been originally forested with scattered clumps of large oak trees, while the intervening spaces were in a semi-prairie condition, supporting a more or less heavy growth of prairie grass.

The Bates silt loam is one of the desirable types of soil in the county. All the general crops grown in the region do well on this type, and the average yields of some of the crops are higher than on most of the other soils. The soil is especially well adapted to corn, on which the ordinary yield is 50 to 60 bushels per acre. Barley produces 30 to 35 bushels and oats 40 to 50 bushels per acre. The quality of the small grains is

not so good as of those grown on the Knox silt loam. Clover and timothy produce from 1½ to 2 tons per acre, and the pasturage is generally excellent. The rotation of crops most generally followed consists of corn, small grains, and hay. Of the small grains, oats is most commonly grown, though barley may also be grown in the rotation following the oats. Where the acid condition is corrected and the soil inoculated, the alfalfa crop promises to do very well.

Dairying is the chief branch of farming followed, and hog raising is carried on quite extensively on many of the dairy farms. The buildings and other improvements on this soil are as a rule better than the average. Some farms produce beef stock in connection with dairy farming. Silos are in quite general use.

VESPER SILT LOAM

This soil consists of eight to ten inches of grayish brown heavy silt loam on yellowish-brown or bluish, or mottled silty clay loam subsoil. This subsoil is sticky and retentive of moisture. Lenses of fine sand may occur in the clay subsoil and beneath this clay, a layer of sand, or sandy clay loam lies at from twenty-four to thirty-six inches. The sandy material lies nearest the surface on slight knolls while on the flats and depressions, the clay subsoil may extend to four feet or more in depth. In a few places, shale or sandstone rock is found within three or four feet of the surface especially on the slight knolls. On the flats, one to three inches of the surface soil may be black with accumulated organic matter.

This Vesper silt loam covers about five to six square miles of land immediately to the north and west of Merrillan. The soil is not found in any other part of the county.

The topography of this soil is level or very slightly sloping. Very slight elevations or knolls occur in a few places. These have been outlined and indicated by the symbol (R) as rolling phase of the type.

The drainage of the type is generally poor. This is due to the combined effects of a sticky clayey subsoil and the level topography. The drainage is so defective that cultivated crops can seldom be matured on it except in dry season. The slight knolls mentioned are well enough drained so that the soil can generally be cultivated. Much of the land is retained in perma-

nent pasture or hay land. A large part of this soil is still timbered or brush covered. The original timber was largely pine with some hemlock, hardwood, and oak. Practically all the merchantable timber has been removed. The present timber consists of oaks, poplar, ash, and birch fifteen to twenty feet high. Grass, willow, and alder cover the lower portions. The soil is very acid, and a good deal of moss grows on the cleared land.

The crops best adapted to this soil are hay (alsike and timothy), root crops, rye, and oats. Corn for ensilage can generally be grown and in dry years ripe corn can sometimes be produced. Most of the cultivated crops are grown on the knolls. Potatoes are grown to some extent as well as buckwheat. Yields of all crops except hay are very variable, and depend almost entirely upon the character of the season.

This land sells for from ten to forty dollars per acre depending upon location and improvement.

The following table gives the mechanical analyses of samples of the soil and subsoil of Vesper silt loam.*

Mechanical Analysis of Vesper Silt Loam

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
212819	Soil	1.4	4.5	2.5	15.3	16.3	41.9	14.9
312820	Subsoil	.6	4.4	2.9	17.0	24.9	33.9	16.2

* The numbers used to identify these samples are the numbers of the U. S. Bureau of Soils, the analyses having been made by the Bureau.

CHEMICAL COMPOSITION, FERTILITY AND IMPROVEMENT OF HEAVY SOILS

The heavy soils have a fairly good supply of the mineral elements of plant food. The Bates soil as its dark color indicates, is especially well supplied with organic matter, nitrogen and a good amount of phosphorus. The lighter colored Knox and Lintonia soils are considerably lower in nitrogen and also phosphorus. The Vesper soil is fairly well supplied with all the essential plant food elements but on account of its acidity and lack of efficient drainage, measures to make these stores of plant food available for crops are necessary. Average analyses

indicate the following amounts of nitrogen, phosphorus, and potassium in these soils in pounds per acre, eight inches deep:

	Nitrogen	Phosphorus	Potassium
		(In pounds)	
Average of Lintonia and Knox silt loams	1,988	820	33,800
Vesper silt loam	4,566	1,920	------
Bates silt loam	5,340	1,440	35,200

It will be seen that there is a good deal of variation in the amounts of the plant foods found in these different soils.

Nitrogen and organic matter.—The light colored Lintonia and Knox soils have the smallest amounts of these elements. They can best be added to the soil by growing and plowing under green crops as clovers and alfalfa. Organic matter added to these soils helps prevent erosion or washing away of the soil, helps prevent drying out by increasing the water holding capacity of the soil, and enlarges the leaf and stem growth of crops giving larger straw on the grain crops and improved yields of silage and corn.

Acidity and liming.—Since all of these soils are medium to strongly acid and usually show need of lime, difficulty with growing clover and alfalfa may be corrected in part by applying ground limestone. The soil should be tested before this application, and this is done without charge by the University Soils Department at Madison. The need for lime as shown by the crops should also be considered. It should not be expected that lime will remedy conditions where the soil lacks good underdrainage as is often the case on the Vesper silt loam.

Phosphorus.—The Knox and Lintonia soils are lowest in the supply of this element, and although they are and have been the best grain soils in the county, if the farm does not produce enough manure to revive the soil where grain is becoming poor, small applications of phosphate fertilizer to help out the manure will be necessary. Even if the supply of manure is liberal the additional use of phosphate fertilizer will usually pay. Lodged grain or light yield may be laid in part to an unbalanced ration of plant food in the soil and addition of lime and small amounts of phosphorus fertilizer often help to remedy this condition.

Potassium.—*These soils are all so well supplied with this element that no artificial application probably will be needed on general farm crops, when manure is used, unless in some places on the Vesper soil where the drainage may be improved, it may be found necessary to apply some of this fertilizer at first until the supplies in the soil become available through cultivation and exposure of the soil to the air.

Crops—†The Knox and Lintonia soils are best adapted to grains and grass and fairly so to corn, while the Bates soil produces the best corn and barley. The Vesper soil produces hay well (alsike and timothy) and fair oats, rye, and a little corn. Methods to improve the surface and underdrainage must be worked out to improve yields on this soil.

In cultivating the Knox silt loam, it should be kept in mind that the soil is low in organic matter, and that much of it is subject to erosion. The supply of organic matter may be increased by supplementing the stable manure with green crops, especially legumes, plowed under. The second crop of clover may well be utilized in this way. Erosion may be held in check by putting the steepest slopes in grass. When necessary or desirable to cultivate the steeper slopes, the plow should be run at right angles to the slope. The drainage channel down the hillside is sometimes left as a shallow sod ditch, while the remainder of the field is cultivated.

The steep parts of the type should be kept in grass as much as possible, and dairying and stock raising are good lines of farming to follow.

There are many good orchard sites on the Knox silt loam. Bushberries, strawberries, etc., do well, and it would seem that such fruits might be profitably grown on a commercial scale since much of the type is within easy reach of shipping points. shipping points. The growing of apples has been developed in these and it is believed that apples could be successfully grown on a larger scale in Jackson county than at present.

*For more information on commercial fertilizers and their uses see page 73.

†For more data on crop rotation, etc., see page 64.

CHAPTER III

GROUP OF MEDIUM HEAVY SOILS

BOONE LOAM

Extent and distribution.—This soil is a gradation between the loessial Knox silt loam and the more largely residual Boone fine sandy loam. This soil is generally distributed over the western half of the county, and occupies gently undulating secondary slopes or nearly level areas lying between the higher land of heavier soil and the streams border areas of fine sand or fine sandy loam. The soil usually lies on a valley slope. This type covers a total area of 22,400 acres.

Description.—The Boone loam consists of a grayish-brown loam or very fine sandy loam eight to ten inches deep on a yellowish-brown loam or sticky clayey sandy loam subsoil. The subsoil is variable, being generally a compact sandy loam on the knolls and a heavy loam or sandy clay loam on the slopes and the level areas. In some cases sand or sandstone is found at less than three feet on knolls, but in most cases the heavy subsoil extends beyond the reach of a forty inch auger.

Topography and drainage.—The drainage of the soil is nearly always good due to the generally sloping or undulating topography. The only exceptions are in the drainage ways, or bordering lower ground where small areas of the soil may be insufficiently drained at times.

Present agricultural development.—The Boone loam is a valuable soil, and is highly developed farm land. Practically all of it is under cultivation. Dairying and general farming are practiced on this soil. The crops grown include oats, barley, clover, corn, and some potatoes, wheat and root crops.

Yields of crops are about as follows: Corn, 50 to 70 bushels; oats, 30 to 40 bushels; wheat, 25 to 30 bushels; barley, 20 to 30 bushels per acre. Clover does well but often freezes out in winter. Improved land sells for from sixty to ninety dollars an acre depending on its location, improvement, etc.

BOONE FINE SANDY LOAM

Extent and distribution.—The Boone fine sandy loam is an important and fairly extensive type of soil in this county, covering a total of 54,400 acres. Considerable areas of this soil are found in the towns of Cleveland, Hixton, Alma, Springfield in the western part of the county, and also in the vicinity of Shamrock in the southern part.

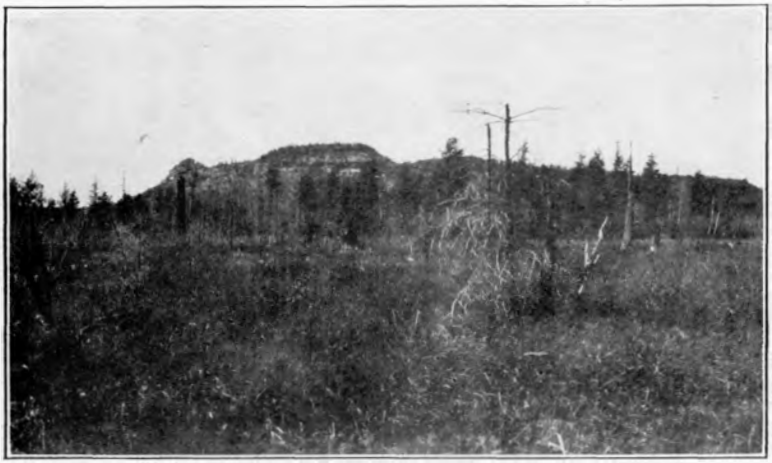
Description.—The surface soil of the Boone fine sandy loam to an average depth of eight to ten inches consists of a grayish-brown fine sandy loam, which in some places contains a considerable quantity of medium sand. The quantity of organic matter present is not large, and a slightly acid condition is found to exist over most of the type. The subsoil consists of a brown to yellowish-brown fine to medium sandy loam, which usually extends to a depth of over three feet.

Both soil and subsoil of this type are subject to considerable variation, though none of the variations are found of sufficient extent or importance to be mapped as a phase, except the more rolling tracts which are usually shallow.

Outcrops of sandstone are not uncommon, although they are not extensive and seldom interfere to any marked extent with cultivation. The depth to the underlying rock is variable, and while it averages over three feet, there are places on the tops of ridges and on knolls where there may be as little as two or three inches of soil. There are also places over gently rolling tracts where the soil has a depth of only two or three feet, but such areas are not extensive.

Topography and drainage.—This soil generally occupies the intermediate slopes lying between the high ridge lands and the sandy flats bordering some of the streams. The topography is generally gently undulating to rolling, some larger areas being nearly level, and some portions near the ridges and rough stony land having a fairly rolling surface.

Generally this soil withstands erosion well, both because the soil can absorb much water quickly and because the surface is generally not very rolling. In a few cases, erosion has gotten beyond control and bad ditches and ravines have been formed. Samples of these big ditches may be found along the Pine Hill Road two miles west of Shamrock.



View of Wildcat Mound. Sandstone ridges are included with the Rough Stony Land type. Black Dunning marsh border soil in foreground and Tamarack peat swamp in the rear, bordering mound.

Topography and vegetation typical of the Boone fine sandy loam. Sandstone ridge of Rough Stony Land in rear.

On account of the sandy character of the soil and the surface features, the natural drainage of this type is excellent. Where the soil is shallow and where the slopes are steep, the type frequently suffers from lack of sufficient moisture, though as a whole it retains moisture fairly well.

Origin.—The original Boone fine sandy loam is largely residual having been derived from the weathering of the Potsdam sandstone, and from a shaly phase of this formation. On some of the slopes, it is probable that some of the sandy material has been moved short distances down the slope by washing. Where there is silty material incorporated with the soil, it is probable that a part of this has been washed down from higher lying silt loam types. Thus it will be seen that the type may also be partly of colluvial origin, although this phase is of minor importance. In a few places, sand dumes have been formed, but these are also of small extent. The original timber growth consisted partly of black and scrub oak covering the shallow knolls and the lighter portions of type.

Native vegetation.—On the heavier portions there was some birch and maple. Sumac, hazel brush, poplar, and wild cherry form the second growth in uncultivated places.

Present agricultural development.—By far the greater proportion of the type is put to some form of agricultural use, and most of it is cultivated. The wooded portion is confined chiefly to the steeper slopes and shallow knolls, which are covered mainly with small oak. As is the case with the county as a whole, most of the type is devoted to general farming, with dairying as the most important branch. In connection with dairying quite a number of hogs are raised.

The chief crops grown and the ordinary yields are as follows: Corn, 40 to 50 bushels; oats, 30 to 40 bushels; barley, 35 to 40 bushels; and hay from one to two tons per acre. Some rye is also grown, and it gives fair yields. On some of the level portions of the type some farmers report an increasing difficulty in getting a good stand of clover. Others on the gently rolling phase report no trouble whatever, no clover having been lost in the last seven or eight years. Very fine stands of clover appear on some of the lighter portions of the type, even though the soil showed indications of acidity in response to the litmus paper test.

When the county was first settled, wheat was grown extensively on this soil, but very little is now produced. It is considered a fair corn soil, and the yields are practically the same as on the Knox silt loam. Potatoes can be grown successfully, though the acreage is not large.

The rotation of crops most commonly practiced consists of corn, followed by oats or barley, with which clover and timothy are seeded. Hay is cut for one or two years, and the field may be pastured for a year before being again plowed for corn. Cultivation of this soil is not difficult, and a lighter class of implements and stock can be used than on the silt loam type.

The selling price of land of this type is quite variable, depending upon location, character of the surface, texture of the soil, and improvements. In the most favorable locations, the gently sloping and nearly level portions of the type sell for sixty to one hundred dollars an acre. The rougher places which are more distantly removed from towns are held at twenty-five to fifty dollars an acre.

VESPER FINE SANDY LOAM

(*Including Vesper Loam*)

The Vesper fine sandy loam is an extensive type of soil. It lies in the east end of the county in a compact body three to five miles wide extending from the vicinity of Merrillan east to City Point.

The surface soil consists of six to ten inches of grayish-brown fine sandy loam. On some places, the surface one-half inch is dark brown or black due to more organic matter in it. The subsoil is a yellowish or mottled fine sandy loam or fine sand. At from twelve to thirty inches deep the subsoil becomes a stiff compact, mottled, or bluish sandy clay loam or clay. This tight clay layer varies from two to twelve inches in thickness beneath which again is found sand, sandstone or shale rock. The rock generally lies at about twenty-four inches beneath the slight knolls while on the flats and lower ground, the surface soil is generally somewhat sandier than usual, the clay layer thicker and the rock lies at greater depths.

The topography varies from flat to gently undulating. In a few places, bordering streams, the land is more rolling, but this condition is not at all extensive. The drainage of this soil is

deficient. Because of the heavy clay layer and the shale rock beneath it, the rain water cannot penetrate deeply into the soil. The result is a soggy, cold condition of the land till late in the season each spring. This is liable to be true even on gentle slopes. The drainage is better in a few instances on small knolls and bordering the stream courses, and these places are where crops are most successfully grown. The drainage of Sections 4, 5, 9, 19, 12, 14 (Township 22, Range 1 West) is better than the average as they border the East Fork of Black River.

The Vesper fine sandy loam is largely brush covered. The original white and Norway pine timber has all been removed and outside of a few oaks and Jack pine, there is very little large timber. Poplar, birch, Jack pine and oak brush cover most of the land. Willow, alder, moss, and sweet fern grow on the lower portions.

In origin this soil is largely residual from the underlying sandstone and shale.

Only a small proportion of the type is improved, and the land has a comparatively low selling value. By many it is considered as having limited possibilities, but demonstrations which have been made with the use of lime and with phosphate fertilizers seem to show that with drainage this soil can be made to produce profitable crops. Yields of corn of 60 bushels per acre are known to have been obtained.

For a discussion of the methods best suited for the improvement of this soil see page 36.

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

MECHANICAL ANALYSIS OF VESPER FINE SANDY LOAM

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
312809	Soil	0.2	2.2	4.4	65.8	11.8	11.2	4.3
312810	Subsurface	.4	1.4	4.3	69.7	11.7	8.8	3.8
312810a	Subsoil	.6	1.0	.8	16.1	21.7	29.0	30.9

CHEMICAL COMPOSITION AND FERTILITY OF THE MEDIUM HEAVY SOILS

These soils vary in the content of plant food as shown by the chemical analyses. In general the loams are better supplied with prosphorus and nitrogen than are the fine sandy loams. The latter possess about 1,500 to 1,700 pounds of nitrogen per acre eight inches deep while the loams have from 500 to 700 pounds more. The fine sandy loams show about 800 pounds of phosphorus while the loams have about 1,000 pounds an acre, eight inches.

Potassium is present in considerable amounts in all the soils, varying from 20,000 to 40,000 pounds an acre, eight inches. The acidity ranges from slight to strong.

The need for lime is most marked in the Vesper fine sandy loam and to a somewhat less degree in the Boone fine sandy loam. This group of soils is adapted to a variety of crops and with the exception of the Vesper fine sandy loam, which is naturally deficient in drainage they produce good crops of corn, potatoes, oats, alsike clover and timothy and some tobacco.

It is more difficult to keep up the content of organic matter in these soils than in the heavier silt loams. Lime will be needed on all of the types when alfalfa is to be grown and may be required to insure a good stand of clover. (See p. for discussion on liming.)

The use of acid phosphate will in most cases prove to be profitable. This applied broadcast to grain crop seeded to clover will not only increase the grain crop but will aid in insuring a good growth of clover or alfalfa which in turn will increase the organic matter and nitrogen content of the soil (For discussion of commercial fertilizer see page).

On the Vesper fine sandy loam tile drainage is needed since this soil is too wet much of the time for most crops to do well. Tiling is made more difficult by the presence of the blue shale clay and shale rock layers at varying depth in the subsoil. Knolls and rolling areas in this soil produce good crops.

In the improvement of the type drainage is the first step. The soil is low in organic matter and phosphorus and is in need of lime, but the supply of potassium is large and this high potassium content appears to be general. With proper drainage and fertilization together with the use of lime, this soil offers good opportunities for agricultural development.

CHAPTER IV

GROUP OF SANDY SOILS

BOONE FINE SAND

Extent and distribution.—The Boone fine sand is widely distributed over nearly all parts of Jackson county. It occurs wherever the loessial or wind-blown silty blanket of soil failed to cover the sandstone, or where the silt surface has since been removed by erosion. In the east half of the county this soil covers the greater part of the upland. In the western part this soil is confined largely to the valleys and slopes surrounding the sandstone ridges and outcrops. Pine, Low and Tank Creek valleys in the towns of Hixton and Albion have much of this soil.

Description.—The soil of the Boone fine sand, to an average depth of six inches, consists of a brown or yellowish fine sand, in the surface inch or two of which there is a very small amount of organic matter. The soil is loose and open, and is occasionally blown into small dunes by the wind. Sandstone fragments and some chert may occur upon the surface and be mixed with the soil. The subsoil consists of a fine yellow sand, which contains fragments of sandstone and chert, and usually grades into disintegrated sandstone or into the solid rock at two to ten feet. The texture may become coarser as the rock is approached. The underlying rock frequently outcrops. The depth to rock is variable and ranges from one foot to five or six feet. Where the depth is greatest, rock fragments are seldom found; where the soil is shallow, they may be very plentiful. As a rule, the soil is thinner in the hill country than in a flat region. The subsoil may have a reddish-brown color, but the type as a whole is quite uniform, and what variations occur are of minor importance.

Topography and drainage.—The topography of this soil varies from very gently sloping to rolling. On the larger areas of

the soil, the surface is undulating for the most part, the rolling topography occurring only in the vicinity of the sandstone mounds and ridges. Some of this soil is nearly level and in the east end of the county the areas of level topography are outlined as a level phase of the Boone fine sand. The level areas outlined occur mainly in the towns of Bear Bluff, Knapp and City Point.

The surface soil has in places been blown into low dunes. On account of the loose, open character of the soil and subsoil the natural drainage is excessive, and crops usually suffer from drought during a portion of every season. On account of the surface features and the loose, open character of both soil and subsoil, the natural drainage is excessive and the type is droughty. None of the slopes are sufficiently steep to make the prevention of erosion an important factor in the management of this soil.

Origin.—In origin the Boone fine sand is largely residual, having been derived from the weathering of Potsdam sandstone. There is but little organic matter present, and such a small quantity of silt and clay that the loose surface material is readily blown by the wind, and in a number of places low sand dunes have been formed. The material composing the type is in an acid condition, as indicated by the litmus paper test.

Native vegetation.—The original timber growth on this type consisted chiefly of Norway and Jack pine and scattered scrubby oak. Coarse grasses and sand burs are also found growing on the type, although there are a number of places where the surface is bare of vegetation, and the soil is now drifting.

Present agricultural development.—The Boone fine sand is one of the most extensive types of soil in Jackson County. While a large part of it occurring in the western part of the county with soils of greater agricultural value is used for some agricultural purpose, a very large part of the soil in the east half of the county is not cultivated. Large areas remain covered with brush. Bushes or small trees and portions once cultivated have been abandoned in many cases. Perhaps fifteen to twenty-five percent of this soil is cultivated or used for some agricultural purpose. The presence of better types of soil in the vicinity always encourages the cultivation of this soil, but where this

soil occurs exclusively in large areas, agriculture does not thrive notably on it.

Good yields of crops adapted to the soil are often produced in favorable seasons where the land is properly cultivated. Such crops as corn, rye, buckwheat, beans, cucumbers, tobacco and clover are grown on this soil in different parts of the county. Special crops succeed best on this soil because of its easy cultivation, but the land can be very quickly run down and crop yields greatly reduced where methods for keeping up the soil fertility are not used.

Dairy farming is at a disadvantage unless the stock can range over a large area of land, or in case the farm includes bottom land or heavy soil for pasturage, for this soil furnishes scant pasturage during the dry parts of the summer months.

Tobacco and beans are grown on this soil mainly in the valleys west of Black River in the towns of Springfield, Northfield, Albion, and Curran. Cucumbers are grown in the towns of Brockway, Alma, and Komensky.

The chief crops grown and the average yields obtained during the most favorable seasons are as follows: Corn, 15 to 20 bushels; oats, 15 to 20 bushels; rye, 12to 15 bushels; buckwheat, 10 to 12 bushels; and potatoes, 50 to 100 bushels per acre.

The yields of crops vary greatly on this soil, depending partly on the location of the land, the kind of season, and in part on how the land is handled. The best yields are generally obtained where this land lies in such a position that it does not dry out too readily in the summer months, such as on a north slope or at the base of a slope where run-off and seepage of the rainfall tend to keep the soil moist and still not too wet. Best yields are also obtained where small patches of this soil are surrounded on the farm by heavier soil. On such places, the farmer seems to have more manure to spare for the light soil, and he often has better success with clover. A slightly more compact subsoil than normal is sometimes found in such locations as described above.

Very good yields of mammoth clover are sometimes obtained on this soil, and in a number of places clover for seed is regularly grown. Some farmers find that spring sown clover with oats does better than with fall sown rye on this soil. In other locations where this soil is extensive, clover is practically never

grown and a good catch is very difficult to obtain. From $150 to $250 worth of tobacco an acre, from $100 to $150 worth of cucumbers, from eight to ten bushels of white beans, and from 90 to 125 bushels of potatoes are some of the yields of special crops reported in favorable seasons. The special crops are subject to frosts and total failures sometimes result from this cause as well as from dry weather. From one to three or four acres per farm is generally the limit of acreage where these special crops are grown, although on a few farms much larger acreages are grown.

The most successful farmers on this soil raise a small acreage of special crops and for general crops, they grow mainly rye, corn or buckwheat and generally are able to grown enough oats for their own use. In some cases a three year rotation of rye or oats with clover first year, hay and pasture second year, corn third year is practiced. Where clover is seldom if ever grown and farm manure is scarce a portion of the land is allowed to lie fallow about one year in three. Very little commercial fertilizer is used except by some of the cucumber growers. Tobacco fields are usually heavily manured and farm manure is the main fertilizer used.

BOONE FINE SAND

(*Poorly Drained Phase*)

In Sections 23, 26, 34, 35 in Town 22 North, range 3 W, three or four miles south of Hatfield, there is an area of several square miles of low lying upland soil which has rather poor drainage, and which is separated from the typical Boone fine sand as a poorly drained phase. This soil is somewhat variable, but in the main, consists of a rather dark, medium to fine sand with a subsoil which is yellow or sometimes mottled. There is no shallow or heavy layer of clay in the subsoil, although sandstone rock is sometimes found at three or four feet below the surface. In a few instances a small amount of sticky material was found in the lower depths.

A part of this land is cultivated and gives fair yields, especially during the drier years.

There is another small area of this type lying in Sections 13 and 24 about one and one-half miles east of Black River Falls. A considerable portion of this area is also under cultivation,

and in improved farm land. Over both of these tracts, the surface is level to very slightly undulating. On the slight elevations, the surface is lighter colored and better drained than the lower areas. During wet years there is sometimes an excess of moisture, but during dry season, this soil is much better supplied with moisture than the typical Boone fine sand. Because of this condition and the presence of clay in deep subsoil, this phase is considered to be a better soil than the typical Boone fine sand, and one which is capable of being more highly improved.

PLAINFIELD SAND

Extent and distribution.—The Plainfield sand is located on flat-topped benches or terraces which rise abruptly from the Black River, and extend back to the high bluff land on either side. In places there are several levels or steps of from fifteen to forty feet elevation each up from the river bottom to the land of the highest terrace on which the residence portion of the city of Black River Falls stands. This terrace level extends several miles eastward along Morrison and Levis Creeks and narrows again to a narrow bench above Hatfield in Clark county. In the southern end of the county, only narrow strips of this soil are found in or bordering the river bottom. Narrow strips of this soil are found in Trempealeau and Beef River valleys also.

Description.—The typical soil of the Plainfield sand consists of a yellowish-brown sand of medium texture extending to an average depth of eight to ten inches. The structure of the soil is loose and open, and there is present a considerable amount of iron, which gives the rusty color and a slight loaminess in places. It also carries a small amount of organic matter, but the color indicates a higher content than actually exists. A little gravel is seen upon the surface in some places, and a small amount of fine gravel is mixed with the soil. The subsoil consists of a yellow medium sand, which usually becomes coarser in texture with increased depth. The subsoil always contains more gravel than the surface soil. Where the subsoil contains considerable iron, as is the case in spots where the drainage has been impeded for any reason, the material has a brownish or sometimes a reddish color, but this usually fades as the depth increases.

Topography and drainage.—The topography of this soil is level, the only variations being where streams have cut across the terraces to the river bottom or at the abrupt rises from one terrace level to another. Where specially marked, the terrace intervals are indicated by cross-lining over the color representing this soil.

Because of its generally loose and open character and the porous condition of the subsoil, this soil is generally well drained, and water passes through it so readily that crops are liable to suffer for lack of water in any spell of dry weather.

Present agricultural development.—This soil is an extensive type in the central part of the county. Large parts of it remain uncultivated. The cultivated portion is occupied largely by Polish people or Indians who cultivate small tracts. The vegetation of the uncultivated portions consists of small scrubby oak, Jack and Norway pine, poplar, birch, oak, cherry. Sweet fern and blueberry brush cover the ground.

From twenty to thirty per cent of the type has been cleared and cultivated at one time, but a considerable number of farms have been abandoned, and no crops are being grown upon them at the present time. The chief crops grown at the present time and the yields secured during the most favorable years are as follows: Corn, 15 to 25 bushels; oats, 20 to 25 bushels; buckwheat, 12 to 16 bushels; and potatoes, 100 to 150 bushels per acre. Potatoes form the chief cash crop, and do better than any of the other crops grown.

In a few cases white beans are grown on this soil, and the yield is as high as ten bushels per acre in favorable seasons. Cucumbers are grown to some extent in the vicinity of Hatfield. The yields of all crops vary greatly with character of the season, and the treatment given the soil. Under most favorable conditions, very fair yields of clover and of mixed alsike clover and rye hay are obtained; frequently fair corn is grown. But the failures of crops are frequent on this soil, and because of the poor pasture afforded, this soil is not well adapted to dairy or general farming.

Some of the Polish farmers maintain a considerable number of young stock by grazing them over large areas of this brushy undeveloped soil, and on the flat shallow marshes which lie at the borders of this type of soil. It is very difficult, however,

View showing the topography and vegetation conditions in the sand and marsh country in the east end of Jackson county. Marsh grass in the foreground, willows and tamarack clump in background.

VIEW OF CORN ON PLAINFIELD SAND.

This shows about an average crop where no fertilizers have been used. The stand was fair but the corn was short, and the yield low.

to raise enough feed on this soil to keep any considerable number of cattle through the long winters.

Land is very cheap on most of this soil type. From six to fifteen dollars an acre represents the selling price of much of it. In the Trempealeau and Beef River valleys the soil is somewhat higher priced due to the presence of better soils in the vicinity.

PLAINFIELD FINE SAND

Extent and distribution.—This soil is practically all confined to the areas bordering Robinson Creek in the townships of Manchester and Millston. Like the Plainfield sand, this soil occupies the highest terrace level along the Black River valley and extends back in a practically level plane eastward to Millston. The texture of the soil seems to be slightly coarser at the east end than at the west end of the area, but no definite boundary can well be established as the change is not uniform nor distinct.

Description.—The surface soil of the Plainfield fine sand consists of a brownish-gray or yellowish loose fine sand extending to a depth of about eight inches. The surface two inches contains more organic matter, making it a brown or dark brown in its virgin state. This is underlain by a yellow loose, fine sand which extends to a depth below the reach of the soil auger. In texture, structure, and color this type is quite similar to the Boone fine sand, but differs from that type in origin and topography. Like the Boone fine sand, it contains only a very small quantity of organic matter, and is in an acid condition.

Native vegetation.—Only a small part of this soil is under cultivation, the farms on it being confined to a small group near Shamrock, near Millston, and at the Sandy Plains School in the center of the area. The great majority of the soil is covered with a second growth of Jack and Norway Pines, oak, poplar, white birch, and hazel brush. A few large white pines in the vicinity of Millston are the only remnants of an original Norway and White Pine forest covering the area.

Present agricultural development.—There are only a few farms under regular cultivation on this soil, and the farming is not of a very progressive kind. The farms are small and considerable parts of the cleared area lie fallow or abandoned where once cultivated. The crops grown consist of rye, corn,

buckwheat, and potatoes. Where grass marshes and stream bottom land adjoin this soil, it is possible to keep young stock and a few dairy cows. The soil is subject to drought, and does not support a good quality of pasture when dry spells occur in the summer season.

In favorable seasons on new ground corn yields 20 to 25 bushels, rye 15 bushels, oats 20 bushels. Beans and cucumbers are grown by some of the farmers. The raising of special cash crops is limited because of the hauling distance to the railroad and the sandy roads. Potatoes yield 100 to 125 bushels. Wild land sells for from five to ten dollars an acre; improved land for from twenty to twenty-five dollars.

PLAINFIELD SANDY LOAM

The Plainfield sandy loam is a brown sandy loam sixteen to eighteen inches deep, resting on a subsoil which becomes lighter in color, and if anything a little lighter in texture with depth, and passes usually at about thirty inches into a yellowish sand. The lower part of the soil section thus resembles that of the Plainfield sand.

In Squaw Creek Valley this soil is reddish or chocolate-colored in places, indicating the presence of a great deal of iron due to a formerly poorly drained condition. This soil is not an extensive one. It is associated with the Plainfield sand soil, and includes several small areas bordering the river bottom or tributary streams south of Black River Falls.

This type has the same origin as the Plainfield types, and also supports about the same scrubby growth.

From an agricultural standpoint, it is somewhat better than the sand type, but yields are lower, and special care is needed in cultivating and fertilizing this type.

VESPER SANDY LOAM

This soil is mapped chiefly south and east of Merrillan, and covers a total of about three square miles of area.

The surface soil is variable, running from a fine sand and sandy loam to a sticky, clayey sandy loam. The subsoil at six to twenty-four inches is a mottled or bluish clay loam, containing sandstones or shale fragments of small size. In some cases,

white sand or sandstone rock lies at thirty to thirty-six inches, but generally the soil is over three feet deep.

The topography is nearly level and the drainage is often deficient both because of the level topography and the impervious subsoil. Where the surface soil is more sandy, and the subsoil clay layer lies at twenty-four to thirty inches or below this soil is not too wet to raise fair crops. Several small clearings are cutivated and corn, beans, potatoes, and rye are grown.

Most of the soil is uncleared, and the vegetation consists of oak, poplar, jack pine, and willow brush. Moss and leather leaf cover the surface of the ground.

CHEMICAL COMPOSITION AND FERTILITY OF SANDY SOILS

The sandy soils are generally lower in content of phosphorus and nitrogen than the heavier soils. The fine sands and sandy loams are somewhat better supplied than the sands. Per acre, eight inches of soil, the sands have from 900 to 1,000 pounds of nitrogen, and about four hundred pounds of phosphorus, while the fine sands and sandy loams have from 1,400 to 1,600 pounds of nitrogen, and five hundred to eight hundred pounds of phosphorus. The potassium amounts to from twenty to twenty-five thousand pounds per acre.

In some respects sandy soils have advantages over heavier soils. They become drier and therefore warmer and can be worked earlier in the spring and more quickly after rains than heavier soils. These advantages are particularly important in regions of short growing periods. But when the soil is too sandy it does not hold sufficient water from one rainfall to another to satisfy the needs of the growing crops and it therefore suffers from drought. Moreover, some sandy soils are lower in their supply of the chemical elements demanded by crops than heavier soils. When these two factors become too low they limit the profitable farming of these soils. In the mapping of the Soil Survey those soils which are classed as sandy loams have fairly good water holding capacity, and when their fertility is properly maintained their good qualities in regard to warmth and earliness can be taken advantage of and they can be farmed with profit. But soils which are classified as sands and some of the fine sands do not have sufficient water

holding capacity and their use for the growth of staple crops is ordinarily unprofitable, unless unusual skill is used in their management. It must be kept distinctly in mind, however, that all types as mapped show some variation in texture or fineness of grain. The chief factor limiting their agricultural use is that of water holding capacity. This depends chiefly on the texture or fineness of grain and can not be affected by any treatment it is practicable to give them. The water holding capacity can be somewhat increased by increasing the amount of organic matter, but this is a comparatively slow process and the amount of organic matter it is practicable to develop and maintain in these soils will increase their water holding capacity only to a limited extent.

When a sufficient supply of active organic matter is developed in these soils more of the phosphorus and potassium will undoubtedly be made available, but the use of fertilizers containing these elements in a more readily available form is desirable whenever these soils are farmed.

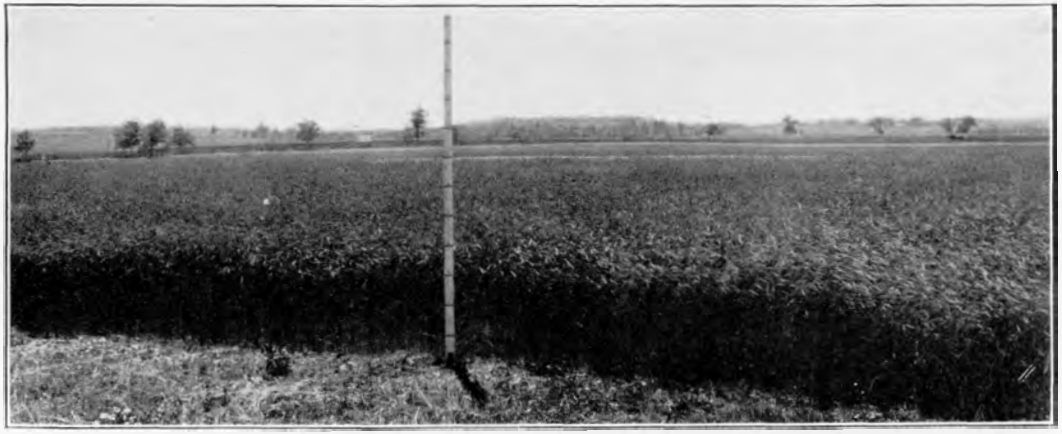
The starting point in the improvement of these soils is the development of active organic matter through the growth of legumes which are able to secure their nitrogen supply from the atmosphere. But before legumes can be grown with the greatest success the liming of the soil is necessary. The growth of a good crop of mammoth clover or soybeans through the use of lime and mineral fertilizers containing phosphorus and potassium is the best means of supplying this nitrogen and organic matter. In most cases this legume should be plowed under as a green manuring crop.

Probably the best way to get clover started is to seed with a small grain. By using a light seeding of rye, disked or harrowed in and seeded to clover in the spring, a good stand can usually be secured. The seed should be put in a little deeper than on heavy soils, and the drill should be followed by a corrugated roller, or if this implement is not at hand, an ordinary roller, followed by a light harrow should be used. When clover is seeded with a small grain in this way the growing grain helps to hold the soil in place and prevent blowing of the loose soil by the wind.

As the result of careful experiments on extremely sandy soils it appears that the best crop rotation for this class of land

CLOVER GROWING SUCCESSFULLY ON PLAINFIELD SAND.

The rotation followed on this field is corn, rye and clover. Plot on right received 8 tons manure and 400 pounds rock phosphate applied to the corn crop. There was no other fertilization during the rotation. Plot on left had no treatment.



FIELD OF RYE ON PLAINFIELD SAND AT HANCOCK, WISCONSIN.

Yield 15.2 bushels per acre in 1922. Rotation corn, rye and clover. A light application of manure and acid phosphate was given the corn crop.

consists of rye, clover, and corn. If the fertility is extremely low, it will be advisable to plow under the entire clover crop. If the fertility is fair the first crop may be cut for hay and the second plowed under. While potatoes are quite extensively grown on these extremely sandy soils this crop is not as well adapted to the sand soils as to sandy loam types. It has been shown by actual field tests that the yields of corn, for example, can be more readily increased on the sand soil than can the yield of potatoes. The potato when grown on sand soils does not respond to methods of soil improvement as readily as when grown on soils which contain somewhat more silt and clay. The sandy loams and fine sands and fine sandy loams are much better adapted to potato culture than are the sand soils. It is therefore advisable to reduce, where possible, the acreage of potatoes on sand soils.

With an increased acreage of corn it will be possible to put up enough silage so silage may be used for summer feeding. With this practice less pasture will be required, and this again will be desirable since the sand soils do not supply good grazing, and are not well adapted to any of the grasses. This system would make possible keeping more stock, and with the increased supply of manure the fertility of the land could be more readily maintained.

When properly managed alfalfa can be successfully grown on very sandy soils. For further information on the management of soils, see Bul. 299, Wis. Exp. Sta.

CHAPTER V

GROUP OF SOILS LACKING GOOD DRAINAGE

DUNNING SAND

Extent and distribution.—The Dunning sand is confined to the sandy portion of the county east of Black River, and in mapping, it was frequently made to include some of the land lying between the marshes and the Boone fine sand. The soil is not all black and not all distinctly flat marsh border land. Small areas of higher land where the drainage is poor, and where grass swales and depressions are too numerous to separate, were included in this type.

Description.—The surface soil of the Dunning sand consists of brown to nearly black, medium, or fine sand six to twelve inches deep, containing a high percentage of organic matter, which imparts to the soil its dark color. The subsoil consists of a grayish or whitish fine to medium sand, which has a leached or washed appearance, and extends to a depth beyond three feet. In places, the subsoil is stained by iron oxide and bluish mottling is not uncommon. The depth of the surface soil varies, but in other particulars the type is uniform.

Topography and drainage.—The surface of the soil is always low and generally level. It is very little higher than the level of the marshes and slightly lower than the bordering sands of light color. On account of its low position and the nearness of the water table to the surface, the natural drainage is poor, and as a result the type is too wet for ordinary farm crops, except during the dry portion of the summer.

This type of soil is an extensive one in connection with the sand and marsh country of the east half of the county. Agriculturally it is not important as the soil is generally too wet to raise crops, and very little of it is under cultivation.

Origin.—The Potsdam sandstone is the parent rock from which the Dunning sand was derived. It has been reworked, trans-

ported, and deposited by the action of the water, but to what extent, it is impossible to say. Under moist conditions, it has acquired a black color through the growth and decay of vegetation. The whitish color of the subsoil may be due to the leaching of organic acids. All of the soil is in a very acid condition at the present time.

Native vegetation.—The native vegetation consists of Jack pine, poplar, sweet fern, common ferns, mosses, blue stem, and several species of marsh grass. There is no timber of any value on the type at the present time.

Present agricultural development.—As the type is low, poorly drained, and acid, it is not cultivated except in a few places. It is devoted chiefly to the production of wild marsh hay and to pasture. Where cultivated corn and buckwheat are the crops most grown. One farmer reported a yield of forty bushels of corn, and 150 bushels of potatoes per acre. Before this type can be farmed extensively, it must be drained, properly fertilized and limed.

This soil has low natural fertility, but when properly drained, limed and treated with stable manure or phosphate and potash fertilizers it can be made to produce good yields of potatoes, corn, oats, rye and clover.

For a discussion of the use of lime and commercial fertilizers see pages 71 and 73.

GENESEE FINE SANDY LOAM

The Genesee fine sandy loam occupies a large part of the bottom lands along the Black River. The soil occupies the same level as the Genesee silt loam, but usually lies on slight elevations from one to four or five feet above the silt loam. The soil is quite variable due to its manner of deposit and occasional overflow. The surface soil varies from a very fine sand to a heavy fine sandy loam or loam. The subsoil is generally more sandy than the surface. The color varies also from light brown to a chocolate or reddish-brown.

This soil also is in large part timbered or brush covered bottom land, but natural open areas or cleared portions are under cultivation. Generally occupying slightly higher elevations than the Genesee silt loam, it is not affected by the smaller floods so that during many seasons, portions of this soil can be culti-

vated. Good crops of corn, oats, and potatoes can be grown. This land cannot well be permanently improved and protected from floods, however, so that its agricultural value is comparatively low.

GENESEE FINE SAND

This type includes several small areas of low-lying fine sand soil on the first bottom land bordering the Black River south of Melrose. The type is not extensive and because of its being subject to frequent overflow, its agricultural value is low. Its use is confined to pasture and wood lot purposes.

GENESEE SILT LOAM

The Genesee silt loam occurs as first bottom land along the larger streams, and is subject to occasional overflow from the streams. The soil is generally a grayish or drab silt loam with a compact mottled or iron stained silty clay loam subsoil. Sometimes the surface two or three inches of soil has a dark brown or black color due to greater amounts of organic matter in it.

The greatest amount of this soil occurs in the overflow lands bordering the Black River from the city of Black River Falls southward. Some was mapped along the Trempealeau River and tributaries. The soil is a grayish-brown heavy silt loam with a mottled iron-stained heavy silty clay subsoil. Variations from this description occur where slight knolls of very fine sandy loam occur, or sandy streaks along abandoned slough banks and water courses.

In Sections 4 and 9 (Township 20, Range 4 West), this soil lies on different levels and portions of it less subject to overflow are cultivated. Grass and willow swales occur in the higher levels where the soil is springy and wet.

The greater part of the Genesee silt loam bottoms are timbered or brush-covered. The trees consist of large elms, ash, soft maple, birch, and willow. In a few places, open areas occur where the vegetation is mainly grass or small brush.

The land is used largely for pasture land and wood lots. Some of the higher levels of small extent could be improved by tiling, but most of the soil is too low and subject to too much overflow to be profitably drained.

WABASH LOAM

This soil is also of alluvial origin, and being situated in the valley bottoms bordering the streams, and subject to more or less overflow, the texture of the soil is not very uniform.

The surface soil of these bottoms is generally a dark brown, drab or black loam or silt loam with a generally heavy mottled clay loam subsoil which, however, may have sandy layers in it. The surface soil also may be strewn with sand, gravel, stones, etc., and sandy layers may be encountered at any depth within the soil section.

The Wabash loam is found in a number of valley bottoms scattered through the west half of the county. The soil type is not extensive, as it comprises narrow strips of bottom land only. Very little of the land is under cultivation, most of it being generally too low and wet. It is, however, almost entirely used for pasture as the soil occurs on the bottoms of the narrow valleys whose slopes are also often used for pasture.

WABASH SILT LOAM

The Wabash silt loam consists of alluvial deposits, chiefly along the upland streams. The areas are quite narrow, varying from strips too small to map up to areas one-half mile or so wide. Because of its stream deposition in narrow bands and the meandering of the streams, it is not very uniform. Generally it consists of a grayish or light-brown silt loam to about eighteen inches, below which as far as the auger will reach occurs a black, mucky, silty loam. In certain places, however, these conditions may be reversed.

A variation from the general black or drab color of this soil is found along the Trempealeau River bottom near Taylor. There the surface soil is reddish-brown or chocolate colored due to large amounts of iron in it. There is a quite general layer of spongy bog iron ore lying at from three to eighteen inches beneath the surface soil in this latter area. This hard, chunky, or gravelly layer is six to eight inches thick, and is underlaid by sand or mottled or reddish sandy clay loam.

The Wabash silt loam is widely distributed in the valley bottoms of the west half of the county. This soil because of its low position is not generally under cultivation.

Much of this type has poor drainage and a good deal of it is subject to one or more overflows each year, and consequently cannot be depended upon for cultivation.

This soil is mostly of alluvial origin. The dark color is due to accumulations of organic matter from decaying vegetation, the growth of which was favored by moist conditions. Where there is a covering of light-colored material over the dark soil, this covering is often colluvial in origin, having been washed down from the adjoining slopes.

This soil is used almost exclusively for pasture and hay land for which it is especially valuable. Occasionally a fairly well drained patch is cropped, corn doing especially well on it, yields of 75 to 90 bushels per acre being reported. Hay will yield from two to three tons per acre. Owing to the narrowness of most of the areas and the low position of the land, it is doubtful if much of this type could be successfully drained. Some of the broader expanses where there is sufficient slope could be much improved by installing tile drains.

CHAPTER VI

MISCELLANEOUS SOILS

PEAT

(Including the Shallow Phase)

Description.—The material classified as peat consists chiefly of decaying vegetable matter in varying stages of decomposition, with which there is mixed a small but varying amount of mineral matter or fine earth. In color the peat varies from a brown to black. The depth of the material forming this type is also extremely variable, and on the soil map has been grouped into two phases. The typical peat is over 18 inches deep and may be as great as 15 feet, although the average would probably be 4 or 5 feet. The shallow phase of peat varies from 6 or 8 inches to 18 inches in depth. Usually the shallow peat is more thoroughly decayed and when this is the case it is of a darker color. The earthy subsoil under most of the peat consists of fine sand.

The color of the peat and the extent to which the vegetable matter has decayed are also variable, and these variations are of importance, although they have not been indicated upon the soil map, except as they are brought out by the differences in depth of the peaty material. By far the greater proportion of the deep peat, including the large tracts in the eastern part of the county, is brown in color having a raw, fibrous structure, showing that it has not reached an advanced stage of decomposition. It has about the color of fine-cut tobacco and it is so raw, fibrous or stringy that in many cases the stems, leaves and grasses or moss from which it is formed can still be recognized. This raw condition often extends to depths of from 3 to 6 or more feet, but usually the lower depths are somewhat more thoroughly decayed and of a darker color than the surface. As a whole, the peat of the shallow phase is somewhat more decayed and of a darker color than the deep peat, and in a few places, because of the larger content of fine earth approaches

a muck in composition. Such dark colored areas, which are well decomposed, however, are of rather limited extent.

As indicated above, the earthy subsoil under the Peat consists for the most part of a white or grayish fine sand. There are two exceptions to this which are worthy of note. The peat areas which are associated with and border the Vesper fine sandy loam in the northeastern part of the county, are frequently underlain by clay or shale the same as that which forms the subsoil of the Vesper types. These peat areas are of limited extent and form only a small proportion of the total area of peat in the county. The other exception is found in the western part of the county where there are small areas of peat land along the bottoms of some of the drainage ways where the surrounding uplands are heavy. In these places the subsoil of the peat is frequently heavy in character, but here also this variation is very limited in extent. In general it may be said that the heavy subsoil is confined chiefly to regions where the subsoil of the adjoining upland types is also heavy, but in such places the subsoil is not uniformly heavy. This soil map does not show this variation in the subsoil, because of its limited extent.

Extent and distribution.—Peat is the third most extensive type of land in Jackson county. It covers 15.7 per cent of the area or slightly more than 100,000 acres. Of this amount about 90 per cent is deep peat and about 10 per cent is shallow peat. The peat is more extensive in the eastern half than elsewhere. In the towns of City Point and Bear Bluff there ar over 60 square miles of continuous marsh land in this county with more of the same type of land in the adjoining parts of Wood and Juneau counties. In the eastern portion of the county the peat is closely associated with extensive sand areas of the Boone and Plainfield series and with the Dunning soils which are marsh border types. In the western portion the peat is found as long narrow strips along the drainage ways. The shallow peat is mostly found around the margins of the large marshes and as small patches associated with the marsh border soils. It may be considered as a gradation type between the Dunning soils on the one hand and the deep peat on the other.

Topography and drainage.—The tracts of peat soil are all relatively low, flat, and naturally very poorly drained. On many of the marshes water stands on the surface during the

spring and early summer. In this soggy condition the land is often so soft that it will not support the weight of stock. During the late summer, especially during dry seasons the marshes dry out so that farm stock can safely go almost anywhere, and the peat frequently becomes so dry that the danger from fires is something which must be considered. When fire once gets started in the peat it is very difficult to extinguish, and sometimes continues to burn until stopped by the fall rains. Practically all of the material mapped as peat is sufficiently high in organic matter so that it will burn when dry.

A number of large drainage ditches have been extended into and through the large marsh tracts, but these only supply partial outlets and in order to have the land sufficiently drained for the safe cultivation of crops numerous lateral ditches supplemented with tile drains are necessary. In the vicinity of cranberry marshes the drainage is restricted by the dams which form reservoirs for storing water so that the cranberries may be flooded when necessary. Outside of the cranberry marshes only very few lateral ditches have been installed, so that on but few if any tracts are the peat lands properly and sufficiently drained. From work already done there appears to be sufficient fall so that from an engineering standpoint it would be possible and profitable to drain all of the peat land in this county.

Native vegetation.—The present timber growth on the peat marshes consists of tamarack, alder, poplar, willows, and various other water loving trees. Only a comparatively small proportion of the peat marshes are timbered, most of them being open and treeless or nearly so. The open marshes support a growth of coarse marsh grass, wire grass or sphagnum moss, through which are scattered a small and stunted growth of water loving shrubs. Some of the grass marshes are pastured or cut for hay. The moss and trees are usually found on the wettest parts of the marsh while the grasses are most common on the parts of the marsh land which are better drained.

Present agricultural development.—While peat is an extensive type in Jackson county it is at present of limited importance agriculturally. Some cultivation is being attempted at several points, notably on Trowe's Marsh 5 and 6 miles northwest from Millston, on the Ring Marsh in Sec. 24 T. 21 N., R 2 W., and on the Albright Marsh in Sec. 30 and 31 T. 20 N.,

R. 1 E. In most of these attempts work has been done on a rather large scale, tractors sometimes being used. In most cases it has been found that due to insufficient laterals or tile ditches the drainage is not adequate and crop failures have resulted because of an excess of moisture, and on land which during a series of dry seasons produced fair to good crops of timothy hay. Commercial fertilizers and lime although needed, are not used to any marked extent on the marshes now being cultivated.

The crops most commonly grown here on the peat are buckwheat, rye, timothy, potatoes, root crops with some cabbage and onions on a small scale. Some attempts are being made to grow corn but because of the danger of summer frosts this crop is very uncertain. These marshes can not be considered as being in the corn belt.

Various sized tracts of the peat lands are being utilized to a limited extent for pasture and hay, although the wild marsh grasses have a low feeding value. These marshes are frequently burnt over to destroy the dead grass and trash upon the surface, and a fair stand of clean grass usually follows. While this is young and tender it makes fair pasture. If the marshes are burnt off during dry seasons there is danger of the peat itself being burnt.

Without fertilization the yields of the crops mentioned when grown on raw brown, fibrous peat are usually low and unsatisfactory. Where the peat is well decayed and of a black color fair crops may be secured for a few years without fertilization, but the readily available mineral plant foods soon become exhausted, when fertilization becomes essential. Where the surface few inches of the peat have been burnt there is a concentration of the mineral elements sufficient in some cases to insure two or three fair crops but when this is used up fertilization is again necessary. The fire, if not controlled, however, may prove to be a damage rather than a benefit, for deep holes may be formed, and the surface of the ground lowered to such an extent that the land will no longer be sufficiently drained.

In some places an industry of limited importance has developed in the cutting of wire grass which is cured like hay, baled, and sold to the manufacturers of grass rugs.

Frosts on marsh land.—It is well known that frosts frequently occur on marsh land where there is no frost on higher

land. This is partly because the cold air which forms on the surface of all the ground at night tends to flow down and collect in low places, but it is also the result of the fact that the loose, spongy soil of peat marshes does not conduct the heat received from the sun during the day downward. In consequence of this, the lower layers of soil do not become warmed in peat marshes as they do in other earthy soils and the little heat left in the surface inch or two of soil is rapidly lost at night by radiation, so that the freezing point is frequently reached on such soil when it would not be on more earthy soils such as sandy loam or clay loam which would conduct the heat downward better during the day and so keep warm farther into the night.

This difficulty with peat marshes can be overcome to a certain extent by heavy rolling which, by compacting the soil, permits the heat to be conducted downward more readily. It will also to a certain extent become less in time, as the peat decomposes and takes on more of the character of muck. Nevertheless, it must always be expected that marsh land will be more subject to late spring frosts and early fall frosts than high land. It may be stated as a general guide, that the occurrence of killing frosts is as liable on marsh land at any given point as it is on upland soil having good air drainage about 150 miles farther north; in other words, the marshes of Dane county are as liable to have a frost which will kill corn as early as are the upland regions of Shawano, Marathon, or Clark counties. The marsh land regions of Jackson county are liable to have frost two weeks or more earlier than the hill tops of the same latitude. This means that corn and potatoes, while safe crops for the upland region, are not safe crops for the marsh land and should not be depended on as the chief crops.

CHEMICAL COMPOSITION AND FERTILITY OF PEAT

The chief difference between peat soils and upland soils consisting largely of earthy matter, is that they have relatively small amounts of the mineral elements phosphorus, potassium, calcium, and magnesium, and have extremely high amounts of nitrogen in the organic matter. The average per cent of phosphorus in the peats in this region so far analyzed is 0.135 per cent. This means that in an acre of soil to a depth of a foot

there is approximately only 675 pounds, or in two feet 1,350 pounds in comparison with upland soils which have approximately twice these amounts. Moreover, the acid condition of these soils renders the phosphorus less available than in a non-acid soil.

The deficiency of potassium in these soils is greater than that of phosphorus. They contain on the average 0.3 per cent of this element, while good upland clay loam soils average two per cent, or over six times as much expressed in percentage. When the greater weight of the upland soils is taken into account it will be found that they contain in the upper two feet 120,000 pounds per acre, while the peat soils contain but 3,000 pounds.

A large amount of organic matter in these soils gives them an extraordinary amount of nitrogen. They average 2.5 per cent of this element, while the upland silt loam soils of this region contain but about 0.12 per cent and this only in the surface eight inches—the amount in deeper layers being much less.

As a result of this difference in the chemical composition the peat soils are very unbalanced. Their rational treatment requires the use of fertilizers containing especially the elements phosphorus and potassium. These elements are contained in relatively small amounts in barnyard manure and good applications of manure will secure good yields of crops on peat soils, but manure contains large amounts of nitrogen not needed by the peat, so that when a farm includes upland soils as well as peat, the manure should be used on the upland soils and commercial fertilizers containing phosphorus and potassium used on the peat land.

On the deeper peats which are in a very raw and acid condition the use of lime in some form in addition to the commercial fertilizers will be found profitable. Occasionally a marsh is found on which on account of coldness and high acidity at first nitrification or the chemical change by which the nitrogen in the organic matter becomes available to crops does not take place readily and the use of a light application of composted stable manure to inoculate the soil with the proper organisms is very helpful.

Crops and system of farming on marsh lands.—Since the growth of corn and potatoes to which these marsh lands would

otherwise be well adapted, is limited in this section on account of the danger from frost, the best staple crops for this land are grasses for hay and pasture, hardy root crops, and rye, and to a less extent oats. When properly fertilized and limed, clover, alfalfa, and other legumes can also be grown. On fairly well drained marsh land well decomposed good pasture can also be developed. The compacting of the soil resulting from the use of this land as pasture is also a great benefit to it. When peat land is placed under cultivation a heavy roller should be classed along with implements necessary to its successful management.

Where good pasture can be secured and other conditions are the most favorable, selected portions of these marshes can be successfully utilized for dairying or stock raising.

Certain special crops, such as cabbage, onions, buckwheat, sugar beets, and rape, are adapted to such lands when well drained and properly fertilized.*

Summarizing the peat situation for the future agricultural development of the peat lands such as are found in Jackson county it may be suggested that before farming on these lands can be permanently successful there are several conditions with which it is necessary to comply.

1. It is absolutely necessary that the land should be sufficiently drained. Large outlet ditches in themselves while necessary are not sufficient, and these must be supplemented with open laterals and tile drains before adequate drainage is insured.

2. This type of land is low in potash, phosphorus and often in lime and these materials must be supplied in proper form and proper amounts before permanent, profitable production can be expected.

3. It must be recognized that the danger from summer frosts make such crops as corn and potatoes uncertain, and the crops to be grown must be those which are not only suited to the soil, but also to the climatic conditions.

4. Those purchasing this type of land must not only see their way clear to pay for the land itself, but they must also provide adequate drainage and fertilization, both of which call for an added investment.

*For more complete discussion of the management of marsh soils see bulletin on this subject by the Agricultural Experiment Station.

5. The use of a heavy roller to compact the soil is a practical necessity in the cultivation of Peat lands.

It is suggested for those who desire to undertake the development of a Peat farm, in any region but have never had experience with this type of land, that it would be a good plan to rent such a farm for a year or two or possibly serve an apprenticeship on some successful peat farm. This would make possible getting valuable experience without making a large investment.

ROUGH STONY LAND

Rough stony land includes rock exposures, cliffs, and land which is too steep and rough to plow or cultivate. It may be considered non-agricultural, as it is of value only for the small amount of timber and pasture it supplies.

This type occupies a large part of the steep walls bordering the valleys and forms a border between the valley bottoms and the high land of the ridges. The type is developed as narrow bands many miles in extent, winding in and out of the valleys and coves, but confined to the steep slopes. A part of the type occurs as narrow ridges upon which areas of soil too small to be mapped are sometimes found. The bluffs and cliffs are highest along the western border of the county, and frequently reach an elevation of two to three hundred feet above the valley bottoms along the sides of which they occur. The ridge tops are also wider here than elsewhere, and range in width from one-quarter to one-half of a mile. The elevation of the ridge tops range from one hundred and fifty to two hundred feet above the valley floor throughout most of the interior of the western part of the county.

The rough stony land type also includes isolated mounds, hills, and ridges of sandstone rocks rising above the comparatively level plane of the eastern part of the county. None of these rough stony areas, such as Saddle Mound, Bruces Mound, or Stanley Mounds have any tillable land on their summits.

Rough stony land is quite uniformly distributed throughout the western portion of the county and is intimately associated with Knox silt loam, the steep phase of this type, and also with some of the Boone types. The greater portion of the rock consists of the Potsdam sandstone, although there is also some granite rock exposed along the bed of the Black River.

The forest growth still remaining consists of white oak, red oak, pine, hickory and a considerable amount of undergrowth and brush in places. The best timber has all been removed and what now remains serves to protect the slopes from washing.

The inclusion of rough stony land in farms reduces the value of better land and it renders the fields on or over the ridges less accessible. It makes hauling to market more difficult, as some of the roads cross steep strips of this class of land.

CHAPTER VII

AGRICULTURE OF JACKSON COUNTY

TYPES OF FARMING

At the present time, the agriculture of the west half of the county is partly general, and partly dairying with grain raising predominating in certain portions. There appears however to be a gradual reduction in grain raising in favor of dairying and general farming. There are several reasons why this portion of the county is best suited to dairying, and chief of these is that all of the land can be utilized to better advantage. When grain growing is followed exclusively it is impossible to fully utilize the steep rocky slopes, but when dairying is followed these slopes are made use of for they supply good grazing. Thus the smooth land and more gentle slopes can be used for growing winter feed for the stock, and the pasture, which is a very important item to the dairymen, is provided by land which in a grain growing program would not be utilized. Another factor favoring dairying in this region is that the steep slopes can be kept more permanently in grass which prevents erosion and the washing away of the surface soil and the loss of fertility.

The agriculture of the county east of the Black River except for small areas where the better grades of soil predominate, is still largly in an undeveloped state. While centers of farming have started around the areas of better soil and around a few small towns, the majority of the land is still covered with brush and is not farmed. This is due in large part to the poor quality of the soils. Groups of farms are found near Shamrock, Millston, City Point, Pray, and Hatfield, and also in the vicinity of Oak Ridge, North Settlement, and Knapp in the interior of this part of the county.

The main crops of the west half of the county where agriculture is highly developed, are the grains and corn and hay

which are largely fed to cattle. The cash crops consist of tobacco, beans, potatoes, rye and on some farms barley, wheat, and oats are sold.

East of the river livestock farming does not thrive so well because of the inferior pasturage produced, except on the patches of better soil mentioned. Clearings are small, only a few head of stock are kept, a little oats, rye and some corn are produced. Partial support of many is derived from picking blue berries, working on the cranberry marshes, or gathering moss or wire grass.

CULTURAL METHODS

In the western part of the county on the heavy soils, some fall plowing is done, but it should be confined to fields where there is not serious danger from erosion. The tendency throughout the county is towards better methods of cultivation, fertilization, and seed selection. It is customary to apply manure to fields to be plowed for corn. When the land is plowed in the fall, manure is often hauled out during the winter and scattered over the plowed field. This is a good practice except where the surface is so steep that fertility is lost by being carried away by rains and melting snows.

In the eastern part of the county where conditions are radically different, other methods are necessary. Spring plowing is better than fall plowing. Covering sandy soils during the fall and early spring with a good growth is a good practice because it prevents loss of plant food by leaching, and the loss of fine sand particles by severe winds. Seeding rye in corn rows at the time of the last cultivation or in potato fields at digging time will prevent some loss of fertility, and this practice should be more generally followed.

Rye seeded early in the fall will help to protect the soil from blowing, but this crop has limitations, and the cheapest and most profitable way of handling the blowing problem is to grow clover and to do this commercial fertilizers may be necessary. With clover to hold the soil in place and a wind break of Jack pine and scrub oak to stop the wind, the blowing problem can be overcome. The use of a corrugated roller is also desirable since this insures a firm seed bed and an uneven surface which offers more resistance to wind. This implement is also needed on peat soil, and every sand and peat farmer should own or have the use of such a roller.

ROTATION OF CROPS*

In discussing rotations, farm crops may be divided into three classes:

1. Grain crops—generally shallow feeders, add little humus or organic matter to the soil, and tend to weediness.

2. Hay crops—legumes, timothy, etc. Legumes have extensive root systems, tap roots, add organic matter or humus and also plant food (nitrogen). They also improve the physical condition of the soil.

3. Cultivated crops—Corn, potatoes, etc., conserve moisture, favor decomposition of organic matter, and destroy weeds. Some are deep feeders, as corn, while root crops are shallow feeders.

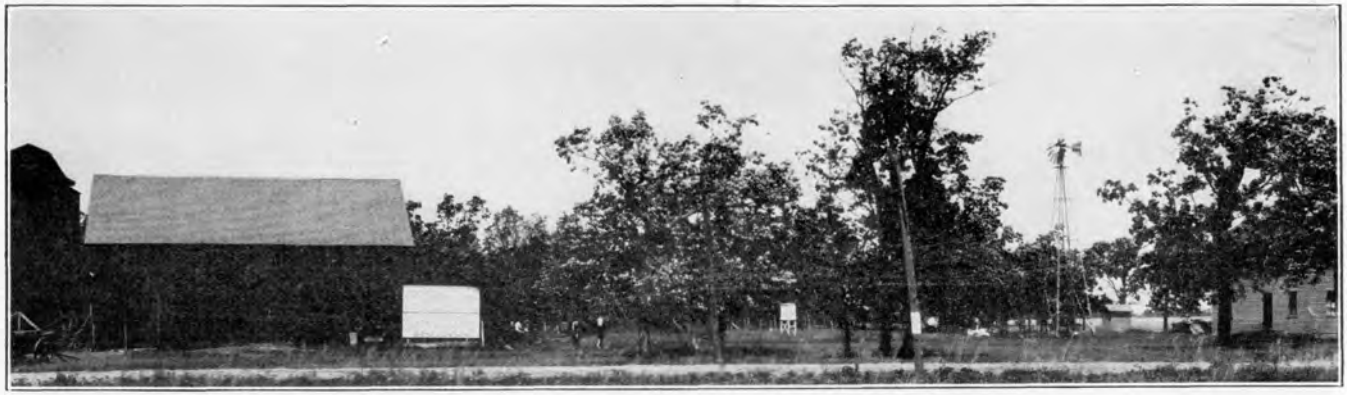
A good rotation should necessarily include crops belonging to each of these three classes. The value of such practice is apparent in its effect on the physical condition of the soil, on weediness, on organic matter supply, on plant diseases, and on nitrogen supply of the soil. Better yields are, therefore, obtained when crops are rotated than when a single cropping system is followed.

Again, crop rotation permits raising livestock and means diversified farming. No one will deny the benefits of this type of farming in stabilizing farm business and making best use of labor and equipment the year around.

It should not be understood, however, that crop rotation means maintaining the supply of plant food better than where a single cropping system is practiced. It is often said that certain crops are "hard" on the soil in the sense that they remove more plant food than other crops. In part that is true, but a more important difference is that some plants remove more of certain elements than others. Again a crop like corn, because of its root development and length of growing season, may utilize plant food that is less soluble.

Potatoes require relatively more potassium; corn draws heavily on nitrogen; while legumes are heavy feeders on lime (calcium) and also require large amounts of phosphorus, potassium, and nitrogen (some of which may be extracted from the air in the soil). Again, grain crops and roots require plant

*See Bulletins of Exp. Sta. for more information on Crop Rotation.



VIEW SHOWING PART OF THE BUILDINGS ON THE EXPERI MENTAL FARM, OF THE COLLEGE OF AGRICULTURE, UNIVERSITY OF WISCONSIN AT HANCOCK, WISCONSIN.

Hancock is located in the western part of Waushara County and is also in the sandy belt of Central Wisconsin. The results of experiments on this farm will apply to most of the sandy land in Jackson County.

SIX ACRE ALFALFA FIELD ON PLAINFIELD SAND ON EXPERIMENTAL FARM AT HANCOCK, WISCONSIN
This view shows the crop during the fourth year after seeding. Average yield per acre per year 2½ tons of cured hay.

food that is readily available, while corn is less particular in this respect.

By properly rotating crops, therefore, the soil is subjected to these different "feeding characteristics." One crop compensates for the other, and there is maintained more nearly a balanced condition than with the single crop system.

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.

There is no one best system of rotation. The rotation depends on the system of farming, and this depends largely on the personal choice of the farmer, for some prefer one system and some another. It is highly desirable to rotate crops, but a serious mistake to think that rotation takes the place of other equally sound practices, such as liming and fertilizing.

Following are a few suggestions which will apply to the western part of Jackson county, and may serve as outlines to be modified according to varying conditions.

As much of the land in western Jackson county is quite rolling this factor should be considered in working out a rotation.

One of the chief difficulties on long slopes is that of the tendency of little streamlets to collect into larger streams which greatly increase their eroding power. This difficulty can be overcome to some extent by laying out the fields in long and comparatively narrow strips on the hillsides so that the land which is in tilled crops such as corn or potatoes will alternate with land in grain or hay, thus greatly shortening the distance down the hill through which this accumulation of streams may take place. The sodded strips serve to check the flow of surface water, absorbing it and carrying it off beneath the surface.

A rotation which adapts itself to this system consists of corn, followed by small grain followed by hay for two years. In some parts of the county grain is inclined to lodge. This tendency may be overcome somewhat by growing grain twice in succession on the same fields. Where the slope is not too great this may be safely done, and two crops of corn may also be grown in this way where the slope will permit. A three year rotation may also be used on much of this land. Corn may be followed by a small grain and the grain by clover. Where the fertility is rather low, the second crop should be plowed under as a green manuring crop.

In the sandy portions of Jackson county, somewhat different rotations should be followed. The following is probably the best for most farms of sandy soil:

1st year: Clover with perhaps a light seeding of rye or oats.

2nd year: Clover for hay, leaving the second crop to be turned under either in the fall or spring.

3rd year: Corn or potatoes.

4th year: Soybeans, which may be used for feed, for hay, and for green manure.

If any other crops are to be grown, they may be planted following clover, thus eliminating one of the crops named. Another rotation which is frequently followed on sandy soils consists of small grain followed by clover, followed by potatoes. The second crop of clover in this system should be plowed under as green manure crop.

It is better to use mammoth clover on the sandy soils than red clover; for it is more hardy and more vigorous in growth, being able to secure its plant food more readily. It grows to about the same size on sandy soils as the medium red clover does on heavy soils.

In some of the rotations suggested it may be desirable to substitute rye for wheat or oats, especially on the sandy soils.

Tobacco can 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. With the tobacco a phosphate fertilizer should be used to supplement the manure. A second crop of clover can be plowed under, and thus save some of the manure for other parts of the farm. Tobacco should not be grown on the same field for a long period of years as is often the practice.

The growing of peas for canning could be made an important crop in this section, and this crop could be readily introduced into a four year rotation. Such a rotation might consist of small grain, clover, cultivated crops, which would be followed by peas. This may be made a five year rotation by adding timothy and cutting hay for two years. This system would be best suited to the western part of the county where the soils are heavier.

On the marsh lands as they are reclaimed, the question of crop rotation should also be considered. There are three types of farming to which marsh soils are adapted and these are stock raising or dairy farming, trucking and a combination of the two in which neither type predominates. Grain farming can not as yet be recommended on marsh soils. Where a farmer has 30 or 40 acres of peat he can divide the field into four parts and raise cabbage on one, sugar beets on one, grain on one and hay on the other. Thus a four year rotation of hay, sugar beets, cabbage and grain would be practiced on the peat. On a dairy farm two or three crops of corn may be grown in succession but in this region one should take into account the danger from frost. The corn may be followed by grain and this by alsike clover and timothy. The hay may be cut the first year and pastured the second. Potatoes may also be grown on peat land but here again the danger from frost and the quality of the product must be considered. In some localities outside of this area in this and other states a one crop system is being followed where celery, peppermint, or some other crop is the entire source of income. While a rotation of crops on such land is not absolutely essential a change of crops is desirable to aid in the control of weeds and insect pests.

EROSION IN JACKSON COUNTY

The most important single problem in soil management in western Jackson county is due to the large amounts of steep or rolling land. The county is in the so-called residual portion of the state where the streams which drain the area have cut down their beds through the formerly level elevated plain into sandstone rock. These valleys have never been altered or filled by action of glaciers which once covered most of the state. The valleys were at first mere erosion ditches or small stream beds which have been enlarged and deepened during geological ages till their beds lie from 200 to over 400 feet below the ridges which extend between. The valleys and their tributaries radiate like the veins of a leaf and the steep slopes which lead down from the ridge top to valley bottom make up a considerable part of the area of the county.

Most of the soil on the sloping land is heavy and is included in the steep phase of the Knox silt loam. These slopes which originally were timbered or brush-covered have been largely cleared and cultivated. Because of their unprotected condition and exposure to the work of surface run-off water from higher land, fields on this type of soil are often extensively washed and gullied by the storm water and the water from melting snow in spring.

Other soils subject to erosion are the soils of the Boone series derived from sandstone and which often occupy lower slopes in the valleys. The soils of the Lintonia series which lie in narrow benches along the sides of the valley bottoms are also subject to severe gullying. The swift flowing water from the ridges and slopes must cross these benches before reaching the valley stream and deep ravines, gullies, and ditches are developed. Soil erosion is a farm problem not only because fields are cut by ditches and gullies which make cultivation difficult, but because erosion removes the finest and most fertile soil particles first and reduces the fertility and yield of fields by removing fine soil and organic matter from the surface. The causes of removal of soil from the surface without formation of gullies generally lie in improper methods of cultivation or poor arrangement of fields. Fields where this kind of erosion occurs are often only gently rolling or undulating and the rain water does not collect in larger swift-flowing rills or

streams which have power to cut ditches, but follows the cultivated rows such as corn or potatoes or the drill rows of grain fields and the soil is removed only from the knolls and deposited in the hollows.

Contour cultivation and arrangement of the crop rows across the slope instead of with or down the slopes retards the movement of soil in such fields. Keeping the most exposed places in sod as much as possible and the cultivation of the field in alternate strips of crop and sod across the slopes are inconvenient but often necessary methods.

Rotation of crops in such a way that two cultivated crops do not follow in succession gives the field opportunity to recover from its losses under cultivation and avoiding a hard bare condition of the eroded ground after harvest as much as possible prevents surface wash in the fall. A cover or catch crop of rye or peas in the corn rows helps protect the soil after harvest and furnishes pasture until winter.

Deep plowing and plowing under of straw, manure, or a second crop of clover to increase the organic matter in the soil also give the surface of the field greater absorbing capacity and resistance to erosion.

Gullying occurs where greater volumes of water collect forming cutting-streams where steeper slopes cause the water to flow faster or in places where the soil has an unstaple foundation of sandy material which easily undermines when the water once cuts through the surface soil and establishes a fall which cuts back in the sandy subsoil. In some situations large gullies one half mile or more in length are sometimes cut during a single season.

In their beginnings most small gullies are easily handled. Small drainage-ways or shallow ditches can be filed with straw or manure and plowed shut. Such shallow drainageways should be left in permanent sod. The plow can be easily thrown out in passing across them. On the level terraces or where heavy soil lies on light sand or sandy gravelly subsoil, small ditches must be immediately tended to because all ditches on such soil are dangerous.

Where the subsoil is clay and where clay or silt soil material is being brought down by the flood water, large gullies may be made to fill by putting in a dam of stumps, brush, and logs. Where the subsoil is sandy much greater care is required. If

dams are built in the latter case, they need to be carefully constructed to prevent the water from cutting around them.

Dams of concrete, stone, wire mesh, and brush have been successfully used. Flume devices also have been used to carry the water over the head of the ditch and down into it preventing its continued growth.

Planting willows and bushes on the sides and bottom of ditches too deep to fill often arrests the growth of the ditch. Sorghum, sweet clover, or rye make good emergency crops on eroded spots and fields which later need to be seeded to grasses and left in permanent sod.*

DRAINAGE†

In Jackson county there are at least 150,000 acres of land which would 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. The major portion of this poorly drained land consists of deep peat, and in the eastern part of the county, the two townships, town 20 and 21 north, Range 1 East, have more than eighty per cent of their area in deep peat. This means that there are over 36,000 acres of this low land in one large body. In addition to this, there are other extensive areas of peat throughout the eastern part of the county. There are also extensive areas of Dunning sand which consist of marsh border soil and this requires drainage, and there is also some land along the Black River which is subject to overflow and which is classed as poorly drained, which is more difficult to reclaim. At the present time there are 46,760 acres of land in drainage enterprises. There are 25.5 miles of open ditches in these drainage enterprises, but only a very small amount of tile has been installed up to the present time. The capital invested in and required to complete operating enterprises in Jackson county amounts to $113,570.

Quite a large number of open ditches have been constructed. Statistics indicate that only 4,140 acres of this drained land are improved at the present time. This means vast areas of land within drainage districts are still lying idle. This is due to the fact that even though outlet ditches have been installed, laterals have not been constructed so that individual tracts of

*See Bulletin 272 of the Wisconsin Experiment Station.

†For a full discussion of drainage questions consult the bulletins of the Wisconsin Experiment Station.

land do not have sufficient drainage at present. Then, too, much of the land is raw, fibrous peat, and this class of soil requires special methods of cultivation and fertilization in order to make its development profitable. It may be stated that most of the marsh land in Jackson county is at present unimproved. The most extensive use which is being made of the marsh land is for wild hay, for moss, and wire grass. Some of the marsh is also utilized for pasture.

The cranberry industry mentioned elsewhere has been developed almost entirely on peat soils, and where this development has taken place, thorough drainage is not wanted in that immediate vicinity. With the proper construction of reservoir and ditches, however, the development of cranberry industry, and the development of farming on cultivated lands need not interfere materially with one another, since the drainage water from one tract may be used at a lower point on the cranberry bogs. It is believed that there is a sufficient fall so that practically all the marsh lands in this county can be successfully drained. Where an area of low land includes part of several farms, the owners can form a drainage district and sell bonds to pay for the improvement. This is the method which has been used, and a number of drainage districts have already been established in the county. 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 a drainage district. Where the areas of marsh land are small and confined to one farm, and where there is an outlet, the farmer can install tile drains and establish his own drainage system.

For a more detailed discussion of drainage see bulletins 284 and 309, Wisconsin Experiment Station.

LIMING

Most of the soils in Jackson county are thought to be in need of lime. All of the soil types show an acid condition which ranges from slight to strong in degree. The subsoils of many of the types also show some acidity to a depth of from two to three feet. The heavy light colored upland soils are usually

acid at the surface, but the deep subsoil may in places be free from acid or even slightly calcarious (containing lime).

The degree of acidity is quite variable, and each farmer may find a wide variation in the need for lime on his farm. It is essential that every farmer should have his various fields tested before making an expenditure for lime. The county agent can do this, or samples may be sent to the Department of Soils of the University where free tests will be made. Failure of clover and alfalfa are often an indication of the need of lime. About three tons of ground limestone per acre is the usual application on these soils when alfalfa is to be grown and two tons where clover is seeded. The amount to be used, however, may vary with the degree of acidity, the character of the soil, and the crop to be grown. Such crops as alfalfa, sweet clover, peas, cabbages, onions, and lettuce have a high lime requirement. Clover, garden beans, barley, hemp, turnips, and raishes 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 Jackson 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.

The best way to apply lime which is dry is with a regular spreader made for this purpose, and there are a number on the market. The end gate type of spreader has given good results in spreading dry or moist lime. A manure spreader may also be used by first putting in a thin layer of manure or straw and spreading the limestone evenly on top of this. Where several farmers are so situated that they can work together, a lime spreader should be secured for this purpose.

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

It should be remembered that most acid soils are also dificient 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 uses of lime alone, and for this reason it is important that both deficiencies should be corrected to secure the most economical production.

THE USE OF FERTILIZERS

We believe that most of the nitrogen needed for plant food by Wisconsin crops can best be secured through the growth of legumes and the use of stable manure. Since the legumes require a good supply of available phosphorus, this element should be applied by the broadcast application of phosphate when seeding down to a legume whenever needed. This phosphorus in part becomes available along with the nitrogen of the legume to the succeeding crop of corn, potatoes, sugar beets, tobacco, etc., all of which on upland soils at least should be grown in rotation with legumes, or else on manured land. Only such additional amounts of phosphorus and potash should be applied to these special crops as are needed. These can then be applied in the hill or drill, if desirable.

Peat and muck soils are abundantly supplied with nitrogen which can be made available by proper treatment but are practically always low in potash and freqeuntly in phosphorus, and even sometimes in lime as well.

Only such amounts of nitrogen should be purchased in commercial fertilizers as are needed to supplement the home grown supply. Such supplementary nitrogen should ordinarily be in immediately available form and be used to encourage early growth. Where it is desired to use a fertilizer carrying nitrogen, it is highly important that this fertilizer be applied with a fertilizer attachment on the planter or in such a manner that it will come within the root feeding radius of the plant. Fertilizer attachments are being used for the application of fertilizers for potatoes and corn. For sugar beets the fertilizer should be applied at the time of planting the crop with a regular fertilizer beet drill. Fertilizers for tobacco and cabbage are usually applied broadcast previous to setting, athough it has

been found desirable to apply a small amount of the fertilizer with an attachment on the tobacco or cabbage setter and the balance to be applied broadcast after the crop has developed a more extensive root system. For onions and other truck crops it is usually desirable to apply the fertilizer broadcast previous to planting the crop.

There are three factors which must be considered in relation to fertility and the yield of crops: First, the condition of the soil itself and the supplies of the various kinds of plant food which it offers in available form; second, the crops to be grown, including the kinds and amounts of plant food they require; and third, the use of fertilizers which will supplement the supply of plant food already in the soil in a way to meet the demand of the crops concerned.

Soils vary greatly in the total amount of plant food they contain in available form and especially in the proportion of the various elements required by crops. Sandy and light soils are generally low in most elements. Light colored clay soils are relatively low in nitrogen and are moderately well supplied with phosphates, but contain potash in relative abundance. Peat soils are always abundantly supplied with nitrogen which can be made available by proper treatment, but are practically always low in potash, and frequently in phosphates, and even sometimes in lime as well.

With reference to crops, there are two things to consider: first, the relative proportion of the different elements they require; second, the total quantity needed. While there are undoubtedly slight variations in the requirements of each single individual crop, they can be grouped into classes fairly well. Such crops as small grains and grasses, including timothy, require a relative abundance of phosphates and moderate amounts of potash and nitrogen. Such crops as corn, potatoes, tobacco, and sugar beets require large amounts of nitrogen and potash with moderate supplies of phosphates. Peas, clover, and alfalfa require large amounts of phosphate, potassium, and lime, but under proper conditions can secure most of their nitrogen from the air.

The total quantity of plant food needed depends largely on the total weight of the crop produced. Such crops as small grain, timothy, and flax require but moderate amounts of total

plant food per acre, while such crops as corn, sugar beets, cabbage, onions, and potatoes, require much larger quantities.

The yields of crops are affected not only by the quantity of plant food available, but by the moisture supply which the climate provides and the portion of it which the soils on which the crops are grown will retain until absorbed by the growing plants.

In working out our ideas of the proper fertilizers to use in Wisconsin, therefore, we must take all of these factors into consideration and should use commercial fertilizers only to supplement the natural fertility of our soils and system of farming. Roughly this means that on any particular kind of soil and for the growing of any one of the groups of crops mentioned, the fertilizer best to use would depend on: first, whether stable manure had been used or not; second, whether legumes, which would supply nitrogen but no other element, have been grown; or third, if the soil is unfertilized in either of these ways.

Acid phosphate should be used on the heavier soils in the general system of farming where a sufficient amount of manure is produced to cover the cultivated land every fourth year. This phosphate fertilizer should be used at rates of 125 to 350 lbs. per acre (depending upon the grade) and should be broadcasted or applied with a fertilizer grain drill at the time of seeding to small grain and clover.

Mixed fertilizers high in phosphate (such as 2-12-2) may be used on lighter soils where there is a limited supply of organic matter. For small grain these fertilizers may be applied at rates of 200 to 400 lbs. per acre depending upon conditions. This fertilizer may also be used on corn at rates of 75 to 125 lbs. per acre and should be applied with fertilizer attachments on the corn planter. Fertilizer applied in this manner for corn should be used only as a *supplement to the usual manurial treatment and in conjunction with a practice as previously outlined.*

Mixed fertilizers high in potash may be used for truck crops where it is impossible to secure a sufficient amount of barnyard manure. It is imperative that some legume such as clover or soybeans be grown under this system in order to supply the necessary amounts of organic matter and partly supply the nitrogen. For potatoes the fertilizer should be applied with fertilizer

attachments in the furrows at rates of 400 to 1,000 lbs. per acre. For onions, cabbage, beets, tobacco, etc., the fertilizer may be applied broadcast at rates of 400 to 1,500 lbs. per acre. The conditions peculiar to the individual case will decide the amounts and kind of fertilizer to use.

Phosphate and potash mixtures should be used on the dark colored soils where there is no need for nitrogen in the fertilizer. Soils ranging from the black sand loams to muck and peats fall under this class. The kind of fertilizer and the rate of application will depend upon the type of soil, the crop to be grown and other conditions peculiar to the individual case and no recommendations can be made unless all these factors are taken into consideration.*

FARM PRODUCTS AND AGRICULTURAL STATISTICS

Of the agricultural products of the county as a whole, the cereals lead by far. The farm value of the cereals including corn December 1, 1920, was over two million dollars, while hay and forage were worth less than a half of this amount, and milk produced had a value of over two million dollars.

Among the cereals, oats represent the greatest acreage and production with corn second, barley third, and rye and wheat about an equal fourth.

The towns of Garden Valley, Albion, Franklin, Irving, Curran, Melrose, and Northfield produced the most grains, hay, corn for silage and tobacco, and have the most cows, horses, sheep, and silos. These towns have largely the Knox silt loam soil.

The towns of Cleveland, Hixton, Alma and Springfield with largely fine sandy loam and loam soil lead in acreage of corn for grain, alfalfa, buckwheat, beans and wild hay, and second in number of hogs, silos, and acres of wheat, tobacco, silage, and potatoes.

The towns with largely medium to sandy soil including Garfield, City Point, Manchester, and Komensky, lead in the production of rye, wild hay, and clover. Brockway, Millston, Knapp, and Bear Bluff the most generally sandy towns led in acreage of potatoes, cranberries, and wild hay. Being only

*For a more complete discussion of commercial fertilizers consult the bulletins of the Wisconsin Experiment Station.

partly developed, they do not compare with the production of the more highly developed towns having heavier soil.

Tobacco has the highest acre value of any of the special crops grown in the county. The census of 1920 reports 209 acres devoted to tobacco growing in the county. The acreage on any one farm is small, and probably averages no more than two to three acres; so that tobacco is grown on about 100 of the 2,400 farms in the county.

The production of cranberries is a special industry carried on chiefly in the marshy parts of the east half of the county. 1910 census reports 529 acres of cranberries with a yield of 529,000 quarts. In 1920, 480 acres produced 548,648 quarts.

In 1917 about 460 acres of beans were produced in Jackson county. In 1920 the crop was 232 acres yielding 2,344 bushels. These also are generally grown on the sandy soils and in small plots of one-half to two acres extent, although a few fields of from five to twenty acres of beans are grown. The white navy bean is the variety generally grown. The greatest acreages are usually in the towns of Alma, Albion, Hixton, and Garfield.

Potatoes are grown on a commercial scale in parts of the county. The largest acreages are found in Cleveland, Irving, Garden Valley, and Garfield and Alma townships. Potato ware houses are located at Fairchild, Price and Black River Falls. Alma Center, Humbird, and Levis.

Cucumbers are quite extensively grown in portions of the county, chiefly on the sandy and sandy loam soils. Salting stations are located at Merrillan, Black River Falls, Hatfield, Levis, and Taylor. As high as $2.00 per bushel of fifty pounds is paid for first grade cucumbers. Seed is generally furnished and farmers are able to make $100 to $150 an acre from this crop where soil and weather conditions are favorable. This crop is very tender and occasionally early frosts in the fall or the yield.

TABLE OF AGRICULTURAL STATISTICS FOR JACKSON COUNTY FOR 1919 AS COMPARED WITH 1918 AND 1909, FROM BULLETIN NO. 28 OF THE STATE DEPARTMENT OF AGRICULTURE.

Number of Farms	1919	1918	1909
Number of farms	2,479		2,382
Acreage in 22 cultivated crops, including tame hay	133,928	132,564	120,563
Corn, total acreage	23,675	22,204	160,058
Production, bushels	1,089,050	865,956	
Corn for grain, acreage	10,418	8,215	
Production, bushels	489,646	328,600	
Corn for silage, acreage	11,837	12,657	
Production, tons	108,900	101,256	
Silos, number	894	792	
Oats, acreage	41,023	43,764	43,491
Production, bushels	1,394,782	1,925,616	
Winter wheat, acreage	3,314	1,513	3,832
Production, bushels	62,966	27,558	
Spring wheat, acreage	7,322	6,231	722
Production, bushels	87,864	155,775	
Barley, acreage	6,918	9,506	8,868
Production, bushels	179,868	344,322	
Buckwheat, acreage	1,810	2,676	1,994
Production, bushels	28,960	50,844	
Rye, acreage	11,436	9,582	7,457
Production, bushels	194,446	182,058	
Peas dry, acreage	272	111	32
Production, bushels	2,992	1,332	
Dry beans, acreage	137	390	207
Production, bushels	2,055	4,680	
Clover and timothy, acreage	33,545	32,032	34,227
Production, tons	53,672	48,048	
Alfalfa, acreage	104	98	20
Production, tons	322	245	
Other tame hay, acreage	661	496	404
Production, tons	859	794	
Wild hay, acreage	3,370	3,812	3,774
Production, tons	5,055	4,574	
Potatoes, acreage	2,471	2,651	2,189
Production, bushels	232,274	288,939	
Tobacco, acreage	550	625	338
Production, pounds	715,000	843,750	
Cabbage, acreage	12	33	10
Production, tons	91	99	
Sugar beets, acreage	16	103	166
Peas for canning	121		
Other root crops	36	16	
Flax, acreage	50	30	

Acreage in 22 cultivated crops, including tame hay	133,928	132,564	120,563
	1920	1919	1910
Milk cows, number January 1	19,762	19,391	17,077
Other cattle	23,978	22,879	14,750
Number of horses and mules, January 1	9,044	9,291	8,514
Number of swine, January 1	29,662	30,615	18,615
Number of sheep, January 1	12,198	14,630	7,966
Milk produced, cwt.	876,865		

Average production, per cow, 4,488 pounds of milk.

AGRICULTURAL HISTORY

Agriculture in its early stages followed close on the heels of the lumberman. Pine forests lined the Black River and covered the east half of the county. During the process of marketing this timber, railroads were built, sawmills established, and towns grew up around the sawmills and lumber camps. Roads were opened from town to town, and the land seeker was attracted to the locality.

The first settlement began about 1850. Wheat was the popular crop at first because it always found a market. Many farmers hauled their wheat twenty to forty miles or more with ox teams to the nearest railroad point. The grain raising was confined to the western half of the county where most of the soil is heavy and better adapted to grains than the soil of the east half of the county.

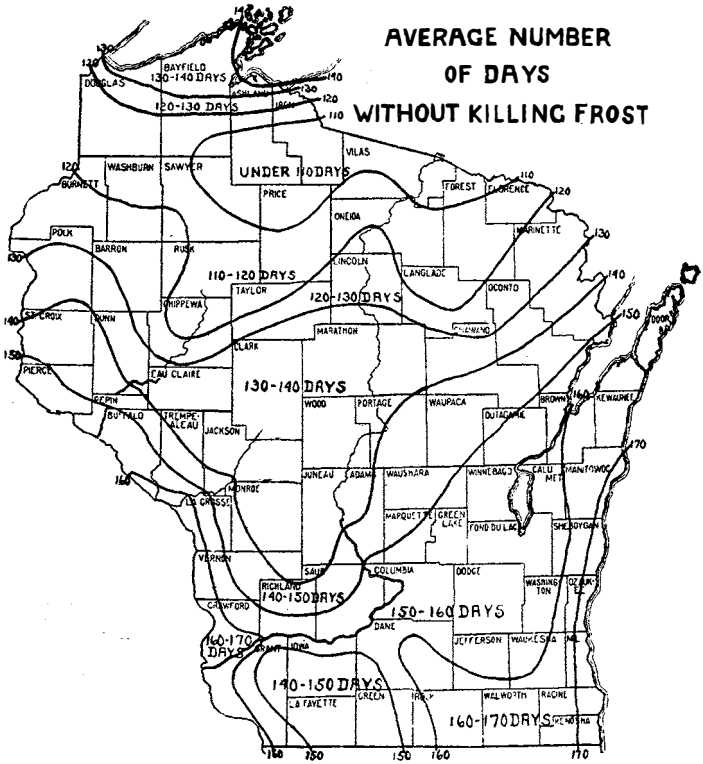
By 1880 there were 1600 farms which have increased to about 2500 at the present time. Since 1880 wheat raising has declined two-thirds while oat growing has increased four, and rye seven times. Due to the too continuous raising of wheat, the yields were reduced for a time and because also of low prices and plant diseases the raising of this crop fell off. As communication and marketing facilities became better, live stock and dairy farming came to the front. At present much more live stock is sold from the farms than formerly and cheese factories and silos are becoming generally distributed in the west half of the county, though grain raising still holds a large share of the agricultural activity of several of the townships.

Agricultural development in the eastern half of the county has been very slow, and by far the greater proportion of this land is unimproved. Future progress in this region will depend upon the drainage of the marshes and in the development of methods through which the farming of the sandy soils and marsh lands can be made profitable.

CHAPTER VIII

CLIMATE

The climate of that portion of Jackson county lying east of Black River is typical of the large area of central Wisconsin which has been described in a study of the climate of Wisconsin* as the Wisconsin River Basin. This region appears to be slightly



cooler than the Mississippi Valley to the west or the Michigan shore to the east, being cooler than the former in summer, and colder than the latter in winter. This Wisconsin River Basin averages about ten days in winter when the temperature drops

*Wis. Exp. Station Bulletin No. 223.

lower than ten degrees below zero, and thirteen days in summer when the termometer rises above ninety. The growing season is somewhat shorter, owing probably to the altitude and the sandy soil and marshy condition of much of the land. Mauston, which is the county seat of Juneau county, has an average season of 130 days between frosts as compared with 160 days at La Crosse to the west, 149 at Oshkosh, and 167 at Sheboygan at the east. Stevens Point has an average growing season of 126 days. From the accompanying chart it will be noted that the growing season of the Wisconsin River Basin averages from 130 to 140 days between killing frosts. There are many places with this basin, however, especially along the marsh land where killing frosts may occur any month during the year.

The western part of Jackson county which ranges in elevation from one to three hundred feet above the eastern portion, falls within the southern Highlands Division as another climatic province in Wisconsin. This region is extremely rough and broken, and by consulting the chart it will be noted that a portion of this region has a growing season somewhat longer than the region in the Wisconsin River Basin. This region is almost entirely free from marshes; practically all of the land is well drained.

From the appended table of average temperatures and rainfall from the station of Hatfield in Jackson county, it will be noted that the annual temperature is 44.1 degrees Fahrenheit, and the annual mean temperature is 30.62 inches. This rainfall is so distributed that the greater part of it comes during the growing season, and while this is true, it frequently happens that during the latter part of the summer of some years, crops suffer from a lack of moisture. This is especially true on the soils of light texture, which predominate in the eastern part of the county. The average date for the last killing frost in the spring at Hatfield is May 20, and the day of the first killing frost in the fall is September 21, giving an average growing season of 124 days. This is somewhat shorter than the period given for the whole Wisconsin River Basin.

This short growing season as well as the sand soils aid in explaining the comparatively small amount of corn raised in this region, and the more extensive development of the potato industry. While corn does not always mature in this region, it can be safely grown as a crop for the silo, and for such use, the acreage could be materially extended.

The following table gives the average annual temperature and rainfall conditions at Hatfield, a station in the north central part of the county on the Green Bay Railroad.

Mean temperature in degrees Fahrenheit:

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
14.9	14.3	28.4	46.9	58.8	66.9	70.6	67.7	60.8	48.8	32.4	18.5	44.1

Mean rainfall in inches:

0.83	0.71	1.29	2.48	4.63	4.50	3.56	3.09	3.49	3.07	1.61	1.36	30.62

SUMMARY

Jackson county is located in the west central part of Wisconsin, and comprises 1,001 square miles or 640,640 acres. It may be divided roughly into two distinct topographical and agricultural regions. The western part, west of the Black River, is largely a rough rolling country with soil of good quality predominating and an agriculture which is highly developed, while east of the Black River the region is largely an extensive sandy plain with many marshes, with the predominating soil of low agricultural value and being but slightly improved.

While the first settlement was made as early as 1818 or 1819, there was but little in the way of agricultural development prior to 1850. The county was established in 1853, and the village of Black River Falls was incorporated in 1866. All of the western part of the county is now well settled, but in the eastern part the region is very sparsely settled.

Two railway systems traverse the area, and these provide transportation facilities for the region, although some portions of the county are quite distant from the nearest shipping point. From Black River Falls to Madison is 127 miles, and to Chicago 250 miles, while to Minneapolis it is 152 miles. These distances are over the Chicago and Northwestern Line.

The mean annual temperature is about 43.8 degrees, and the mean annual precipitation 31.6 inches. The marshy region in the eastern part of the county is much more liable to have summer frosts than the hilly country to the west.

In the western part of the county, agriculture is well developed, and the region is in a prosperous condition, while in the eastern part there is but little development, due to the sandy and marshy condition of the soils.

Jackson county lies almost entirely within the unglaciated portion of the state, and the soils have been derived largely from the disintegration products of the underlying sandstone and shale, and also from the wind blown material known as loess. In addition to these sources of origin there are also large tracts

which have been modified by the action of water and deposited in the form of stream terraces or valley fill. Accumulations of vegetable matter have also given rise to extensive bodies of peat, and smaller accumulations of organic matter have modified several of the various soil formations.

Including rough stony land and peat, twenty-eight types of soil were recognized and mapped in Jackson county.

The Knox series includes the light-colored upland soils which are largely of loessial origin, and which include the best extensive tracts of land in this region. Knox silt loam, with its steep phase was mapped.

The Boone series includes soils derived directly from the weathering of the Potsdam sandstone. In some cases some shale and also loess had modified some of the types. The types mapped are Boone loam, fine sandy loam, fine sand, sand, with phases of some of these types.

Lintonia soils are made up chiefly of secondary loess now found as terraces throughout the region of Knox soils. The types mapped are Lintonia silt loam, loam, and fine sandy loam.

Bates soils are very similar to the Knox, except they are dark-colored, semi-prairie soils. The silt loam was the only type mapped.

The Plainfield series consists of light-colored alluvial soils found as terraces, valley fill, or outwash plains. In this county, the following types were mapped: Plainfield fine sandy loam, sandy loam, sand, and fine sand.

The Vesper series consists of residual soils which have been derived largely from a shaly phase of the Potsdam sandstone, and which usually have a subsoil containing considerable clay or shaly material. They are nearly level, and usually rather poorly drained because of the shale in the subsoil. The types mapped are Vesper silt loam, fine sandy loam, and sandy loam.

The Dunning series consists of low lying dark-colored poorly drained sandy soils bordering marshy tracts. It may be residual or alluvial in origin. Only the Dunning sand was mapped in this area.

The Wabash series includes the dark colored bottom land soils in the western part of the area, where the upland soils are largely Knox silt loam. The types silt loam and loam were mapped.

The Genesee series includes the light-colored first bottom soils. The types mapped are silt loam, fine sandy loam, and fine sand,

Peat consists of decaying vegetable matter in various stages of decomposition. Several depths were indicated in the field work, and of these, the shallow phase is shown on the final map.

Rough stony land consists of steep, rough, and rocky land which is too rough or too rocky to be cultivated. Its chief value is for the limited amount of pasture which it affords.