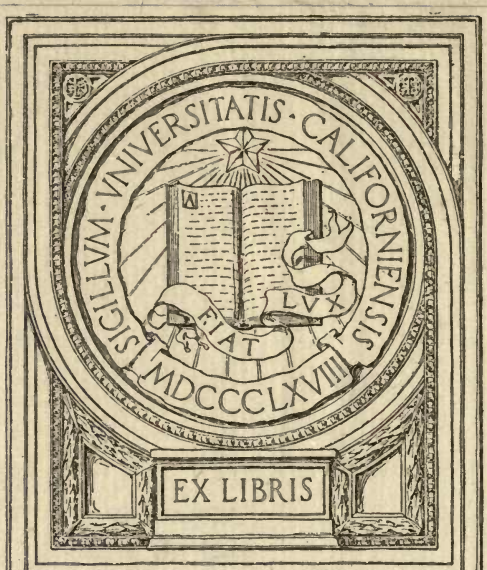

WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY

E. A. BIRGE, Director. W. O. HOTCHKISS, State Geologist.
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SOIL SURVEY IN COOPERATION WITH THE COLLEGE OF AGRICULTURE
H. L. RUSSELL, Dean.

BULLETIN NO. 52--B SOIL SERIES NO. 17

SOIL SURVEY

OF

WOOD COUNTY

WISCONSIN

BY

A. R. WHITSON, W. J. GEIB, GUY CONREY, W. C. BOARDMAN AND CLINTON B. POST

OF THE

WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY

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

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INTRODUCTION

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

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

It is the object of this survey to make an inventory of the soils of the State, and to be of practical help to farmers by lo-

cating 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 course 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 over 50% of Silt and Clay.

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

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

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

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

Clay.—Over 30% clay.

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

and gravel. The Plainfield series includes light colored soils in regions where no limestone is present, where the parent rock was largely sandstone, and where the material occurs as outwash plains or stream terraces. The soils in this series also have a wide range in texture. The name used for a soil series usually indicates the locality where that particular series was first recognized and mapped by the Soil Survey. By uniting the soil class 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 WOOD COUNTY, WISCONSIN

CHAPTER I.

GENERAL DESCRIPTION AND HISTORY OF THE AREA.

Wood County is located in the center of Wisconsin, and the geographical center of the state falls within this area. It has a length north and south of 30 miles and a width east and west of

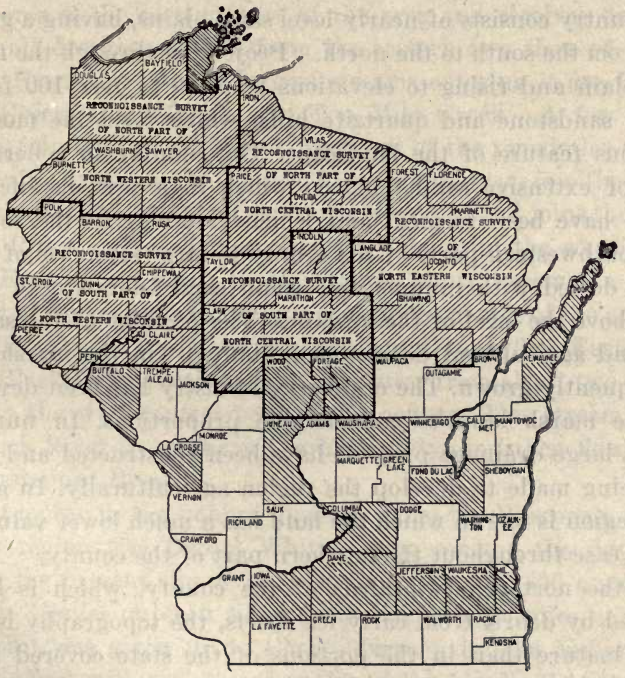

FIG. 1.—Sketch map showing area surveyed.

30 miles. It would be a square, but for the fact that there are two townships missing from the northeast corner of the county. The county comprises an area of 809 square miles or 517,760 acres.

The surface of the area falls naturally into two topographic divisions and the line separating them runs nearly parallel with, but somewhat to the north of, the Green Bay & Western Railroad, which crosses the county from the east to west, passing through Grand Rapids, Elm Lake, Dexterville. The region to the north of this line comprising more than half of the county, consists of an undulating or nearly level to rolling country throughout which the soils are heavy and of good to excellent quality for agricultural purposes. Many communities here are as well improved and as highly developed as the best farming regions of southern Wisconsin. The most conspicuous features in this region are the Marshfield Moraine south and southeast of Marshfield, Powers Bluff, southwest of Arpin, and Cory Mounds in the west central part of the county. To the south of this line the country consists of nearly level sand plains, having a gradual rise from the south to the north. Projecting through the floor of this plain and rising to elevations from 20 to over 100 feet are a few sandstone and quartzite hills, which form the most conspicuous feature of the landscape. The country in general consists of extensive sand flats, on which in a few instances low dunes have been formed, and which give way in the southern and southwestern parts of the county to large stretches of marsh often dotted with innumerable small sand islands only 1 or 2 feet above the level of the lowlands. The fertility of the sands is low and agricultural development limited. On the marshes hay is frequently grown. The cranberry industry has been developed on the marsh land to considerable proportions. In numerous places large drainage projects have been constructed and efforts are being made to develop the region agriculturally. In general this region is one in which the land has a much lower value than is the case throughout the northern part of the county.

In the northern two-thirds of the county, which is largely covered by debris from early ice sheets, the topography is much more mature than in the portions of the state covered by the Late Wisconsin Ice Sheet. In most cases slopes are long and gentle, there are no lakes, and comparatively few swamps. The elevation of railway stations will give an idea of the average elevation of the region. Vesper has an elevation above sea level of 1090 feet, Arpin 1149 feet, Marshfield 1283 feet, and Auburndale 1213 feet. In the highest portions of the Marshfield Moraine

an elevation of 100 to 150 feet above the surrounding lowland is reached, though no topographic survey has been made of this region. Powers Bluff reaches an estimated elevation of 300 to 400 feet above the surrounding lowland, and this is doubtless the highest point in the area.

The sand flats of southern Wood County, which are largely of alluvial origin, are considerably lower than the north portion of the county. The elevation at Port Edwards at the railroad station is 969 feet, at Nekoosa 959 feet, Dexterville 977, and at Babcock 977 feet. It will thus be seen that there is a difference in elevation of from 200 to 300 feet between the sand and marsh region of the southern part of the area and the region of heavy soils in the northern part of the county.

The drainage of most of the county is into the Wisconsin River, which crosses the eastern part of the area and receives directly nearly all drainage waters from the eastern two tiers of townships. From the east the largest streams entering it are Buena Vista Creek, Duck Creek, and Ten Mile Creek. A few small streams join it from the west. Nealy all of the remainder of the area drains first into the Yellow River which traverses the western portion of the county from north to south, and joins the Wisconsin River at Necedah in Juneau County to the south. The Little Eau Plaine River in Marathon County receives a small amount of drainage from the extreme northern side of the county. This stream joins the Wisconsin River at Dancy. The East Fork of the Black River receives drainage water from about two townships in the west central part of the county. This stream joins the Black River in southern Clarke County, and then flows into the Mississippi River.

The pioneer in the lumber business along the Wisconsin River in this region was Daniel Whitney who erected the first saw mill on the present site of Nekoosa in 1831. In 1836 a strip of country 3 miles on each side of the river, to 40 miles north of this point was given up to the lumbermen by the Indians. In 1838 the first mill was erected at Grand Rapids. In 1844 Portage County, which was originally included Wood, was organized. In 1848 title to all lands was taken from the Indians and the country opened up for settlement. In 1856 Wood County was separated from Portage. Grand Rapids was incoporated in 1869. The first settlement in Marshfield was made in 1871. Dexterville

was settled in 1852 and Pittsville in 1858. Settlements were made in the southern portion of the county earlier than in the northern, chiefly because pine was the predominant timber growth while in the north the pine was usually mixed in with hardwood. Lumbering was the chief industry for a long period after the first settlements. The old Wisconsin Central Railroad (now the Soo Line) was built through the county to Marshfield in 1871. The Wisconsin Valley Railroad (now the C. M. & St. P. Ry.) was built through the county in 1873.

Among the early settlers many came from the older states of Illinois, Ohio, New York, and also from Canada. Later many foreigners were attracted to this region and among these the Germans, Norwegians, and Swedes were the most numerous. People of German descent are probably the most numerous at present. All portions of the county are now settled, but the extent of development and diversity of population is variable, following largely the quality of the soil. The southern part of the county is for the most part thinly settled and only a comparatively small percentage of the land is improved, while throughout the northern part of the area the region is well settled and the land highly improved.

Grand Rapids, with a population of about 8000, is the county seat and the largest city in the area. It is a distributing and railroad center of importance, four separate railway lines entering the city. Extensive water power is developed here from the rapids in the Wisconsin River and one of the chief uses of this power is in operating an extensive paper mill at this point. Other extensive power developments and paper mills are located within the area at Nekoosa, Port Edwards, and Biron. Marshfield, the second city of importance, has a population of 6000 and is located in the center of a highly developed agricultural region. Nekoosa, a paper mill town, has a population of about 1200. Among other towns in the area are Pittsville, Babcock, Dexterville, Auburndale, Milladore, Vesper, Arpin, and Rudolph.

The county is well supplied with railroads. A line of the C. M. & St. P. Ry. crosses the area from north to south passing through Rudolph, Grand Rapids, Nekoosa, and Babcock. A branch extends from Babcock to Pittsville, Vesper, Progress, and Lindsey. A branch of the C. N. W. from Fond du Lac to Marshfield passes through Grand Rapids, Vesper, Arpin, and

Marshfield where it joins another branch which again joins the main line at Merrillan Junction. The Soo Line (Old Wisconsin Central) crosses the northern part of the county passing through Milladore, Auburndale, and Marshfield, with a branch extending from Marshfield to Grand Rapids and Nekoosa. The Green Bay and Wesetern crosses from east to west, running through Grand Rapids, Elm Lake, and Dexterville. From Marshfield to Chicago it is 284 miles over the Soo Line, and from Grand Rapids toChicago over the C. M. & St. P. Ry. it is 270 miles.

The numerous towns within the county furnish a market for considerable farm produce, but the greater proportion is shipped to outside points. A large proportion of the income from farms comes from the sale of dairy products, chiefly butter and cheese, much of which goes to Chicago and eastern and southern cities. Practically all fat stock sold is shipped to Chicago. Hay is frequently shipped to Milwaukee.

The wagon roads throughout the southern one-third of the county are sandy. In places there are deposits of clay which could be utilized in improving the roads and this is being done in some instances. In the northern portion of the county the soil is heavy and where graded up roads are generally good. With continued heavy rains and when the frost is coming out roads are often heavy. Under the State Aid Highway Law many miles of improved road are being built each year and it is the plan to ultimately have such roads in every community.

Rural mail routes reach all parts of the area and the telephone is in common use in farm homes. Rural schools are found in every community and most of the school buildings are modern structures and kept in good repair.

SOILS*

The region covered by the present survey, in common with a considerable area extending over several adjoining counties in central Wisconsin, owes the general character of its surface to at

* For a full discussion of the geology of this region see Bul. XVI, Wis. Geol. & Nat. Hist. Survey, by Dr. Samuel Weidman, on Geology of North Central Wisconsin. Practically all Geological data used in the Soil Survey report of Wood Co. has been taken from this Geological report.

least four distinct processes of formation. These may be termed glacial, residual, alluvial, and probably loessial. To these may be added the accumulation and decay of large amounts of vegetable matter in low places and the formation of Peat.

Glacial formations cover approximately 60 per cent of the county and these formations were deposited at a much earlier date than the glacial debris covering northern and eastern Wisconsin. Geologically it is called the Pre-Wisconsin Drift, in which three periods of glaciation have been recognized. Two of these are found in Wood County. The glacial region is confined to the country north of the Green Bay & Western Ry. and covers most of the north two-thirds of the county with the exception of a narrow belt along the eastern border. The greater part of this region is within the region where the First Drift or earliest drift appears as the surface formation. About one township in the extreme northwestern corner of the county is covered by the Second Drift. Marshfield is situated on this area. Marking the southern border of the Second Drift is a pronounced range of hills known as the Marshfield Moraine.

The topography over the glaciated region varies from level to rolling, and in a few places hilly, though most of the region is characterized by long gentle slopes. There are comparatively few stones found upon the surface and most of the material consists of a silt loam or clay loam in texture. One of the most important characteristics of this old drift is the heavy compact subsoil and the fact that this subsoil is strongly mottled. This material has weathered to a much greater extent than the Late Wisconsin Drift, the topography is much more mature, and no lakes and a few peat marshes are found.

The portion of the area which is considered to be largely of residual origin occurs along the eastern border of the county in Milladore, Sherry, Sigel, and Rudolph Townships. The material forming the soil, and more especially the subsoil, has been derived from the weathering of the underlying crystalline rocks. Angular rock fragments frequently are found scattered over the surface, and a few glacial bowlders also occur. It seems probable that the region was traversed by an ice sheet, but its influence was very slight and does not seem to have influenced the region to any appreciable extent. This region is mostly gently rolling, with long slopes and broad rounded elevations.

In the southern half of the county there are a few areas over which the soil is also residual, but here it has been derived from Potsdam sandstone instead of from crystalline rocks.

The alluvial formations are confined to the southern one-third of the county, mostly south of Grand Rapids and the Green Bay and Western Railroad. This region consists of a series of sand flats associated with which, west of the Wisconsin River, there are extensive marshes. In some of these marshes there are numerous small sand islands only 1 or 2 feet higher than the level of the marshland. The greater part of the material throughout this sandy region is of alluvial origin, having been deposited by enlarged streams during pre-glacial or inter-glacial times. In a few places the underlying Potsdam sandstone comes to the surface and gives rise to a residual sandy soil. Where a shaly phase appears with the sandstone the residual material is considerably heavier.

Over most of the county north of the Green Bay & Western Railroad there appears a covering of extremely silty material which has some of the characteristice of loess and some authorities indicate that this may have been deposited by wind action. This loessial blanket extends over the residual area as well as over the glaciated region, but it is usually thin—from a few inches to two or three feet in thickness.

Throughout most of the northern half of the county and over isolated areas in the southern portion crystalline rocks make up the surface rock formation. These are, for the most part, granite. In the vicinity of Milladore, Pittsville, Grand Rapids, an at a few other points gneiss and schist appear as the surface rock. In the vicinity of Arpin and Powers Bluff conglomerate and quartzite occur. In Milladore and Sherry Townships and at a few other points diorite-gabbro appears as the surface rock. Outcrops of these various rocks are frequently seen.

Over most of the southern part of the county and along the western border Potsdam sandstone appears as the surface rock. In a few places the sandstone outcrops, though in most cases, especially near the Wisconsin River, it is deeply buried by deposits of alluvial sand.

All rock formations have contributed to a greater of less extent in the formation of the soils of this region. A much larger proportion of the soil material has come from the crystalline

rocks than from the sandstone. Through glacial action the crystalline rock debris has been carried over onto sandstone over considerable areas, especially in the western portion of the county. In other places small patches of sandstone occur over the crystalline rocks in the northern and northeastern parts of the county.

Ten soil series and 18 soil types, exclusive of Peat and Muck, were recognized and mapped in this survey.

The Colby series comprises light colored timbered upland soils chiefly within the region of Pre-Wisconsin glaciation where the material has come largely from crystalline rock formations and where the subsoils are compact, of impervious nature, and strongly mottled. This is the most extensive series mapped and is the predominating soil throughout the northern two-thirds of the county.

The Marathon series comprises light colored upland timbered soils where the material is largely residual, having been derived from the weathering of the underlying crystalline rocks. It is confined to the northeastern portion of the county. It is of much smaller extent than the Colby soils.

The Vesper series is characterized by heavy surface soils of glacial or loessial origin, underlain by sand or bed rock at an average depth of from 18 to 24 inches. The underlying rock is usually sandstone, though in some cases it was found to be crystalline rocks. The surface is usually level and the natural drainage is deficient over the typical soil.

The Kennan series includes light colored upland timbered glaciated soils derived from crystalline rock material. It differs from the Colby by having a more open subsoil and by not being mottled.

The Whitman series includes dark brown to black lowlying soils which occupy a position comparable with the Clyde series, but which occur in a non-calcareous region and have been derived largely from crystalline rocks. They may occur as depressions or poorly drained areas in the upland or as alluvial bottoms along stream courses throughout the same region. The series is of limited extent in the present survey. It is most closely associated with Colby and Marathon soils.

The Boone series includes light colored upland soils which

have been derived from the weathering of Potsdam sandstone. The soils are for the most part very sandy.

The Plainfield series includes light colored timbered soils of alluvial origin where the parent material has come largely from sandstone formations. This series is found extensively in the southern third of Wood County in the valleys of the Wisconsin and Yellow Rivers. Most of the soils mapped in this series in the present area are of a very sandy nature. They occur chiefly as terraces and are not subject to overflow.

The Dunning series consists of low-lying dark colored or black soils which have a position comparable with that of the Clyde soils, but the Dunning differs from the Clyde by being in a non-calcareous region, and by having been derived largely from sandstone material. It is confined to the southern part of the area.

The Genesee series consists of light to dark brown alluvial soils occupying first bottom lands which are subject to overflow. The parent material came largely from reworked glacial debris.

The Antigo series includes light colored soils of alluvial origin where the parent material has been derived largely from crystalline rocks and now occurs as outwash plains or river terraces above present flood flow.

Peat, Shallow Peat, and Muck consist of decaying vegetable matter with which there is incorporated varying amounts of mineral matter, and which extends to varying depths.

Undifferentiated sand and marsh consists of marsh land and low flat sand islands so intricately associated that a separation was impossible on the scale used.

Area of different types

Soil	Acres	Per cent
Colby silt loam	109,440	25.9
Rolling phase	24,384	
Vesper silt loam	60,736	15.0
Rolling phase	16,640	
Peat	49,920	13.1
Shallow phase	17,856	
Plainfield sand	60,224	11.6
Whitman silt loam	42,112	8.1
Sands and peat (undifferentiated)	28,736	5.6
Dunning sand	16,640	3.2
Plainfield fine sand	15,936	3.1
Boone fine sand	14,528	2.8
Vesper fine sandy loam	8,896	1.7
Rolling phase	8,896	1.7
Marathon silt loam	8,000	1.6
Dunning fine sandy loam	7,424	1.4
Genesee fine sandy loam	7,000	1.4
Marathon fine sandy loam	6,208	1.2
Genesee silt loam	5,312	1.0
Dunning fine sand	3,840	.7
Plainfield sandy loam	2,304	.4
Antigo fine sandy loam	1,216	.2
Muck	960	.2
Kennan fine silt loam	512	.1
Total	517,760	

CHAPTER II.

GROUP OF HEAVY SOILS

COLBY SILT LOAM

Extent and distribution.—The Colby silt loam is the most extensive type mapped. It occupies a large part of the northern half of the county. It occurs here in areas unbroken except for an occasional hill or ridge occupied by the rolling phase and small, narrow areas of Whitman silt loam along stream courses. Within the Vesper soils the Colby silt loam is mapped in a few areas where the depth to the sandy layer is so great as to warrant its separation.

Description.—The surface soil of the typical Colby silt loam is a grayish-brown silt loam, 8 to 10 inches in depth, very smooth to the feel, and carrying little or no coarse material. When wet it is more yellowish brown in color and rather sticky, though it does not polish on the auger. A few bowlders occur scattered over the surface.

The subsoil is a mottled yellow, drab, brown, and blue silt loam, grading into a heavy, tenacious, sticky silty clay loam at depths of 15 to 18 inches. This mottled silty clay generally extends to a depth greater than 3 feet. The stiff, close character of the subsoil makes it almost impervious to water, and this stratum is locally called "hard-pan." The mottled color of the subsoil is characteristic of the type. It is not uncommon for the mottlings to come within 2 or 3 inches of the surface.

The type as a whole is remarkably uniform, but the lower subsoil is subject to some variation. In the vicinity of the Marshfield Moraine a layer of gravelly, gritty silty clay loam occurs at varying depths. At greater distances from the moraine, both east and west, the mottled silty material becomes deeper and in general extends to a depth greater than 3 feet. In the northern part of Richfield Town residual material from sandstone occurs at depths

of 36 to 40 inches, while farther south, in the same town, the sandstone comes closer to the surface. Where the sandy material is within 20 inches or less of the surface the soil is separated as the Vesper silt loam. There is an increasing percentage of very fine sand in both surface soil and subsoil as the Vesper soils are approached, the texture being a silty loam in some places. The sandstone stratum does not extend as far north in the eastern part of the county as in the western, but there occasional isolated outcrops within 3 or 4 miles of the north county line, as just south of the railroad tracks, a few rods from Auburndale, in the northeast quarter of section 27.

A variation in the type occurs in the northern two-thirds of Rudolph Town and in a small area north of Milladore. The surface soil here is a gray to yellowish-brown silt loam, 8 to 10 inches deep, friable in structure and smooth to the feel. The subsoil consists of a brownish-yellow silt loam grading at 18 to 20 inches into a mottled silty clay loam, very heavy, tenacious, and sticky. The mottlings are yellow, brown, and gray. The subsoil below the depth of 30 inches may contain considerable residual material, although the mottled subsoil quite commonly continues to a depth greater than 3 feet. The topography in general is gently undulating to undulating. Because of the heavy, tenacious character of the subsoil the land is nearly always poorly drained, especially in the more nearly level areas, and crop production is more often limited on this account than for any other reason.

Topography and drainage.—The topography of the Colby silt loam ranges from level to gently undulating. The region occupied by this type is characterized by long, gentle swells and broad, nearly flat areas. Because of the level topography and impervious subsoil, the type as a whole is poorly drained. The drainage of the areas of Colby silt loam is divided. In the northern part of the county it is toward the north, into the Little Eau Plaine River. In the central part of the county Mill Creek and its tributaries drain to the east into Portage County. In the western part the Yellow River drains to the southwest into Juneau County, cutting through the Marshfield Moraine in section 26, township 25 north, range 2 east. The line of the Minneapolis, St. Paul & Sault Ste. Marie Railway follows approximately the divide between the first two drainage systems, and the Chicago and North Western Railway the divide between the second and

TYPICAL SURFACE FEATURES OF COLBY SILT LOAM, ON MARSHFIELD BRANCH EXPERIMENT STATION FARM

There are over 100,000 acres of this class of land in Wood County. This is a good productive soil but because of the level to very gently sloping surface and the heavy, tight subsoil the natural drainage is somewhat deficient.

UNIMPROVED COLBY SILT LOAM

During the period of transition from cut-over lands to cultivated fields this soil affords most excellent grazing.

third. The most extensive unbroken areas of Colby silt loam, with a typical level to very gently rolling topography, occupy these divides, as in sections 27, 32, 33, and 34, Milladore Town; sections 14, 15, and 16, Auburndale Town; section 17, Lincoln Town; and along the line between Marshfield and Richfield Towns. In some instances the surface is that of a long, gentle slope rather than strictly level. These areas occupy the same physiographic position as the broad prairies of southern Wisconsin. Adjacent to intermittent drainage courses and where the Whitman silt loam occurs the Colby silt loam is commonly quite level and wet. Some of the wettest areas are indicated by marsh symbols.

Origin.—The Colby silt loam is confined to the region covered by the early periods of glaciation. The glacial material has come from crystalline rocks and has been weathered to a much greater extent than material from the late Wisconsin drift. The extreme silty surface soil appears to be part of the blanket of loesslike material which covers much of the State. In a few places the deep subsoil is residual from the underlying crystalline rocks. Both surface soil and subsoil show varying degrees of acidity. The material is often strongly acid.

Native vegetation.—The original timber growth on the Colby silt loam consisted of mixed hardwoods, maple, oak, basswood, elm, birch, large white pine, and some hemlock. The second growth is poplar. Most of the merchantable timber has been cut, but a considerable acreage still supports some valuable timber.

Present agricultural development.—Less than 25 per cent of this type is under cultivation. Adjacent to the railroads the land is fairly well cleared, but in many sections the more remote tracts are still in brush and timber. Away from the villages there are large areas that have not been cleared at all except in small patches near the roads. Before clearing the land seems wet, but under cultivation the surface water is removed with more rapidity. Even then, however, the drainage is not adequate in many cases, because of the slow movement of water downward through the soil. This causes the ground to remain very wet for some time after rains and crops do not make their best development.. The soil is cold and backward in the spring. The nearly level and the very gently undulating areas have about equally good under-

drainage, but the gently undulating land is the more desirable from the standpoint of surface-drainage possibilities.

Where fair drainage can be effected this soil gives good yields. It is especially well adapted to grasses, clover making a remarkably good growth. Oats, barley, rye, and other grains produce large yields, but have some tendency to lodge. Corn for ensilage does fairly well and the crop often matures. Root crops give heavy yields.

Selling values of improved land of the typical Colby silt loam range from $40 to $100 an acre.

In the cultivation of this soil the fields should be plowed in narrow lands, so that the dead furrows will assist in carying off the surface wate. Practically all the land would be improved by tile drainage. Because of the impervious nature of the subsoil the lines of tile, to be most effective, must be placed closer together than on any other soils in Wisconsin. The type requires careful cultivation with heavy stock and tools. It should be worked only when moisture conditions are most favorable. A mellow seed bed can then be readily obtained. The plowing under of green manuring crops, preferably the legumes, improves the physical character of the soil and increases the supply of origanic matter. As the soil is acid, and frequently strongly acid, the use of lime is necessary if alfalfa is to be grown. On new land red clover does very well in spite of the acidity, because of the high virgin productiveness, but on old fields the use of lime would be beneficial to red clover and also to general farm crops. Because of the rather high cost of correcting the acidity on this type it may be advisable to grow such legumes as alsike clover and soy beans, which do well on acid soils, in place of red clover and alfalfa.*

COLBY SILT LOAM, ROLLING PHASE.

Extent and distribution.—The rolling phase of the Colby silt loam occurs in the northern half of the county in irregular areas associated with the typical Colby silt loam. It has a more rolling surface. In a few areas mapped, such as those adjacent to Powers Bluff and Cary Mounds, the topography is very rolling and the phase much better drained than the typical

* For chemical composition of this soil see page 33.

soil. The rougher areas containing rock outcrops are indicated on the map by symbols.

Description.—The surface soil of the Colby silt loam, rolling phase, is a gray to brown, friable silt lam, 8 to 10 inches deep, very smooth to the feel and comparatively low in organic matter. The virgin soil often has a dark-brown color in the surface one or two inches, due to an accumulation of organic matter. An occasional bowlder occurs on the surface. The subsoil consists of a grayish-brown silt loam mottled below 12 inches with yellow, brown, and gray. Below 15 inches the subsoil becomes a strongly mottled, heavy silt loam or silty clay loam. It is very compact, tenacious, and impervious to water.

On the whole the surface material is remarkably uniform, but the lower subsoil is variable. Prevailingly a mottled silty clay loam extends to a depth greater than 3 feet, but occasionally within 30 inches a gravelly clay loam of glacial origin occurs. Reddish, gritty clay loam or clay, of residual origin, is also encountered in places. In some of the more rolling areas there is very slight mottling and in some places almost none. In places here the soil resembles very much the Kennan silt loam, rolling phase, except that the gravelly layer is lacking.

Topography and drainage.—The phase has a very gently rolling to rolling topography. In the more rolling situations some small areas are too steep for general agriculture, being better adapted to use as pasture. The natural surface drainage is in general good, but some of the more gentle slopes would doubtless be benefited by tile drainage. The rolling phase is separated chiefly to indicate those areas which have slope enough to insure good surface drainage. Only in the more rolling areas is erosion serious, although it demands some attention on the gently rolling to rolling tracts.

Origin.—In origin the rolling phase of the Colby silt loam is practically the same as the typical soil having been derived through early glacial action from crystalline rocks, and being covered with a mantle of loess-like material, the exact origin of which seems to be still in question. Like the typical soil, the phase is quite acid.

Native vegetation.—The original timber growth on this soil consisted of mixed hardwoods, some hemlock, and large white

pine. All of the pine and much of the best hardwood has been removed.

Present agricultural development.—A large percentage of this phase is under cultivation. Owing to its better drainage it has in general been taken up before the more level soils. It is very productive. Grains,such as oats, rye, and barley do well and occupy a large proportion of the total cultivated area. Corn ripens on this soil better than on some of the other types. Some of the best corn observed in the fall of 1915 was on one of the more rolling areas of this soil, where air drainage had prevented early frosts. The phase makes an excellent general-farming and dairying soil, since it is especially well adapted to grasses and clover. Some of the most highly developed farming communities in the county are on this class of land.

The suggestions made for the improvement of the typical soil apply also to this phase, except in regard to the drainage conditions. Because of the better drainage the phase can be cultivated earlier in the spring. It is somewhat easier to handle and on the whole is more desirable soil.

Land values on the rolling phase of the Spencer silt loam range from $50 to over $100 an acre, depending upon the location, buildings, topography, and other factors. *

VESPER SILT LOAM

Extent and distribution.—The Vesper silt loam is the second soil type in the county in importance from the standpoint of area covered. It occupies a total area of over 60,000 acres not including the rolling phase which covers an additional 16,000 acres. The Vesper silt loam occurs as a broad, rather irregular belt which extends nearly across the center of the county from east to west. The towns of Vesper, Pittsville, Veedum, Progress and Lindsay are largely surrounded by this soil. This Vesper area is bounded on the south chiefly by the sandy soils of southern Wood County, and on the north by the heavy soils of the Colby series.

Description.—The surface soil of the Vesper silt loam, extending to a depth of 8 to 10 inches, is a gray to grayish-brown silty loam to silt loam, containing in some places a small amount of fine and very fine sand. It is not uncommon for the surface soil

* For chemical composition of this soil see page 33.

to show slight mottlings. Fragments of sandstone occur occasionally on the surface over areas of small extent, but most of the type is stone free. The subsoil to a depth of 20 to 24 inches is a very compact silt loam, mottled drab, yellow, and brown. It passes at a depth of about 2 feet either into a drab or yellow, fine or medium sand or into more or less decomposed sandstone. Above the sand or sandstone the subsoil for a few inches is a heavy sandy loam or gritty clay loam.

The character and depth of the subsoil material are variable. Their condition over a large part of this type is probably well shown in the clay pit at the brick and tile works at Vesper. Beneath a 2 foot layer of more or less mottled silt loam there occurs about two feet of decomposing sandstone and sand. This is underlain by a red clay which extends to a considerable depth, and is derived apparently from the weathering of underlying crystalline rocks. The sandstone varies in thickness; in places it is very nearly lacking. This condition gives rise to considerable variation in the subsoil. Occasionally the red clay comes quite near the surface over a small area where the sandstone is lacking. In places the sandstone or sand may be within 18 to 20 inches of the surface, and the silty layer a little thinner than typical. The silt loam in other places may be deeper than typical. In general, where the mottled silt loam to silty clay loam layer has a depth greater than 30 inches the soil is separated as the Colby silt loam, on the assumption that where the heavy subsoil is of this or a greater depth the drainage possibilities more nearly approximate those of the Colby soil. This type very much resembles the Colby silt loam, except in its sandy subsoil.

Topography and drainage.—The topography of most of the type is level. Some areas are gently undulating, but on the whole the surface is much more nearly level than in the case of the corresponding type in the Colby series. The Vesper silt loam occurs in broad, level areas which often extend for several miles unbroken except for an occasional strip of marsh lying at only a slightly lower level. Because of the flat topography, the drainage of most of the type is naturally very poor.

Where the soil section remains uniform but the surface becomes sufficiently rolling so that the surface drainage is fair to good the material has been separated on the soil map and indicated as the rolling phase.

Origin.—The material forming the Vesper silt loam has been derived from several sources. The type occurs within the region covered by the pre-Wisconsin ice sheets, and part of the mantle over the rock is doubtless of glacial origin. The extremely silty material, however, is loesslike in texture and structure and may be in part of wind-laid origin. The deep subsoil in most cases is residual from sandstone. In a few instances where sandstone is lacking the underlying crystalline rocks are the source of the material. Both surface soil and subsoil show varying degrees of acidity.

Native vegetation.—This soil was originally timbered with mixed hardwoods, white and Norway pine, and some hemlock. Practically all the pine was logged off many years ago. Large areas have been burned over, as just west of Vesper and west of Pittsville, and are now covered with a second growth of poplar. Where the land has not been burned over the present timber growth is basswood, maple, elm, birch, and poplar.

Present agricultural development.—Except in areas adjacent to the railroads this type is not highly developed. Large areas have not been cleared at all except in patches adjacent to the highways. The areas in Sigel Town probably are as well developed as any part of the type.

Surface drainage improves very much upon clearing of the land, but the level topography and tight, impervious nature of the upper subsoil cause drainage even then to be deficient. Shallow surface ditches help to remove the water, but often it is difficult to obtain an outlet low enough to empty these, and frequently water stands on the ground for several days after a rain, doing much damage to growing crops.

The principal crops grown are clover, timothy, rye, oats, and some barley. Corn is a rather uncertain crop because of the poor drainage and the danger from frosts in the low-lying, level areas. Corn for ensilage does fairly well. Grasses are especially well adapted to this soil. Crops such as cabbage, rutabagas, mangel-wurzels, and turnips produce heavy yields and the roots can be used to some extent to take the place of ensilage. When the price of cabbage is low this crop is often fed to cattle.

Improved farms on the Vesper silt loam range in value from

$35 to $75 an acre, the price depending upon the acreage cleared, the farm buildings, location, drainage, and other considerations.*

VESPER SILT LOAM, ROLLING PHASE

Extent and distribution.—The Vesper silt loam, rolling phase, occurs in the central part of the county, where it occupies the more rolling land in association with the typical Vesper silt loam. The phase occurs on slopes and hills. Throughout Sigel Town the phase occupies many short slopes, marking the boundary between one broad level area and another level area at a slightly higher elevation. Its most extensive development occurs northeast of Pittsville, where it covers several square miles.

Description.—The surface soil of the rolling phase of the Vesper silt loam to a depth of 7 to 9 inches is a grayish to grayish-brown silty loam to silt loam, containing a small amount of fine and very fine sand. It is underlain by a mottled brownish-yellow silt loam to silty clay loam which contains a very small percentage of fine sand. At 24 to 30 inches there is a very abrupt change to a yellowish or drab fine or medium sand or sandy loam or decomposing sandstone.

Considerable variation occurs in the subsoil, both in depth and character of the material. In some areas the mottled silty clay loam subsoil is undoubtedly deeper than typical, but in general where it extends to a depth greater than about 30 inches the soil is mapped as the Spencer silt loam. In places in some of the larger areas a gravelly sand occurs. This is probably of glacial origin. Associated with the sandstone are shaly layers which weather into a mottled gritty clay, with the result that occasional heavy layers are encountered in the subsoil. Fragments of sandstone occur frequently on the surface. Much of this rock is of a very indurated nature and has furnished little material to the surrounding silt loam soil. On slopes occasional rock outcrops occur. This phase resembles very much the rolling phase of the Colby silt loam, but differs in containing sandy material in the subsoil.

Topography and drainage.—The topography of the Vesper silt loam, rolling phase, is undulating to gently rolling. Most

*For a discussion of the chemical composition of this soil see page 33.

of the land is well drained. Only in the more rolling areas is the phase subject to erosion.

Origin.—The material forming this soil is from several sources and has practically the same origin as that giving rise to the typical soil. The phase differs chiefly in being much better drained.

Native vegetation.—The native vegetation on this soil consisted of oak, basswood, maple, elm, and pine. At present much of the land not improved is covered with poplar.

Present agricultural development.—A rather large proportion of the phase is under cultivation. The area northeast of Pittsville is very highly developed. The phase is a very good general farming soil, and is especially well adapted to grasses. Excellent yields of oats, rye, and barley are obtained. Potatoes yield quite heavily. In the vicinity of Pittsville an area of about 100 acres devoted to cabbage is partly on this soil. Heavy yields of cabbage of excellent quality are obtained. Root crops make excellent growth and to some extent take the place of corn, although the phase is about as well suited to corn as any of the other heavy types of the county.

Many of the small areas of the phase within broad tracts of the typical Vesper silt loam make excellent building sites and are used to quite an extent for this purpose.

The phase can be cultivated under a wider range of moisture conditions than the typical soil, and is a better all-around type, since it warms up earlier. is better drained, and slightly lighter in texture. It is considered a first-class general-farming soil. *

Improved farm land on this phase ranges in value from $75 to $100 an acre, the price depending upon the location, improvments, and other factors.

KENNAN SILT LOAM

Extent and distribution.—The Kennan silt loam, occurs in the northwestern part of the county, occupying the area known geologically as the Marshfield Moraine. This enters the county in sec. 6, T. 24 N., R. 2 E., and extends continuously east and northeast through the southwestern part of T. 25 N., R. 2 E., leaving the county in secs. 5 and 6, T. 25 N., R. 3 E. It occupies a ridge

* For a discussion of the chemical composition of this soil see page 33.

VIEW SHOWING TYPICAL SURFACE FEATURES OF COLBY SILT LOAM, ROLLING PHASE

The long gentle slopes as shown in this view are characteristic of the rolling phase, and explain why the natural drainage is better than on the Colby silt loam which is level.

VIEW IN THE MARSHFIELD MORAINE, WHERE KENNAN SILT LOAM IS THE PREDOMINATING TYPE OF SOIL

This soil occupies the most pronounced range of hills in Wood County. The range extends to the southwest from Marshfield. In many places it is more rolling than indicated in this view.

rising 75 to 150 feet above the surrounding lowland to the south and southeast, which can be seen for a distance of 10 to 20 miles.

Description.—The surface soil is a smooth, yellowish-brown to brown silt loam 8 to 10 inches in depth. It is underlain by a light yellowish brown silt loam containing a small amount of very fine sand. At a depth of 15 inches this material gradually changes into a brownish-yellow silty clay loam. Very slight mottling brown iron stains sometimes occurs at a depth of about 20 inches. At 24 to 30 inches the subsoil becomes gritty and grades into a gravelly, sticky sand, which carries some cobbles. This coarse material is derived from crystalline rocks. Bowlders occur frequently on the surface. The surface soil resembles the Colby silt loam, rolling phase, but the subsoil does not show the mottling characteristic of the Colby series and the gravel content is greater.

In some of the more rolling and broken areas of the Marshfield Moraine the soil varies from typical in being gravelly. It usually consists of somewhat gravelly loam or silt loam underlain by a very gravelly layer, but in places the surface material has been eroded away, leaving a gravelly sandy loam exposed. This phase covers a total area of less than 1 square mile in sec. 26 and also in secs. 27, 28, 33, and 34, T. 25 N., R. 2 E. It gives good yields of such crops as rye and oats, but when planted to such crops as corn the land tends to wash badly.

Topography and drainage.—The surface of this type is rolling to very rolling, and the natural drainage is good. Some of the steeper slopes are subject to erosion, and upon these there is sometimes difficulty in using modern farm machinery.

Origin.—The soil has been formed very largely through the weathering of drift composed of ground-up granites. The Marshfield Moraine is the terminal moraine of one of the pre-Wisconsin ice sheets. The accumulation of drift which forms the ridge is of considerable depth, varying from about 86 feet at Marshfield to 156 feet at Bakerville and 160 feet north of Lindsey.

Native vegetation.—The timber growth on this land consisted of mixed hardwoods, white pine, and hemlock.

Present agricultural development.—This soil is more highly developed than any other in the county. A very large proportion of it is under cultivation. It is an excellent small-grain soil,

and corn does very well. There is less danger of damage from early fall frosts than on the Colby silt loam. The soil is very well suited to grasses and clover. It is all devoted to general farming and dairying, for which branches of agricuture it is very well adapted. The farm buildings and other improvements on this land are the best in the county.

Land values on the better improved areas of the Kennan silt loam, in the vicinity of Marshfield range from $100 to $150 an acre.*

MARATHON SILT LOAM

Extent and distribution.—This type is of rather limited extent, occupying a total area of 8000 acres. It is confined almost entirely to the northern part of the county in the Town of Rudolph, where it occurs as extensions of larger tracts in Marathon and Portage Counties. The areas are usually small and of irregular outline.

Description.—The surface soil of the Marathon silt loam, to a depth of 7 to 8 inches, is a brown to yellowish-brown silty loam or silt loam, carrying a small amount of very fine sand. Occasional rock fragments are common on the surface. The subsoil consists of a yellowish-brown silt loam grading into a silty clay loam of various colors—yellow, brown, and reddish brown. Yellowish brown predominates. This color variation does not occur as a mottling, but depends upon the character and degree of weathering of residual material in the subsoil. Below 2 to 3 feet the subsoil quite commonly, is more or less gritty and contains fragments of crystalline rocks.

This soil does not have as prominent a gray cast as does the Colby silt loam, and does not show the mottling characteristic of the Colby soils.

Included areas in the north-central part of the county, near the county line in township 25 north, ranges 3 and 4 east, vary slightly from the typical silt loam. The surface soil here is a grayish-brown to brown silt loam, 8 to 10 inches in depth, underlain by a yellowish-brown silty loam which grades into a silty clay loam. At 2 to 3 feet decomposed granite is encountered.

* For a discussion of the chemical composition of this soil see page 33.

Because of this more open subsoil the type has even better drainage than the Colby silt loam, rolling phase.

Topography and drainage.—The surface soil of this type ranges from gently rolling to rolling, and the natural drainage is everywhere good. A few of the steeper slopes show evidences of erosion, and this is apt to become more serious unless precautions are taken to minimize the effects.

Origin.—This soil apparently is partly residual. In the western part of Rudolph Town the presence of numerous bowlders would indicate that the residual material has been covered to a greater or less depth by glacial drift. The surface soil probably has originated from the weathering of the same silty covering from which the Colby surface soils are derived.

Native vegetation.—The original timber growth on this soil consisted of mixed hardwoods, white pine and scattered hemlocks. By far the greater part of the timber has been removed, only a few wood lots remaining.

Present agricultural development.—A large proportion of the land is under cultivation. The soil is very productive. It is especially adapted to oats, barley, rye, grasses, and clover. Corn does very well for ensilage, and in the average year it ripens. The steeper slopes are not well suited to intertilled crops, because of the possibility of erosion. The tendency to erode is lessened by the presence of rock fragments on the surface and through the soil.

CHEMICAL COMPOSITION AND FERTILITY OF HEAVY SOILS

The heavy soils of the Colby, Vesper, Kennan and Marathon series have a good supply of the mineral elements phosphorous and potassium.

Phosphorous.—The total amount of phosphorous in an acre to a depth of 8 inches varies from 1,100 to 1,400 pounds. This would be sufficient for 100 to 150 crops if all were available, but it is never practicable to secure good growth from such soils after the total phosphorous has been reduced to six or eight hundred pounds and better results are always secured when the total phosphorous content of this layer of soil is retained at from 1,500 to 2,000 pounds per acre 8 inches. A farmer on this land, therefore, should adopt plans which will maintain the present supply

of this element rather than attempt to draw on it even for a short number of years. The availability of this element requires a good supply of organic matter.

Potassium.—The element potassium exists in very much larger amounts in these soils than does the element phosphorous—in fact they contain on the average over 30,000 pounds of this element per acre to a depth of 8 inches. This is a sufficient supply to meet the demands of heavy crops for several hundred years. The entire problem with reference to potassium, therefore, is connected with its availability. When a good supply of active organic matter is present it can be assumed that there is sufficient potassium made available for practically all crops grown on this land. In the case of a few special crops requiring unusually large amounts of this element, such as cabbage and tobacco, the use of potash fertilizers may in some cases be profitable. The system of farming followed will also influence the potassium supply. A large part of this element goes to the stalks and straw of the plant so that if the hay and rough forage is fed the greater portion of this element is returned to the land in the manure—differing radically from phosphorous which goes to the grain and is, therefore, more likely to be sold.

Organic matter and nitrogen.—Compared with prairie soils which have shown a lasting fertility, these soils are distinctly low in organic matter and nitrogen. In fact, most upland soils of wooded regions are low in organic matter. When stock raising is practiced manure is available and is of course good as far as it goes, but on comparatively, few farms is there sufficient manure produced to maintain the organic matter in soils of this character, and other means should be used to supplement the barnyard manure. Green manuring crops should be used as far as possible, turning under the second crop of clover whenever this can be done rather than using it for pasture. Seeding clover in corn at the last cultivation will secure good growth when the season is favorable. Cultivated ground when used for pasture should not be grazed closely.

Nitrogen is perhaps the most essential element of plant food and large amounts are used by all crops. It exists only in the organic or vegetable matter of the soil, there being none whatever in the earthly material derived from the rocks. Soils which are low in organic matter are, therefore, also low in nitrogen. By

all means the cheapest source of this element is through the growth of legumes such as clover, alfalfa, soy beans, etc., which collect it from the atmosphere. When these crops are turned under they contain an abundance of this element. When fed to stock a portion only is returned to the land. But when land of the character of that under discussion is used for mixed farming so that at least one-fourth produces a good crop of clover or alfalfa each year the supply of nitrogen can be maintained on a dairy or stock farm but where any considerable portion of the land is in crops which are sold entirely one-third or more would have to be in some legume crop to maintain the nitrogen supply.

Acidity and liming.—Since all of these soils were formed from rocks not containing lime carbonate they are essentially all acid. The degree of acidity varies from one which would require 1,000 to that which would require 5,000 pounds or more lime to correct. This acidity is not in itself a direct detriment to the growth of most farm crops, but does interfere with the growth of the best legumes. Clover will do well while this soil is new even though acid, but after this land has been cropped a number of years the acidity should be corrected to secure the best results with medium red or mammoth clover. Alfalfa is very sensitive to acidity and lime in some form must be used to secure good results with this crop even on new land.

Crops.—Kennan and Marathon silt loams and the rolling phase of Colby and Vesper silt loams are adapted to a wide range of crops including corn, root crops, grasses and small grains. The typical Colby silt loam and Vesper silt loams, however, are not so well adapted to such a range of crops because their level surface and heavy subsoil give them rather inadequate drainage. They are, however, well adapted to grains and grasses. Fields on the Colby and Vesper soils having good slope and surface drainage can be made to produce good corn by careful management. The soils of this group are well adapted to dairy farming on account of their unusual fitness for the growing of hay and pasture.

CHAPTER III.

GROUP OF FINE SANDY LOAM SOILS.

MARATHON FINE SANDY LOAM

Extent and distribution.—This type of soil is confined to the northeastern half of the Town of Milladore where it is the prevailing upland soil. It covers a total area of 6,208 acres.

Description.—The surface 6 to 10 inches of this soil is a grayish-brown to yellowish-brown fine sandy loam, with sufficient content of fine material to be slightly sticky. Small, angular crystalline-rock fragments occur frequently on the surface and through the surface soil and subsoil, and there is an occasional bowlder. The subsoil is a yellowish-brown fine sandy loam, grading into a sticky sandy loam or fine sandy loam. Below 24 to 30 inches the subsoil becomes a sand and quite commonly contains many rock fragments. The subsoil varies to quite an extent, occasionally being a rather heavy fine sandy loam to loam. In sections 1 and 2, Milladore Town, there occurs below 30 inches a compact layer, derived probably from mica and chlorite schists. It contains a large percentage of fine mica flakes and has a smooth feel like soapstone. At 3 to 8 feet the rotten rock is reached.

Included with this type are some areas of fine sand which are too small to show as a separate type. In the northern tier of "forties" in section 25, Miladore Town, is a narrow strip of fine sand, known locally as the "sand ridge." Other small areas occur throughout the center and in the southwest corner of section 16, and in the northwest quarter of section 3. In these areas the soil consists of a yellowish-brown medium fine sand, 6 to 10 inches deep, underlain by a brownish-yellow fine sand which continues to considerable depths. The color grows lighter with depth. In cuts the sand is seen to reach depths of 8 or 10 feet. This fine sand variation contains very few rock fragments, and in places none are observed.

In one place the surface soil to a depth of 8 inches consists of a yellowish-brown fine sandy loam carrying a moderate amount of rounded gravel. This is underlain by a light yellowish brown fine sandy loam which becomes lighter in texture and color with depth. The rounded coarse material may be derived from a conglomerate or it may be of glacial origin, occuring, as it does, very near the boundary of the area of this soil.

Topography and drainage.—The topography is for the most part rolling and the natural drainage is very good, but a few included areas are nearly level or very gently rolling and some of these are not quite so well drained. When the land is cleared and the channels become better established most of these level areas will drain out readily.

Origin.—The greater part of this soil is derived from the weathering of siliceous granites, mica schists, chlorite schist, and other similar rocks. Evidences of glacial action in the form of bowlders occur in sections 5 and 13, and the soil material has very probably been reworked to some extent by the ice.

Native vegetation.—This land was originally heavily timbered with white and Norway pine, hemlock, and mixed hardwoods. The pine has practically all been cut many years ago, and much of the other timber has been taken out more recently. At present a number of farms contain some merchantable timber. Much of the land has been burned over and has grown up to poplar. This growth, with the numerous stumps and old tree trunks towering up, gives the undeveloped areas a desolate appearance.

*Present agricultural development.**—Much of this type is unused. Many settlers have recently come in and undertaken the work of clearing. Owing to its good drainage and medium texture this soil is warmer and earlier than the surrounding silt loams. It is well adapted to potatoes, small grains, and grasses. Corn will probably do much better on this soil than on the surrounding heavy types, since it warms up much earlier and is not subject to frosts, owing to its rolling topography.

Uncleared land of this type has a selling value of $15 to $25 an acre.

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* For chemical composition of this soil see page 41.

VESPER FINE SANDY LOAM

Extent and distribution.—This soil occupies a total area of 8896 acres. It occurs in the central and west-central parts of the county, where it is associated with the Boone fine sand and the Vesper silt loam. In general, the areas of this soil lie to the north of the Boone fine sand.

Description.—The surface soil of the Vesper fine sandy loam, extending to a depth of 6 to 10 inches, is a grayish-brown loamy fine sand to fine sandy loam. In some places the surface soil has a dark-brown color, due to the accumulation of organic matter. The subsoil is variable. Prevailingly it consists of a yellowish-brown to a grayish-yellow fine sandy loam, grading at 20 to 24 inches into a quite sticky, gritty clay loam. This heavy layer is of a bluish-drab color, and usually carries considerable sand, which gives it a very gritty feel. Quite commonly this layer is mottled with red, yellow, blue, and drab. In many places the heavy layer is lacking, the subsoil grading from a fine sandy loam into a light grayish yellow to yellow fine or medium sand and then into the sandstone. Fragments of sandstone are common on the surface and throughout the soil section.

This soil very much resembles the Whitman fine sandy loam in texture, topographic position, and drainage conditions. The surface accumulation of organic matter in this soil is much less, and the drainage on the average is probably a little better.

Topography and drainage.—The topography is level and the natural drainage is generally poor. In a few areas the natural drainage is much better than the average, and a small proportion of the phase has naturally good drainage.

Origin.—The material forming this soil has been derived largely through the weathering of Potsdam sandstone, with which there is associated varying quantities of shale. This shale on weathering gives rise to the clayey material in the subsoil. Both surface soil and subsoil are acid.

Native vegetation.—The timber growth on this soil at present is largely poplar, with some alder and willow. Some open strips are covered with marsh grass. The original timber consisted of Norway and white pine.

Present agricultural development.—Only a very small proportion of the type is farmed. Some of the better drained areas have been put under cultivation recently. Over a large part of the type artificial drainage will be necessary before the land can be farmed with much success. Even under the most favorable conditions this can be classed as only a fair soil. In its present condition most of the type has a low value, and for successful use it will require careful management.*

VESPER FINE SANDY LOAM, ROLLING PHASE

Extent and distribution.—This phase has practically the same area within the county as has the typical soil, covering as it does 8,896 acres.

It occurs in irregular areas associated with the Vesper soils throughout the south-central part of the county. The largest areas occur in secs. 2 and 11, T. 23 N., R. 4 E., west of Vesper, in sec. 2, T. 22 N., R. 4 E., in vicinity of Altdorf, and along the Yellow River near Pittsville. The only area of any considerable extent mapped outside the region in which the Vesper soils predominate is in secs. 11, 12, 13, and 14, T. 24 N., R. 5 E., adjacent to Mill Creek. In this area sandstone was observed the NW.¼ NE.¼ sec. 14, and for this reason all the fine sandy loam soil was mapped with the Vesper series, notwithstanding the fact that in some places no sandstone was in evidence.

Description.—The surface soil, to a depth of 8 to 10 inches, is a grayish-brown to yellowish-brown fine sandy loam, with a slightly darker color in the surface 1 or 2 inches in virgin areas. Fragments of sandstone occur frequently upon the surface and through the surface soil. The subsoil is a yellowish-brown, or in places slightly reddish brown, fine sandy loam, with a slightly greater content of clay at 15 to 18 inches. Below 20 to 24 inches it becomes lighter textured, grading into a yellowish, fine to medium sand from the underlying sandstone, which is generally reached within 3 feet. In many places the subsoil below the depth of 1 foot is a fine to medium sand.

Topography and drainage.—The topography is in most places gently rolling to rolling. In certain areas along the Yellow River south of Pittsville and along Hemlock Creek south of Vesper the surface is nearly level, but on account of the situation adjacent to the river the drainage conditions are much better

* For chemical composition of this soil see page 41.

than on the best areas of the typical soil and the land corresponds in agricultural value with that of more rolling topography.

Some areas mapped with this type consist of sandstone mounds of considerable height covered, for the most part, with a fine sandy loam soil. The slope is too steep for tillage, and rock outcrops are common. Such an area occurs about one-half mile northeast of Lindsey. These rocky and stony areas are shown on the map by symbols.

Origin.—The type has been derived largely from the weathering of Potsdam sandstone. In some places a few rounded pebbles and bowlders occur. The type occurs within, but near the border of, the area covered by the pre-Wisconsin ice sheets, and this location would account for the presence of such bowlders. The glaciation, however, was too feeble to have much influence upon the composition of the soil.

Native vegetation.—This land originally supported a heavy growth of Norway pine, white pine, and some hardwoods, but practically all the timber has been cut or burned off. At present most of the areas are covered with poplar.

Present agricultural development.—On the better portion of this type where the soil has a fair depth, and is not too stony a rather large percentage is under cultivation. Many of the areas are associated with the level portion of the Vesper silt loam, and Whitman silt loam, and are the only well drained portions of the land. As they furnish an elevated building site, quite often these spots of rolling Vesper fine sandy loam were the first land cleared.

The chief crops grown are potatoes, rye, oats, corn for silage and grasses. A few acres of cucumbers, and some root crops are also produced. While this soil does not yield as well as some of the heavier types it may be considered a fair soil and with careful management very good crops can be grown. Because of its sandy nature it warms up quicker in the spring than the heavier types, which is a decided advantage. *

ANTIGO FINE SANDY LOAM

This type occupies a total area of only 1,216 acres. It occurs exclusively on the lower terrace immediately adjacent to the

* For chemical composition and methods for the improvement of this soil see page 41.

Wisconsin River. The material has been deposited by flood waters. The soils in the Wisconsin bottoms are quite variable in composition and small areas of fine sand often occur within the fine sandy loam.

The surface soil of the Antigo fine sandy loam extends to a depth of 8 to 12 inches. It consists of a medium to dark brown, silty fine sandy loam to fine sandy loam. The virgin soil in the surface for 2 or 3 inches has a high content of organic matter, which gives it a rather dark color. The surface soil is underlain by 4 or 5 inches of loamy fine sand, and at 15 to 18 inches a medium sand of a yellowish-brown color is encountered. At 30 to 36 inches the subsoil becomes a coarse sand, containing a high percentage of fine gravel.

The original timber on this soil consisted of white and Norway pine, birch, and elm, with willow and alder along streams where drainage is somewhat deficient.

In other parts of this and other States where it is extensively developed this type is a fairly good general-farming soil. Because of its small extent in this county it is of little importance agriculturally.

CHEMICAL COMPOSITION AND FERTILITY OF FINE SANDY LOAMS

These soils are only a little more open in texture than the silt and clay loam types. They have a good water-holding capacity and will support very good pasture, but the somewhat higher percentage of fine sand which they contain reduces the water content of the surface somewhat so that they warm up more readily in the spring and have less tendency to bake and crack than the heavier soils. These qualities make them better adapted to such crops as corn and potatoes than the heavier soils.

The total amount of the plant food elements, phosphorous and potassium, is nearly as large in the Marathon, Vesper and Antigo fine sandy loams as in the silt loams. However, they have rather less organic matter and this together with the somewhat coarser texture results in a slower rate of chemical change by which the inert plant food of the soil becomes available to crops. For this reason the increase in the supply of active or fresh organic matter and the use of available plant food either in the form of stable manure or of commercial fertilizers be-

comes more important and especially when crops such as potatoes which are sold from the farm, and of which heavy yields must be grown to be profitable, are produced.

The increase in the supply of active organic matter is of the utmost importance. A high degree of fertility cannot be maintained in these soils unless about twice as large an amount of organic matter is developed in them as that which they originally have. The plowing under of legumes, such as a second crop of clover or a crop of soybeans, is the best method of securing this result. The application of phosphorous and potassium fertilizers can best be made for these crops, since it secures a much larger growth of these crops themselves and becomes available through their decomposition to the following crops of corn or potatoes.

These soils were derived from rocks devoid of lime carbonates and therefore have a marked tendency to become acid. The degree of acidity is usually only slight in the new soil, but increases as the land is cropped from year to year. This acidity does not affect the growth of most crops directly, but makes it more difficult to maintain a good degree of fertility. This is true because it is a condition unfavorable to the continued growth of the best legumes—clover and alfalfa. The slight degree of acidity does not interfere with the growth of clover while the soil is comparatively new, but does reduce the yields as the fertility is reduced by further cropping and even in the virgin condition acidity interferes with the growth of alfalfa. It is also a condition unfavorable to the maintenance of a good supply of available phosphorous in the soil. These objections are probably not sufficient to make necessary the use of lime to correct the acidity on all of the land under cultivation for a number of years, but does make it desirable that farmers wishing to grow alfalfa should lime as well as inoculate the soil for this crop and also to watch the growth of clover carefully from year to year, so as to begin the use of lime on the fields as they are sown to clover as soon as it becomes difficult to secure a good stand.

These types of soils are well adapted to general farming and some special crops such as potatoes can also be grown to very good advantage.

CHAPTER IV.

GROUP OF LIGHT SANDY SOILS.

PLAINFIELD SAND

Extent and distribution.—The Plainfield sand occurs in a large, almost unbroken area in the southeastern part of the county, bordering the Wisconsin River on both sides. A few small areas are also scattered through the southern part of the county.

Description.—The surface soil of the Plainfield sand, extending to a depth of 5 to 8 inches, is a yellowish-brown to brownish-gray, loose and incoherent sand, consisting very largely of rounded quartz grains. In local areas and in virgin land the soil may have a slightly darker color in the surficial 1 or 2 inches, due to accumulations of organic matter. The organic content on the whole is very low. In general the surface soil is free from gravel, but occasionally gravel occurs in small quantities on the surface and mixed with the soil, as in an area just north of Grand Rapids.

The subsoil consists of a yellowish to yellowish-brown sand, which becomes lighter in color and texture with depth. The color at the bottom of the 3-foot section is usually pale yellow. More gravel appears in the subsoil than in the surface soil, but in most instances the soil section to a depth greater than 3 feet is very nearly gravel free.

The soil in general is quite uniform. In occasional areas the surface soil is slightly loamy. With increasing distance from the Wisconsin River on the west, as the water table approaches the surface, the Plainfield sand very gradually becomes darker colored and grades into the Whitman sand. A variation in color occurs in small areas in sec. 2, T. 21 N., R. 6 E., and adjoining sections, where the surface soil is a dark-red medium

sand underlain at a depth of about 24 inches by a yellowish-brown sand similar to the typical subsoil. The soil is very noticeably coarser in texture than the sand along Yellow River and undoubtedly less retentive of moisture.

Topography and drainage.—The type has a level to very gently undulating surface, occurring as a broad plain lying from 20 to 40 feet above the level of the river. Several streams from the east cutting through the terrace of the river have eroded the land to a considerable extent in places. Immediately adjacent to the Wisconsin River is a lower terrace the soils of which have a finer texture than the Plainfield sand on the high terrace. The slope between the two terraces having a medium textured sand has been included with the Plainfield sand. The natural drainage of the type is somewhat excessive and the soil suffers from drought.

Origin.—The Plainfield sand is of alluvial origin. The material has been derived mainly from sandstone. In places there is evidence of wind action. Practically all of the type is acid.

Native vegetation.—The original timber growth on this soil consisted of small jack pine, scrub oak, a few Norway and white pine trees, some white oak, bur oak, and scrubby hazel brush. All the timber of any value has been cut, but there is still much scrubby growth over the type.

Present agricultural development.—Although from 15 to 20 percent of this type has been placed under cultivation numerous farms were seen which appear to have been abandoned. The soil has a considerable lower value than the heavier types of the area and it requires careful management. Rye, Potatoes, and buckwheat are among the important crops grown and fair yields are secured in the most favorable years. Corn and some oats are also grown, but pototoes are the chief cash crop. In the vicinity of Nekoosa cucumbers are grown on a commercial scale, and are usually satisfactory in their yields. Timothy and clover are grown for hay and pasture but clover seldom does well unless given special fertilization. Liming the soil also greatly aids in getting a good stand of clover, and is really essential to continued success with this crop. Over much of the type the permanent water table lies at a considerable depth, and this with the loose open soil and subsoil result in a very droughty condition. In years when rainfall is not plentiful crops suffer

from the lack of moisture to a marked degree, but when there is a heavy rainfall, well distributed very fair yields are often secured. This soil can be profitably farmed, but it requires a thorough knowledge of the needs of the soil and very careful management.

Chemical composition and fertility.—Soils which are classified as sands are so coarse as a rule that they 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 cannot be affected by any treatment it is practical 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 it is practicable to develop and maintain in these soils will increase their water-holding capacity only to a limited extent.

The total content of the essential elements of plant food in Plainfield sand is low. The nitrogen supply in the surface 8 inches per acre is usually about 1200 to 1400 pounds. The Phosphorous supply usually ranges from 600 to 800 pounds while the amount of potassium will average close to 25000 pounds per surface 8 inches.

The starting point in the improvement of this soil is the development of active organic matter through the growth of legumes which are able to secure the 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 phosphorous 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. When clover is seeded with a small grain in this way the growing grain heps 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 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 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 soil 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.

BOONE FINE SAND

Extent and distribution.—The total area of the Boone fine sand in Wood County is 14,528 acres. It occurs along the northern boundary of the large sand and marsh areas in the southern part of the county. It is mapped in irregular areas extending east and west across the county, largely in T. 22 N. Outside this general area there are numerous isolated sandstone outcrops where this soil has been formed through the weathering of the underlying rock, as around South Bluff in Remington Town.

VIEW OF PLAINFIELD SAND IN THE WISCONSIN RIVER VALLEY

The loose, open character of this soil makes the drainage excessive, and its natural fertility is low. With proper cultivation, lime and fertilizers, however, profitable crops can be grown. This view shows an excellent crop of clover hay.

TYPICAL SURFACE FEATURES OF PLAINFIELD SAND

While potatoes are extensively grown on this soil, they are not as well adapted to sand soils as to sandy loam and fine sandy loam soils. Corn responds more readily to improved methods on the sand than potatoes, and therefore more corn and less potatoes should be grown on these extremely sandy soils.

Description.—The surface soil of the Boone fine sand is 4 to 8 inches deep. It consists of a gray to brownish-yellow fine sand. Quite commonly in virgin areas the soil in the surface 1 or 2 inches has a brown or dark-brown color, due to accumulations of organic matter. In the better drained areas, where there is sparser vegetation, this surface layer of darker material is often lacking. The surface soil is loose, incoherent, and very open. Fragments of sandstone occur frequently on the surface and mixed with the soil. The subsoil consists of a yellow fine sand which frequently becomes coarser with depth. Over a considerable part of the type sandstone comes within 3 feet of the surface. Sandstone fragments are common throughout the lower subsoil.

Because of variations in the sandstone from which this soil is derived, there are frequent variations in texture. In some areas the texture is a medium rather than a fine sand, but in all cases fine sand predominates. Occasional shaly layers in the sandstone have given rise to gritty clay loam or clay layers in the subsoil. The depth to sandstone is quite variable. In some places sandstone does not occur within the 3-foot level, while in some quite large areas it comes within 2 feet of the surface.

Some small, very wet, low-lying areas are included with this type where the soil resembles the Whitman series, except in the lack of organic matter and in the occurrence of sandstone in the subsoil.

Included with this type is a long, narrow area in secs. 21, 24, 25, and 27, T. 23 N.. R. 6 E., Rudolph Town, where the soil is a medium sand, resembling very much the Plainfield sand to the south. It differs from that type, however, in its topographic situation, lying 20 to 30 feet above the main body of the Plainfield soils. If more extensive, this soil would be mapped as the Boone sand.

In a few places the Boone fine sand occurs adjacent to the Plainfield fine sand and resembles it very much in color, texture, and topographic situation. In most cases the presence of sandstone fragments affords a means of differentiating between these soils, but in some instances this is lacking and because of depth of the sand it is necessary to separate the soils on the basis of the general location.

Topography and drainage.—The surface of the type varies from level to rolling. The small isolated areas are quite generally rolling. Many of the larger areas have a level to gently undulating topography, with occasionally small surface irregularities, due to wind action in forming small dunes.

Much of the type is well drained and droughty, but in some low-lying areas adjacent to marshes the elevation above the marsh is very slight and the water table lies too close to the surface for good results with ordinary crops. Wind erosion frequently takes place on this soil, especially after it is cleared and put under cultivation

Origin.—This soil is very largely derived from the weathering of Potsdam sandstone, but it has been modified in some cases by the action of running water, especially adjacent to the Plainfield soils.

Native vegetation.—The native vegetation consists of Jack pine, some Norway and white pine, scrub oak, birch, and poplar, the latter now predominating

Present agricultural development.—Only a small proportion of the type is under cultivation, rye, potatoes, and buckwheat being grown. Corn does poorly. The soil where well drained is droughty, owing to its loose, open structure. and has a low agriculture value.*

PLAINFIELD FINE SAND

Extent and distribution.—While most of the Plainfield sand occurs along the Wisconsin River, the fine sand is most extensive adjacent to the Yellow and Hemlock Creeks, the type extending in an almost unbroken area from the south county line to a point 2 miles north of Dexterville, following the course of the Yellow River. Over nearly all of Remington Town it is the predominating "island" type in the areas mapped as Sands and Peat (undifferentiated).

Description.—The surface soil of the Plainfield fine sand is a medium brown to yellowish-brown fine sand, 6 to 8 inches deep. The virgin soil quite commonly shows a dark-brown color in the surface 2 inches. due to an accumulation of organic matter. The

* For a discussion of the chemical composition and management of this soil see page 50.

soil in general is low in organic content except adjoining low, wet areas, where the color is a little darker. The subsoil is a yellowish-brown, uniform fine sand. In places it is bright yellow, but more commonly the color becomes lighter with increasing depth. A noticeable charateristic of most of the type is its small content of medium and coarse sand. The soil is much more coherent than the Plainfield sand and consequently not so droughty.

In some areas along the lower terrace adjacent to the Wisconsin River fine sand has been washed in over the coarser medium sand by flood waters. Several such areas occur in the vicinity of Nekoosa and to the south of this place. The soil here consists of a brown to dark-brown fine sand, 8 to 10 inches deep, underlain by lighter colored material of much the same texture to 18 to 24 inches. Underneath this in places is a shallow layer of loamy medium sand to sandy loam. In nearly all cases a medium sand, similar in texture to the soil on the surrounding high terrace, occurs at depths of 24 to 30 inches. As the soil of this character is largely of recent alluvial origin, deposited by flood waters at irregular intervals, it shows numerous irregularities in composition.

Topography and drainage.—The surface of most of the type is very nearly level. There are frequent gentle undulations. The land is all naturally well drained and the soil is somewhat droughty, except bordering marshy areas, where drainage is in places somewhat deficient.

Origin.—All of this type is of alluvial origin. It has been derived from material which came originally from Potsdam sandstone. Both surface soil and subsoil show varying degrees of acidity.

Native vegetation.—The timber growth consisted of Norway, jack, and white pine; bur oak, scrub oak, and poplar. Along the Wisconsin River bottoms there is some elm, birch, and willow.

Present agricultural development.—A small proportion only of the Plainfield fine sand is in improved farms. South of Babcock there is quite an area under cultivation, while to the north the proportion of this same type being cultivated is somewhat smaller, most of the development being adjacent to the road east of the Yellow River. Rye, buckwheat, potatoes and corn are the chief crops grown, as on the Plainfield sand. Clover

and timothy are grown to a limited extent for hay and pasture, but yields are usually not satisfactory, except when the most favorable conditions prevail, or when special fertilization has been given the crop.

Because of the finer texture of this type the Plainfield fine sand is a more desirable soil than the Plainfield sand. Average yields of most crops are somewhat larger and the type as a whole can be more easily improved.

PLAINFIELD SANDY LOAM

The Plainfield sandy loam is of very limited extent, and covers a total area of only 2304 acres. This type occurs almost exclusively on the lower terrace adjacent to the Wisconsin River. A few small areas are mapped elsewhere in the southern part of the county.

To a depth of 7 inches the soil of the Plainfield sandy loam is a brown, light sandy loam. This is underlain to a depth of about 28 inches by a light-brown medium sand, below which a mixture of medium and coarse sand and fine gravel occurs.

The surface is very nearly level, but natural drainage is fairly good. The original timber consisted of elm, scrub oak, birch, willow, and hazel.

This is an alluvial soil. It consists of material originally derived from sandstone.

In agricultural value this type is somewhat better than the sand and fine sand of the same series, but owing to its limited extent it is of little importance in the agriculture of the county.

CHEMICAL COMPOSITION AND FERTILITY OF BOONE AND PLAINFIELD FINE SANDS, AND PLAINFIELD SANDY LOAM.

These soils have intermediate texture and hence have moderate water-holding capacity. They are not fine enough to be especially well adapted to grasses for pasture, though a fair quality of pasturage can be secured on the heavier phases of these soils. The more deeply rooted crops, such as clover, rye, corn, and potatoes, find sufficient moisture during average seasons and suffer from drought only during periods of relatively low rainfall.

In chemical composition these soils are also of an intermediate character. The total phosphorus averages from 850 to 900 pounds in the surface 8 inches per acre. The total potassium of the surface 8 inches per acre is 25,000 to 30,000 pounds or but little over one-half of that found in heavier soils such as the Kennan silt loam. The organic matter of these soils is also comparatively low, averaging from 2.5 to 3.0 per cent in the surface 8 inches and from 1 to 2 percent in the second 8 inches. They have a correspondingly low nitrogen content, averaging from a thousand to 1,500 pounds in the surface 8 inches and from 500 to 800 pounds in the second 8 inches.

The most important point in the management of these soils is to follow methods which will maintain and increase the organic matter. In the virgin condition these soils are but slightly acid as a rule, but with continued cropping the acidity increases and for the best growth of clover and especially alfalfa liming is essential. This use of lime not only makes the soil more suitable for the growth of alfalfa and clover but assists in preventing the leaching of phosphorus and maintaining it in form which is available for growing crops.

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

When these soils are used for the growing of potatoes or other special crops to a considerable extent the use of commercial fertilizers containing phosphorus and potassium will be found necessary to maintain the soil productivity. Clover or some other legume must be grown regularly in the rotation to maintain the nitrogen and organic matter and part or all of this should be

plowed under. It is often desirable to use the commercial fertilizers containing phosphorus and potassium in order to secure a good growth of this clover and there is little loss in so doing, since essentially all of the phosphorus and potassium applied to the soil for the clover becomes available to the succeeding crop through the decomposition of the organic matter.

The liming and also the inoculation of the soil is of the utmost importance when alfalfa is to be grown and will be found helpful on the older fields even for the growth of medium red or mammoth clover.

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

CHAPTER V.

GROUP OF POORLY DRAINED SOILS.

PEAT

Extent and distribution.—In Wood County Peat covers a total area of 67,776 acres, including what has been mapped as the shallow phase. The type of Peat is mapped most extensively in the southern and southwestern parts of the county, where it is the predominating soil over many square miles. Through the central and northern parts of the country it occurs in numerous isolated areas of varying size, the largest being in the northeastern part of the county in Milladore Town.

Description.—The soil classed as Peat consists of brown to black vegetable material, much of which still shows traces of the original plant fiber. Only those areas are mapped as typical Peat in which organic matter has accumulated to a depth of 2 feet or more. In some areas the depth is greater than 15 feet. Dependent upon the stage of decomposition, the organic matter varies from raw and fibrous plant remains to a very fine grained material, which shows little trace of the original plant fiber. Over most of this type the organic soil is underlain by fine or medium sand. In those parts of the county where the surrounding upland soils are heavy the underlying material is silt and clay, with some sand. In the southwestern part of the county the peaty matter is underlain by decomposing sandstone which contains some shaly layers. These give rise to clayey material.

Throughout the marshy areas in the southern part of the county numerous small sand "islands," varying in size from a few square rods to 2 or 3 acres, occur in the midst of the marsh land. Where these "islands" occupy less than 25 per cent of the surface the land is mapped as Peat. Many of the marsh areas have been burned over, leaving a deposit of ashes. Where this is of recent origin it appears as a yellowish or reddish-yel-

low layer, 1 inch to 3 inches thick on the surface. In time this becomes incorporated with the underlying vegetable matter, and the soil takes on the appearance of well decomposed Peat.

Topography and drainage.—The surface of this land is nearly level. The small sand islands which occur in the type in the southern part of the county have only a slight elevation above the marsh. Because of the flat topography, the natural drainage is very poor. Much of the Peat land is included in drainage districts and open ditches have been dug to serve as outlets; but lateral ditches or tile are needed to complete the drainage system.

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 Wood 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.

Native vegetation.—The native vegetation on the open areas of Peat consists largely of marsh grass, sedges, and sphagnum moss. Where timbered the land supports tamarack, spruce, and cedar. Wild cranberry is abundant in some places. In the southern part of the county much of the marsh is open. An extensive spruce swamp occurs south of Elm Lake, in Cranmoor Town, and another in the northwest part of Remington Town, near the county line. The marsh in the northern part of Milladore Town is largely open. Just east of the "island" in this marsh there is an extensive area of tamarack and spruce. In some places along the borders of this marsh there is a heavy growth of black ash.

Present agricultural development.—Much of this land is utilized for crops which do not require thorough drainage. About 1,000 acres are devoted to cranberries, largely in Cranmoor Town. There are several cranberry bogs in the western part of Remington Town. In addition to the land actually in cranberries, many acres of the marsh are used as reservoirs for water needed in cranberry production. Marsh grass is cut on a considerable acreage for hay. Where wire grass predominates the crop is sold to grass-matting companies for $15 to $18 a ton. Sphagnum moss is gathered and shipped in considerable quantities to cities for the use of florists.

Large areas of Peat are being organized into drainage districts, and ditches are being installed. Adjacent to the ditches the land is well drained, but at some distance from them the drainage is seldom adequate. The strip of land which will be drained by the ditch is somewhat narrower in the case of the Peat than on the sandy marsh soils. In a few instances private enterprise has tiled some of the land and adequate drainage has been secured in this way. After thorough drainage has been provided fair yields of a number of crops can be secured where proper farming methods are followed. Small grains make a rank growth, but are apt to lodge and not fill out very well. Some special crops such as onions and cabbage do well on Peat land when properly fertilized, and celery is raised extensively in other regions on similar soil. Owing to the location and low situation

these Peat lands are subject to early frosts which may prevent the ripening of certain crops which mature in the early fall, especially corn and potatoes. One farmer on Peat who has put in numerous open ditch laterals, reported having raised as much as 50 bushels of buckwheat per acre, although several crops were lost through frost. He has also raised excellent crops of onions on a small scale. On this farm oats have also done well, and corn has given fair yields. Another farmer who has tile drained 200 acres of peat land reports excellentcrops of oats, fair barley, good potatoes and excellent hay. Where large tracts of peat are being improved tractors and other heavy machines are being used in a number of cases.

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 phosphorous, potassium, calcium, and magnesium, and have extremely high amounts of nitrogen in the organic matter. The average per cent of phosphorous in the peats of 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 phosphorous less available than in non-acid soil.

The deficiency of potassium in these soils is greater than that of phosphorous. 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 re-

quires the use of fertilizers containing especially the elements phosphorous 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 phosphorous 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 not too raw 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.

On account of the crops to which this land is adapted and its use as a pasture, marsh lands can be used for dairying or stock raising to good advantage.

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

Peat, shallow phase.—Areas of Peat in which the depth of the accumulation is less than 24 inches are mapped as a shallow phase. The peaty material in these areas rests on a gray to white sand. Scattered throughout the phase are sand "islands" too

small to show on the map. Areas in which these constitute more than 25 per cent of the surface material are mapped with the miscellaneous type of Sands and Peat (undifferentiated). Where the covering of peaty matter is shallow the soil resembles the fine sand or sand. Where the accumulation of organic matter has a depth of approximately 6 inches or more the soil is mapped as Peat, shallow phase; where it is of less depth the soil is classed in the Dunning series.

Peat, shallow phase, occurs in irregular areas along the borders of large marshes and in narrow depressions in the Plainfield soils. The largest area is mapped in the eastern part of Cranmoor Town. With increasing distance from the Wisconsin River the water table in this area lies closer to the surface. The soil gradually passes from Plainfield sand through Dunning sand and Peat, shallow phase, into typical Peat.

The surface of the areas of Peat, shallow phase, is level, and the natural drainage is very poor. The native vegetation consists of marsh grass, sedges, sphagnum moss, willow, and alder.

Outside the cranberry district most of the areas of this phase are in drainage districts and are more or less thoroughly drained. Adjacent to the ditches some fairly good yields are obtained. Good crops of rye and buckwheat were observed on this land in the course of the soil survey. Considerable marsh hay is cut on some areas. The Peat, shallow phase, has a value probably slightly higher than the typical peat, but requires practically the same treatment.

MUCK.

In the surface 10 to 15 inches the type mapped as Muck consists of black, well-decomposed organic material with a considerable admixture of silt and clay. This is underlain by a blue or drab silty clay loam, which is usually quite gritty. At a depth of about 2 feet a sticky gray sand occurs and continues to a depth of 3 feet or more. The content of sand in the subsoil is variable. The material quite commonly is very sandy.

Muck covers a total area of 1.5 square miles. It occurs in depressions in the southern part of the area of Vesper soils. The soil resembles very much the associated Whitman silt loam, but has a much higher content of organic matter.

TYPICAL VIEW OF THE TYPE MAPPED AS SANDS AND PEAT (UNDIFFERENTIATED)

Where the brush and timber stands we find islands of sand, surrounded by marsh which consists of Peat, and black sandy soils of the Dunning series.

DRAINAGE IS THE FIRST STEP IN THE IMPROVEMENT OF MARSH LAND

There are over 65,000 acres of Peat land in Wood County. Many large drainage canals have been constructed through the marsh lands, but up to the present time but few open laterals or tile drains have been installed. Thorough drainage is necessary for the successful growing of cultivated crops.

The timber growth consists of alder and willow. In open areas marsh grass is the principal vegetation.

Practically none of the type is under cultivation at present. A small area is used for pasture in the south part of T. 23 N., R. 5 E.

In the improvement of this soil drainage is the first step. The Muck has about the same chemical composition as the Peat, the chief difference being that it contains somewhat more mineral matter, and smaller percentage of organic matter. Like the Peat it is deficient in the mineral plant food elements and these must be supplied before satisfactory yield can be secured over a period of years. When drained, cleared and properly cultivated somewhat higher yields may be expected than on the typical Peat soil. Suggestions for the improvement of Peat will apply to the Muck as well.

SANDS AND PEAT (UNDIFFERENTIATED)

Extent and distribution.—This mixed type occupies a total area of 28,736 acres in Wood County.

The type of Sands and Peat (undifferentiated) is mapped chiefly in the south-central part of the county, both east and west of the Yellow River. Near this river the type is made up largely of the Plainfield fine sand, Dunning fine sand, and Peat, shallow phase. In the eastern part of the area of this type the Plainfield sand, Dunning sand and Peat, shallow phase, are the chief soils included.

Description.—The soil material mapped as Sands and Peat (undifferentiated) is subject to wide variation. In general, it consists of several classes of marshland through which there are scattered innumerable low, flat "islands" of sand. The soil on the islands consists of a brown or yellowish sand or fine sand underlain by yellow, rusty-brown or nearly white sand of medium to fine texture. The content of organic matter in the surface soil is small and the material is usually loose and open in structure.

The sand islands included in this type are less than 10 acres in extent individually. Those covering 10 acres or more are mapped separately, the soil being classed with the Plainfield series. The soil on these islands includes the same material as

that in the larger areas of Plainfield soils. The marshland included in this group may consist of any one or more of several types. Where the islands are very close together the surface material of the intervening lowland is usually made up largely of sand, fine sand or fine sandy loam, cantaining sufficient organic matter to have a black color. The subsoil usually consists of a gray or nearly white sand varying in texture from coarse to very fine. It is in most places fine in texture. Wherever these black, sandy soils occur in an area 10 acres or more in extent they are mapped separately and classed with the Dunning series.

A Noticeable variation occurs in the subsoil of this mixed type. In a number of instances the underlying layer is a fine-textured, nearly white material sometimes referred to locally as clay. It appears to consist chiefly of very fine sand, with a small proportion of silt and probably only a very small percentage of clay. This material sometimes comes within reach of the 3-foot soil auger, but it usually occurs at a greater depth and is most often seen along the banks of freshly dug drainage canals, where it has been reached at a depth of about 3 to 8 feet. This bed of fine material does not appear to be continuous.

In some instances the type of Sands and Peat (undifferentiated) is underlain by sandstone rock with which shaly material is associated. Where open ditches are cut through such formations thin beds of clay or sandy clay are sometimes seen. These have come from the weathering of the shaly sandstone rock. Areas in which this material comes within 3 feet of the surface are of small extent.

Small areas of Peat are also included in this type of undifferentiated soils. This consists of vegetable matter in varying stages of decomposition, with which small quantities of fine earth have become incorporated. The depth of the peaty matter is variable. It is usually underlain by sand. Where the areas of Peat are over 10 acres in extent they are mapped separately.

The size of the sand islands and of the intervening strips of marsh and the relative proportions of a given area occupied by each are variable. On the whole, it is estimated that the marsh and the sand islands have about an equal aggregate extent. In areas where the sand islands cover less than 25 per cent of the surface the soil on the islands is undifferentiated and the area is mapped with the marsh soil. Where the islands make up

more than 75 per cent of the total area the whole tract is mapped as one of the Plainfield types.

Topography and drainage.—The surface of this land is level except for slight undulations due to the low sand islands which rise only a few feet above the marsh. The sand islands are usually fairly well drained, while the intervening areas of marsh are naturally poorly drained. A large proportion of this class of land has been incorporated in drainage districts and is now being reclaimed by large open ditches or canals.

Origin.—The greater portion of the material composing this mixed type is of alluvial origin, having come in part from granitic rocks, but probably more largely from sandstone formations. Varying amounts of organic matter have accumulated in the lower places, which accounts for the dark color.

Native vegetation.—The native vegetation on the sand islands consists chiefly of scrub oak, jack pine, poplar, and sweet fern, while that on the marshes consists of alder, willow, poplar, and marsh grass. Many of the marshy tracts have no tree or brush growth.

Present agricultural development.—Only a small proportion of this land has been placed under cultivation. Small areas are included in some of the cranberry growing districts. A few small fields in areas where drainage has been partly established are under cultivation, but the results have usually been unsatisfactory, owing in part at least to insufficient drainage. Marsh hay is cut from some of the open marshes, and wire grass for use in the manufacture of rugs and matting is cut in small quantities.

The construction of large, open ditches does not necessarily in itself provide adequate drainage for a soil of this character. The land bordering properly constructed ditches should be sufficiently drained, but at distances of about one-half mile or more, or sometimes even less, from the outlet ditch the drainage may not be sufficient, so that the use of tile drains or additional open ditches is necessary.

The distance back from the ditch which will be drained will depend upon the depth of the ditch and the character of the soil, and also upon the slope of the land.

When adequate drainage has been provided this land will require careful management before profitable crops can be grown over a period of years.

Chemical composition and fertility.—Because of the great variation in the materials making up this type a chemical analyses of any one phase would not be representative of the type as a whole. The analyses of the peaty portion will correspond closely with that of the typical peat. The black sandy soils have the same composition as the Dunning types, and the sand islands are Plainfield soils. The supply of phosphorous and potash is low in all the soils making up the type, and these elements must be supplied. The supply of nitrogen in the marsh soils is high, but in the soil of the sand islands it is low and should be increased. The plowing under of legumes and the applying of stable manure or mineral fertilizers containing phosphorous and potash will assist in building up the productiveness of the soil on the islands. The use of fertilizer containing potash and phosphorous will be necessary on the Peat soils before cultivated crops can be grown profitably over a period of years.

For a more complete discussion of the chemical composition and fertility of this soil reference is made to the description of the various soils which make up this mixed type.

GENESEE SILT LOAM

The Genesee silt loam occurs as first-bottom land along some of the larger streams. Along Mill Creek an area of this soil extends from sec. 32, T. 25 N., R. 4 E., throughout the remainder of the course of this stream within the county. The soil here is a silt loam, except in the last 2 or 3 square miles, where there are some sandy spots.

The Yellow River has developed a narrow strip of bottom land in the northwestern part of the county. Throughout most of Richfield Town and the northern part of Wood Town the bottom land where present is too narrow to show on the map. From a point near Pittsville the lower terrace continues southward along the river to the county line without a break except in sec. 10, T. 22 N., R. 3 E. The Genesee silt loam occurs as the predominating type as far south as the Green Bay & Western Railway line near Dexterville. South of the railroad three areas of this soil are mapped separately from the terrace immediately adjacent to the river in secs. 22, 27, and 34. These three areas constitute practically all of the type under culti-

vation. Just south of the track the land has been protected from inundation by means of a dike, and this type, with the adjoining Peat land, is being ditched and drained.

The surface soil of the Genesee silt loam, extending to a depth of 8 to 10 inches, is a medium to dark brown silt loam. Where the type is associated with the Colby soils it resembles them very much in texture, but is slightly darker in color. The subsoil of the type is variable. In general it consists of a yellowish-brown silt loam, grading into a silty clay loam. Lenses of sand are commonly encountered.

Both surface soil and subsoil are subject to considerable variation. Within the general area occupied by the Colby silt loam the material is a fairly uniform silt loam, but the type includes numerous small areas where the surface soil is black, resembling the Whitman silt loam, and often wet and marshy. Small sandy spots occur occasionally. In the areas associated with the Vesper, Boone, and Plainfield soils this uniformity is lacking. Here there is more or less sand along with the silt loam that has been carried in from the Colby soils, and small areas of fine sands and fine sandy loams are included within the predominating Genesee silt loam. If more extensive, these sandy areas would be mapped with the Genesee fine sandy loam.

The Genesee silt loam consists of alluvial material derived largely from crystalline rocks.

The timber growth on this soil is quite heavy. Maple, elm, birch, and ash grow adjacent to the streams, and in the wettest areas alders and willow make up the growth.

This soil is well adapted for use as pasture land when drained and protected from flooding. Hay, grain, and corn do very well. On account of the drainage requirements most of the type is of low value at present.

GENESEE FINE SANDY LOAM

The Genesee fine sandy loam occupies a total of 7,040 acres and is found as first bottom land along the larger streams within the area. The soil mapped as the Genesee fine sandy loam is quite variable, owing to its alluvial origin and liability to overflows. The type includes sandy, first-bottom soils along the Wisconsin River and the lower courses of the Yellow River, Hemlock Creek and the East Fork of the Black River.

Along the Wisconsin River the surface soil varies from a fine or medium sand to a fine or medium sandy loam. The color is yellowish brown to light brown, except in depressions, where the accumulation of organic matter has given rise to a darker color. The subsoil quite generally is a medium to coarse sand. Along Yellow River the soil is a brown fine sandy loam, with occasional small areas of silt loam.

This soil is timbered quite heavily with elm, birch, ash, and some pine. None of the land is under cultivation. Because of its poor drainage and small extent this type is of little importance in the agriculture of the county.

WHITMAN SILT LOAM

Extent and distribution.—Whitman silt loam is an extensive soil in Wood County and covers a total area of 42,112 acres. It occurs in irregular tracts through the portions of the county where Colby and Vesper soils are found. Where associated with the Colby soils it usually occurs as narrow strips along streams and drainage courses. Several quite broad level areas of very wet land have been included in this type, the largest of which is in sections 22 and 23, Town of Sherry. Through the region of Vesper soils there are many broad areas of Whitman silt loam. Most of these occur in an east and west belt extending nearly across the center of the county.

Description.—The surface soil of the Whitman silt loam, extending to a depth of 8 to 12 inches, is a dark grayish brown to black silt loam, high in organic matter. The subsoil is drab in color, mottled with brown, yellow, and sometimes red. The mottling quite commonly is more of less localized, with drab predominating. The subsoil in texture is a silt loam to silty clay loam. It becomes heavier with depth. The material is compact and puttylike, and very retentive of moisture.

Where the type is associated with the Colby soils the depth of the heavy subsoil is usually greater than 36 to 40 inches, but throughout the region occupied by the Vesper soils the deep subsoil quite commonly is similar to that of the Vesper series, being derived from sandstone. Below 30 to 36 inches, and in some places at even shallower depth, white or drab sand underlies the silty clay loam, and this in turn rests on sandstone. It

is unusual for the hard sandstone to occur within reach of the 3-foot soil auger.

Included with the type are some areas where the dark surface soil is very shallow and occasionally almost lacking. Areas of this character are low lying and very poorly drained, however, and the soil is similar in many respects to the typical Whitman silt loam, although much lower in organic matter.

The Whitman silt loam resembles the Clyde silt loam of the southern part of the state in color, texture, and structure, but it is derived from crystalline material and is acid, while the Clyde soils are encountered in limestone regions and are not acid.

Topography and drainage.—The Whitman silt loam has a very nearly level topography. Natural drainage is very poor.

Origin.—This soil consists of sediments washed from crystalline-rock debris. Because of the low position and wet condition of the land there has accumulated a large amount of organic matter, to which is due the dark color of the soil.

Native vegetation.—The natural vegetation characteristic of the narrow strips along stream courses is made up largely of alder and willow, with some elm, ash, and birch along the border. Over large areas elm, ash, and birch are more abundant, and in some places poplar is commonly associated with the alder and willow. In the wettest areas there is little timber, marsh grasses predominating.

Present agricultural development.—Very little of the type is farmed. A large area southwest of Vesper in sec. 16, T. 23 N., R. 4 E., Hansen Town, is being tiled. In the northwest quarter of sec. 35, T. 24 N., R. 5, E., Sherry Town, and in adjacent "forties" a small area of Whitman silt loam is under cultivation, but the drainage is so poor that crops do not give very good yields in years of average rainfall.

The Whitman silt loam is naturally a strong, productive soil, and with thorough drainage will make excellent land for general farming purposes. It is especially well adapted to grasses for hay and pasture. With drainage, corn for ensilage would also prove a good crop. Because of the high content of organic matter in most areas of the type, grain would probably lodge badly. Those areas with a very shallow accumulation of organic matter will, upon drainage and cultivation, develop into a soil resembling the more nearly level areas of the Colby or Vesper silt loams.

Before this soil can be cropped with much success artificial drainage must be supplied. Many of the large areas, because of the level topography, will be rather difficult to drain successfully, and much care will be necessary in laying out a drainage system.

Chemical composition and fertility.—As indicated above the Whitman silt loam of Central Wisconsin is quite similar to the Clyde silt loam of Southeastern Wisconsin, differing chiefly by being acid while the Clyde soils are not acid. From the standpoint of the plant food elements which they contain these two types represent the best balanced soils in Wisconsin. Whitman silt loam as found in Wood County contains from 3 to 5 times as much nitrogen and organic matter as does the average light colored upland heavy soil in the same region. It contains from 1500 to 2000 pounds of phosphorous in the surface 8 inches per acres, and from 40,000 to 50,000 pounds of potassium.

The availability of the phosphorous and potassium will depend largely upon the rate of decomposition of the organic matter. There is usually sufficient phosphorous available for a number of years but after a time the use of a fertilizer supplying this element may be advisable. The same is frequently true with the potassium supply. Stable manure will supply these elements, but as this soil is high in nitrogen and does not need more, the stable manure can be utilized to better advantage on upland soils deficient in organic matter, and mineral fertilizers containing phosphorous and potassium used instead on the lowlands.

The Whitman silt loam is acid, and this condition would materially interfere with the successful growing of alfalfa. While the soil is new and the fertility high clovers will do well, but after the fertility has become somewhat reduced clover may not do so well, and liming will then be advisable.

In the improvement of this type the first step is to supply adequate drainage. Open ditches will not be sufficient by themselves, and should be supplemented by the use of tile drains. As the subsoil is heavy and tight, tile will have to be placed closer together than in soils which are more open in character. When well drained this will be one of the strongest, and naturally most productive soils of the county. Except for danger from frosts it would make excellent corn land. It is well adapted to grasses and at present hay is the most important

crop produced. On the parts best drained alsike clover and timothy do very well.

A simple system of surface drains may be readily installed to give temporary relief. If the fields are plowed in narrow lands leaving dead-furrows at intervals of from 2 to 4 rods running with the slope, and leading to open ditches at the side of the field fairly good surface drainage will be provided. Such a system, however should be supplemented with tile to insure drainage which will permit growing all cultivated crops suited to the region.

DUNNING FINE SANDY LOAM

Extent and distribution.—This type occupies a total area of 7,424 acres. A few small areas are found in the northeastern portion of Milladore Township, but the most extensive tracts occur from 3 to 6 miles southeast from Pittsville. Most of the areas, which are rather small and irregular are found through the center of the county between the heavy Vesper soils and the sandy belt immediately to the south.

Description.—The surface soil of the Dunning fine sandy loam, extending to a depth of 6 to 10 inches, is a dark-brown to black fine sandy loam high in organic matter. It is underlain by a drab to yellowish-drab fine sandy loam, which becomes a sticky sand or very gritty clay loam below 18 to 24 inches. Yellow, red, blue, and drab mottling is quite common.

The surface soil is not very uniform. Considerable silt and clay is mixed with the sand in places, especially along drainage courses heading in areas of silt loam soils, in which case the soil is a loam rather than a fine sandy loam. On the other hand, small areas in which the texture approaches a fine sand are also included. Where the type occurs associated with peat soils, a 2 or 3 inch layer of peat is often encountered on the surface, as in the areas northeast of Dexterville.

The subsoil of this type also is quite variable. Within areas of sandy soils it consists of a gray to drab sticky fine sand or fine sandy loam. Occasionally layers of sandy or gritty clay loam of a drab mottled color occur where the soil is associated with the Boone fine sandy loam, poorly drained phase. In places the subsoil may be a fine to medium sand below the surface foot. Where the type is associated with the Boone soils

layers of a mottled color, with red predominating, are seen where the subsoil has been derived to a considerable extent from shaly layers in the sandstone.

In some small included areas, associated with the Plainfield sand, the texture is coarser than typical. The soil here consists of a 6-inch layer of dark-brown to almost black sandy loam with 1 or 2 inches of well-decomposed peaty material over the surface. The subsoil consists of a gray sandy loam grading into a yellow medium to coarse sand.

Topography and drainage.—The surface is level, the water table lies near the surface, and the natural drainage is poor. In some places large open ditches have been dug. Only a small proportion of the type is sufficiently drained to permit the growth of general farm crops.

Native vegetation.—Most of the land supports a heavy growth of alder and willow, with marsh grass in the broader open areas. At the head of the drainage courses the native timber consisted of ash, elm,birch, some hemlock, and pine. At present there is considerable poplar.

Present agricultural development.—Practically none of this land is utilized at present, except that marsh hay is cut to a very small extent on some of the broader open areas. Most of the type occurs in an undeveloped part of the county and probably will not be utilized until more of the upland has been put under cultivation.

In its present condition the agricultural value of this soil is rather low. In many cases the ditches constructed do not drain the land thoroughly except immediately along the ditch. Little of the type has been cleared and placed under cultivation, and the yields are usually low. Under the most favorable conditions, fair yields of buckwheat, alsike clover, and timothy are obtained. A number of other farm crops, such as corn and small grains, are frequently grown, but yields are uncertain. When thorough drainage has been supplied all of the general farm crops common to the region can be grown successfully upon this soil.

DUNNING SAND

Extent and distribution.—This type is associated with the Plainfield sand, occurring in the southeastern part of the county

on both sides of the Wisconsin River. The largest continuous area is mapped in T. 22 N., R. 5 E. Here the sand gradually becomes darker as the water table approaches the surface with increasing distance from the Wisconsin River. On the eastern side of this area the surface soil is a dark-brown medium sand, only a little darker than the Plainfield sand. The two soils merge into each other with a gradual darkening in color. On the western side, where the peat marsh is approached, there is a shallow covering of peaty matter. This accumulation gradually increases in depth with distance from the river. Throughout this area of Dunning sand there are a few scattered "islands" of Plainfield sand, 2 to 5 acres in extent, which reach an elevation of 1 or 2 feet above the surrounding wet soil and afford good building sites. In T. 21 N., R. 4, E., the Dunning sand occurs associated with the Plainfield sand in the miscellaneous type mapped as Sands and Peat (undifferentiated).

Description.—The soil of the Dunning sand to a depth of 5 to 12 inches consists of a dark-brown to black medium sand. Very commonly the virgin soil has a 2 to 4 inch surface covering of dark-brown peat containing a small proportion of sand. On cultivation this becomes mixed with the underlying sand and gives rise to a sandy peat or peaty sand, the texture depending on the relative proportions of the various constituents. The surface soil generally contains a considerable quantity of organic matter. Because of the coarse nature of the sand grains the organic matter stands out as separate particles, and gives the surface soil an apparently loamy texture.

The subsoil of this type consists of a light-yellow to gray, medium to coarse sand which becomes coarser with depth. With increasing depth the color partakes more of a gray or whitish cast and the material has a leached appearance. Occasional yellow iron stains or mottlings occur in the subsoil.

Topography and drainage.—The surface of the Dunning sand in general is level to very gently undulating, and the natural drainage is poor. Some large open ditches have been constructed, and along these the drainage conditions have been greatly improved.

Origin.—A large proportion of the material forming this soil is of alluvial origin, having been deposited by running water when the Wisconsin River was at a much higher stage than at

present, probably during glacial times or during the retreat of the ice sheet, when great volumes of water were escaping from beneath the ice. The parent material was largely Potsdam sandstone, and in a few instances the soil may be residual from this rock. The dark color is due to the accumulation of decaying organic matter, the growth of which was favored by the moist conditions. The material is acid, differing in this respect from soils of the Clyde series, which are similar in many other ways.

Native vegetation.—The native vegetation consists chiefly of willow, poplar, and alder, with marsh grass and some moss. In many places the marshy land is open and coarse grass or moss constitutes most of the growth. In others there is quite a dense growth of brush.

Present agricultural development.—Only a very small proportion of this soil has been cleared and placed under cultivation. Where open ditches have been installed it is usually fairly well drained along the ditches so that cultivated crops can be grown. Back from the ditches, however, the drainage is usually deficient. Ditches now being constructed, as a rule, are deeper than those dug in previous years and will furnish drainage for a wider area on either side of the ditch than formerly. From the undrained areas some marsh grass is cut for hay, and portions of it are also utilized for pasture, especially where it is included with a farm which is made up largely of upland soils. When drained such crops as buckwheat, alsike clover, corn, rye and other general farm crops can be grown but the yields are uncertain.

DUNNING FINE SAND

Extent and distribution.—Dunning fine sand occurs along the Yellow and Hemlock Rivers in association with Plainfield sand, in much the same relationship as the Dunning sand and Plainfield sand along the Wisconsin River. Fairly large tracts occur south and southwest of Babcock and south of Dexterville.

Description.—The surface soil to a depth of 6—12 inches is a dark brown, fine sand, carrying a fairly high percentage of organic matter. It is not uncommon for the surface 2—4 inches of the virgin soil to be a peaty material, and these have been

* For the chemical composition and methods for the improvement of this soil see page 72.

included within the type areas where this peat accumulation has a depth as great as 6 inches. On drainage this shrinks and with cultivation sand mixed with it will give a peaty fine sand which is quite characteristic of the type.

The subsoil is a pale yellow to gray fine sand, becoming a gray or whitish fine sand at 15—18 inches. Where thrown out along drainage ditches the sand takes on an almost white appearance when dry.

Some variations in this type were noted. In the portion of this soil west of the Yellow River the sand will average a little finer than the areas to the east. The subsoil is subject to local variation. Layers of very fine sand are common and an occasional layer of even finer texture was noted where the grains were of silt size. If this very fine material were of any extent undoubtedly the subsoil would have a greater water holding capacity than the typical soil. The area in Section 27, T. 22 N., R. 3 E., in part at least is a badly burned peat marsh where the peat has burned down almost to the sand.

Scattered through areas of this soil are numerous tracts of less than 10 acres, averaging 2–5 acres, which have a slightly higher elevation than the general level and where the soil is Plainfield fine sand. If these sand islands make up over 25% of the soil the area has been included with the undifferentiated type. In cultivated fields and drainage ditches the difference in color of the soils show up very markedly.

The surface has a yellowish-brown color on the islands, while the surrounding soil has a dark brown color. In the subsoil the islands have a distinct yellow color while only a short distance away on an equal level the subsoil is gray or white. On the island the soil is low in organic matter and the yellow color indicates a much better condition of oxidation than in the surrounding Dunning soil in which the gray color is due to the deoxidation of the iron compounds.

In the undifferentiated type throughout the township of Remington and adjacent townships many small areas of Dunning fine sand occurring between islands of Plainfield fine sand have been included.

Topography and drainage.—The surface of this soil is level. Where small sand islands are associated with the type the topography has a slightly undulating character. The natural drain-

age is poor. Where ditches have been constructed the drainage is usually good, but some distance back from these ditches the drainage is usually deficient. The distance from the ditch within which adequate drainage will be secured is probably less than in the case of the Dunning sand which is much coarser, and has a lower water holding capacity.

Origin.—This soil is largely of alluvial origin, resulting from the weathering of sandstone and subsequent transportation by running water. The dark color is caused by an accumulation of organic matter, formed through the decay of vegetation which makes a rank growth on these moist soils.

Native vegetation.—The native vegetation consists of willow, alder, poplar, marsh grass and a small amount of moss.

Present agricultural development.—Until quite recently only a comparatively small portion of this type has been under cultivation. As most of the areas are included within drainage districts, drainage conditions on considerable of the type has been greatly improved and several tracts have been placed under cultivation in Sections 29, 35, 36, T. 21 N., R. 3 E., south and southeast of Babcock and also south of Dexterville.

The chief crops grown are rye and buckwheat, both of which give fair yields. Timothy, alsike clover and red top can be grown. As the soil is acid, red clover will not do well without the use of lime.

On cultivation the active organic matter in this soil, also in Dunning sand, very soon is used up through cropping and oxidation, and after a few years there are left many places where the soil is a gray-brown fine sand, very low in fertility.

If this type of soil is handled properly, and mineral plant food supplied as needed, it can be farmed profitably. Without careful management results will be uncertain.

CHEMICAL COMPOSITION AND FERTILITY OF DUNNING SAND AND FINE SAND.

These soils are well supplied with nitrogen and organic matter but they are usually deficient in the mineral plant foods phosphorous and potassium. The greatest deficiency, however, is in drainage, and before cultivated crops can be grown successfully a thorough system of drains must be provided. Open

ditches as now installed are not sufficient in themselves, and must be supplemented either by open laterals, or tile drains, or both. When drainage has been provided it will be found that the most economical and profitable crop production can be secured by the use of mineral fertilizers containing phosphorous and potassium. Such crops as alsike clover and timothy, buckwheat, and corn may be expected to give best results on this kind of land under good management.

CHAPTER VI.

GENERAL AGRICULTURE OF WOOD COUNTY.

AGRICULTURE.

The earliest settlements in this territory were made in the fifties. The sandy regions were occupied first, as the tree growth here was almost entirely pine. which was the only timber handled by the early lumbermen. Hardwood at first was of little value, and where clearings were made in hardwood sections the timber was frequently burned. The first farms were small, and large areas of land remained in the cut-over stage for a considerable length of time before they were subdivided. Agricultural development has been much slower on the sandy soils than on the heavier lands in the northern two-thirds of the county. Agriculture is more highly developed in the section around Mansfield than in any other part of the county although settlements were made in some of the sandy sections considerably earlier.

Practically all the general farm crops now grown were produced in the early history of the county, but the relative importance of a number of crops has changed. Hay and oats have always been the most important crops from the standpoint of acreage.

The censuses of 1880, 1890, and 1900 indicate for those years an acreage of rye somewhat greater than that of corn, while at present the reverse is true. In 1879 the acreage of wheat was over five times as great as in 1909. Buckwheat, peas, and beans are apparently not as extensively grown as they were 10 or 15 years ago. The greatest development has taken place in dairying and in the production of crops associated with this industry. The dairy production in 1909 was approximately seven times as great as in 1899. This rapid growth still continues, as is indicated by the fact that from 1910 to 1913 the number of cheese factories and creameries increased about 25 per cent.

The agriculture of the county at present consists chiefly of general or mixed farming, with dairying as the most important branch. The chief crops grown, in order of acreage, according to the census of 1910, are hay, oats, corn, rye, potatoes, barley, buckwheat, wheat, and peas. All of these may be considered in part as cash crops, for some of the hay and corn and a considerable proportion of the small grain are sold directly from the farm. The greater part of the production, however, is used in feeding live stock and finally finds its way to market in the form of dairy products, beef or pork. A considerable quantity of grain and hay is used as feed for work stock. Potatoes and various garden vegetables are grown mainly as subsistence crops, but small quantities are placed upon the market.

Hay is grown more extensively than any other crop. The 1910 census reports 33,951 acres in all tame and wild grasses, with a production of 53,494 tons, or an average yield of over 1½ tons per acre. About 67 per cent of the hay consists of timothy and clover mixed and about 15 per cent of timothy alone. Little clover is grown alone. Minor hay crops consist of wild marsh grass, millet, small grains, and alfalfa. Tame hay is grown by far the most extensively on the Colby silt loam. On account of the acid condition of the soils alsike clover is grown to a considerable extent. Red clover does well on land where the fertility has been kept up and thrives on new land in spite of the acidity, but on run-down fields it is not so successful.

Oats in 1909 occupied 14,664 acres and gave a production of 396,762 bushels. This crop is grown to only a small extent in the southern part of the county on the sandy soils, the greater part being produced on the Colby and Vesper silt loams and the Kennan silt loam, in the central and northern parts of the county.

The acreage of corn in 1909 was less than half that of oats. Corn, however, appears to be gradually increasing in acreage, owing partly to the rapid increase in dairying and partly to the recent introduction of varieties that can be matured nearly every year.

Rye was grown on 6,297 acres in 1909, with a total production of 78,206 bushels. This crop is grown most extensively on the sandy soils and does better on such land than any of the other small grains. It is grown with success on some of the drained

marshlands in the southern part of the county. Barley in 1909 occupied only slightly more than half the acreage devoted to rye. It is grown mostly in the northern half of the county, where silt loam soils predominate. The present acreage of wheat is small, being little more than one-tenth of that in 1899. Buckwheat is quite a common crop on the reclaimed marshy lands in the southern part of the county, but its total acreage is small.

Potatoes are quite an important crop, occupying 4,610 acres in 1909. The sandy areas produce most of the crop grown for market. Potatoes are grown for home use in all parts of the county and on practically all the various types of soil.

Peas are not grown as extensively as in former years. In 1909 the production was 3,664 bushels, while in 1899 it was 15,365 bushels, and in 1889, 17,682 bushels. More peas are now canned than formerly, but the canning industry has not yet become very important.

Cabbage is an important crop, especially in the vicinity of Pittsville, where it is grown on a commercial scale. In nearly all parts of the county it is grown for home use. Tobacco is grown on a very small total area, mainly by settlers who have come from tobacco-growing regions. Such crops as beans radishes, lettuce, onions, carrots, strawberries, and bushberries are grown on most farms.

Cranberry growing has been quite extensively developed in the southern part of the county, chiefly on peat lands. Wisconsin is the third State in the United States in cranberry production, and within the State Wood County ranks first. The Wisconsin Agricultural Experiment Station for a number of years maintained a branch station near Cranmoor, where special attention was given to questions relative to cranberry growing.[1]

The following table, compiled from census reports, shows the acreage and production of the principal crops at the last four census years:

[1] For a full discussion of this industry attention is directed to Bulletins 119, 213, and 219 of the Wisconsin Experiment Station.

Acreage and production of principal crops, census years 1880 to 1910.

Crop	1880		1890		1900		1910	
	Acres	Tons	Acres	Tons	Acres	Tons	Acres	Tons
Hay	7,945	9,543	23,842	23,501	28,880	38,275	38,306	57,846
		Bushels		Bushels		Bushels		Bushels
Oats	2,101	54,284	6,245	203,181	11,829	331,740	14,664	396,762
Corn	1,529	43,442	1,841	57,789	4,763	105,070	6,713	154,710
Rye	1,728	17,511	3,023	37,944	5,417	72,830	6,297	78,206
Barley	79	1,507	145	3,293	1,754	42,500	3,801	91,622
Wheat	1,323	11,906	901	15,428	2,289	34,240	244	2,784
Buckwheat	61	588	414	5,439	832	8,920	523	3,329
Potatoes	.....	56,756	1,560	15,366	4,169	273,625	4,610	318,446
Peas	.....	3,133	.....	17,682	1,010	15,365	229	3,664
Beans	.....	419	.....	326	158	1,110	17	426

Fruit growing receives but little attention in Wood County. Much of its area is not especially well adapted to fruit production. The level, rather poorly drained heavy soils are not suited to the growing of tree fruits. Apples are grown more extensively than any other tree fruit. They are produced mainly in the more rolling parts of the county.

The live-stock industry is an impotant branch of farming. The 1910 census reports 32,561 head of cattle in the county, of which 18,465 are dairy cows. In 1909 there were 9,343 calves sold or slaughtered, 7,148 other cattle, 9,326 hogs, and 2, 459 sheep and goats. Dairying is the most important branch of live-stock farming. The principal dairy products are cheese and butter. A small quantity of milk is retailed in the towns. Holstein blood predominates in the dairy herds. The use of purebred sires is gradually improving the stock. There are numerous herds of purebred cattle. The tendency at the present time is to send milk to cheese factories rather than to creameries. The number of cheese factories is increasing quite rapidly, while creameries are decreasing in number. In 1910 there were 17 cheese factories and 27 creameries, while in 1913 there were 32 cheese factories and 22 creameries. The dairy products reported in 1909, exclusive of those used in the home, amounted in value to 610,475. Some beef are raised within the county but the number is much smaller than that of dairy cows. Most of the calves sold are from dairy herds. Hog raising is an im-

portant source of revenue. This industry is carried on in connection with general farming and dairying.

The character of the soil and topography has an important influence upon crop production in this county. On the heavy soils of comparatively level surface, which are cold and backward in the spring, corn does not do nearly so well as on soils of the same texture having a more rolling topography. Fruit and truck crops are but little grown in the regions where heavy, nearly level soils predominate. In the southern and southeastern parts of the county, where sandy soils predominate, the topography is not so important a factor. Except on the lowest sandy areas the natural drainage is good and frequently excessive. It is generally recognized by the farmers that the heavy soils are especially well adapted to the production of hay. Drainage increases their adaption to small grains and corn. The sandy soils are considered better adapted to rye than to other small grains, and a number of the sandy types are considered better for potato culture than the heavy soils. It is recognized that the northern part of the county, where heavy soils predominate, is better adapted to general farming and dairying than the southern part, where sandy soils and marshes abound.

The methods of farming followed are about the same as those practiced throughout the general farming and dairying districts of Wisconsin and adjoining States. The silo is in common use on dairy farms, and a considerable part of the corn crop is handled as ensilage. Hay is stored in barns or stacks and used mainly as feed for stock, though large quantities are also sold. Considerable grazing is available on cut-over tracts, and cattle, sheep, and goats are used to advantage in clearing new land. A considerable area of cleared land deficient in drainage is used for pasture.

Throughout the northern half of the county, and including the greater part of the region where heavy soils predominate, most of the farms are well equipped. The farmhouses are generally well built and in good repair. Most of the barns are built upon a stone or concrete foundation, with a cement floor, and have storage room for hay and grain. Modern stable equipment is used in dairying. Silos are often built of concrete. Milking machines are in use on a number of farms. The farm

machinery in use is modern. The work horses are mostly of the heavy breeds, such as Percheron and Belgian. The cattle are mostly of mixed breeding, with Holstein blood predominating. Purebred sires are common. Throughout the sandy parts of the county and in some sections of heavy soil where drainage is most deficient the farm improvements are as a rule below the average. On the lighter soils the work horses are lighter in weight, and modern machinery is not in as common use.

On the heavy, level or nearly level soils a rather conspicuous cultural feature is the practice of plowing fields in narrow lands, so that a dead furrow left at intervals of 2 to 4 rods will act as a ditch to help carry off the surface water. This practice greatly assists in promoting surface drainage and usually insures fair drainage without the use of tile. On some of the large tracts of reclaimed lowland in the southern part of the county traction plows are used.

On the heavy soils a rotation in quite common use consists of corn, small grain for one or two years, and timothy and clover, from which hay is usually cut for two years. The field may be pastured a year before being again plowed for corn. On the sandy soils a rotation frequently followed consists of small grain, clover, and potatoes. In no part of the county has the question of crop rotations best suited to the soils been given careful consideration by the majority of farmers. Barnyard manure is the only fertilizer used to any considerable extent.

Farm labor is not so difficult to obtain as in some sections of the United States. In many cases women and children assist with the farm work. Farm hands hired for the year or by the month are usually paid from $30 to $45 a month. Married men are usually given a house, fuel, and garden. During haying and harvesting seasons the wage for special help is about $2.00 to $2.50 a day.

The average size of the farms in Wood County is 105 acres. Land holdings range in size from a few acres to several thousand acres. In the sandy and marshy region a considerable area is held in large tracts. Some cut-over land in other parts of the county is also in large holdings. In 1910 there were 2,706 farms in the county, occupying 54.8 per cent of its total area. Of the land in farms, 38 per cent is improved. The 1910 census

reports 92.9 per cent of the farms operated by owners, 6.1 per cent by tenants, and 1 per cent by managers.

In 1900 the average value of farm land in the county was $14.40 an acre, while in 1910 it was $32.36, having increased 125 per cent. Prices depend upon the extent of improvement, location, quality of soil, and other factors, and are variable in all parts of the county. In the vicinity of Marshfield, where agriculture is the most highly developed, farms frequently sell for $100 to $125 or more an acre, while in the sandy regions partly improved farms sell for $25 to $50 an acre. Cut-over hardwood land in undeveloped parts of the county ranges in selling price from $20 to $30 an acre. The unimproved sandy and marshy soils in the southern part of the county are usually held at a figure considerably lower than this.

CHAPTER VII.

CLIMATE.

The climatic conditions in Wood County are fairly uniform, but vary somewhat from place to place with difference in topography. In the southern part of the county there are extensive marshes and sand flats, while in the northern part the soils are heavier, the surface is considerably higher, and the topography is undulating to rolling. The most pronounced variations in climate are in the occurrence of frosts. The relative liability to frost is of vital importance to the cranberry industry, which is quite extensively developed in the marshy region in the southern and southwestern parts of the county.

The only Weather Bureau station in Wood County with long records is at Grand Rapids, which is situated within the extensive sand-plain area bordering the Wisconsin River. This place is a number of miles from the larger marshy tracts, and the records, particularly those in regard to frost occurrence, do not apply to the extensive low, wet areas in the vicinity of Babcock, Cranmoor, and to the west, nor to the higher, more rolling country in the northern and western parts of the county. They do, however, apply to all the level sandy areas in Wood County east of the Wisconsin River and to the extensive sand terraces reaching back several miles from the river on the west. The following table gives climatic data colected at the Grand Rapids station and at Neillsville, which is the county seat of Clark County, adjoining Wood County on the west. Neillsville is situated in a somewhat rolling country, and the records of this station are more nearly applicable to northern Wood County than are those taken at Grand Rapids.

Normal monthly, seasonal, and annual temperature and precipitation.

Month	Grand Rapids (elevation, 1,021 feet)		Neillsville (elevation 996 feet)	
	Temperature	Precipitation	Temperature	Precipitation
	° F.	Inches	° F.	Inches
December	20.4	1.51	19.5	1.63
January	12.3	1.22	12.2	1.09
February	14.8	.64	14.0	1.33
Winter	15.8	3.37	15.2	4.05
March	30.2	1.48	28.5	1.97
April	44.4	2.56	44.6	2.82
May	56.4	4.39	55.8	4.37
Spring	43.7	8.43	43.0	9.16
June	66.5	2.91	66.2	4.59
July	69.5	3.25	69.8	3.91
August	67.6	3.21	67.1	3.63
Summer	67.9	9.37	67.7	12.13
September	60.6	3.25	59.5	3.88
October	47.1	2.14	47.2	2.92
November	31.9	1.61	31.0	1.65
Fall	46.5	7.00	45.9	8.45
Year	43.5	28.17	43.0	33.79

The following table shows the mean minimum temperatures at the Weather Bureau Station at La Crosse, Wis., and at different locations at Mather, Wis., during the season of 1907. Mather is in the cranberry region about 6 miles south of the southwestern corner of Wood County and conditions there are fairly representative for the Wood County marshes.

Month	Readings from LaCrosse Weather Bureau Station	Shelter on upland, Mather, Wis.		Shelter on marsh over moss, Mather, Wis.		At 5 inches above marsh over moss in open, Mather, Wis.	
		Reading	Difference	Reading	Difference	Reading	Difference
May	44.7	40.9	—3.8	38.1	—6.6	36.2	—8.5
June	56.2	49.1	—7.1	45.4	—10.8	42.3	—13.9
July	62.2	55.6	—6.6	51.7	—10.5	49.0	—13.2
August	59.3	54.0	—5.3	50.1	—9.2	47.1	—12.2
September	50.7	47.1	—3.6	44.3	—6.4	40.4	—10.3
October	38.2	33.4	—4.8	29.9	—8.3	25.3	—12.9

These tables indicate that temperatures for the southern portion of the county, especially over the marshy regions, are somewhat lower than over the higher and more rolling sections of the area. This means that the length of the growing season between killing frosts is shorter on the lowlands and that there is also more danger from summer frosts. Because of these conditions such crops as corn and potatoes should not be regarded as crops of major importance on the reclaimed marsh lands, although corn can be grown for silage with a fair degree of certainty of its escaping summer frosts.

The winters in Wood County are long and severe, but the summers are pleasant. The rainfall is normally well distributed throughout the growing season. The months of May, June, July, and August each have on an average approximately 3 inches of rain, but in any of these months, especially July and August, there may be periods during which crops suffer considerably from drought.

The average date of the last killing frost in the spring as recorded at Grand Rapids is May 23, and that of the first in the fall September 26. This gives an average growing season for the vicinity of the station of approximately 126 days. In the marshy region to the west and southwest the period free from frost is shorter, and summer frosts are not uncommon in the cranberry-growing districts.[1]

[1] For a full discussion of climatic conditions and their relation to the cranberry industry in Wisconsin see Bulletin T of the U. S. Weather Bureau and Bulletin 223 of the Wisconsin Experiment Station.

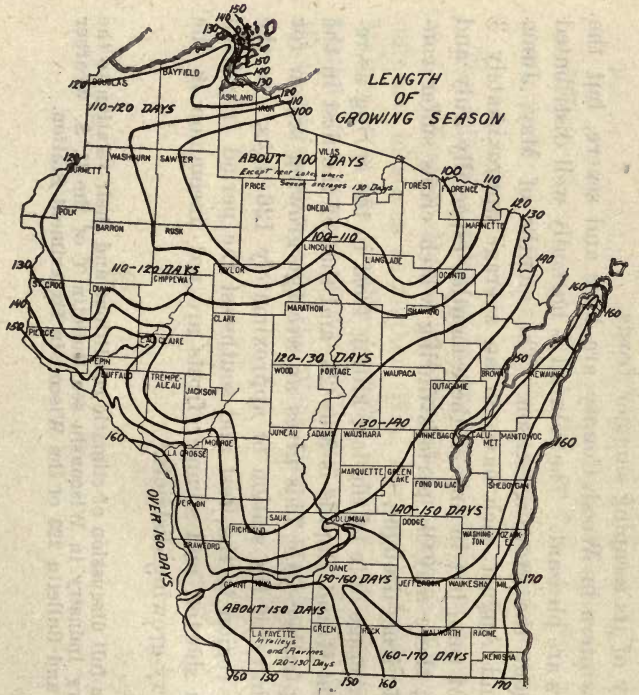

Fig. 2.—Map showing length of growing season for corn.

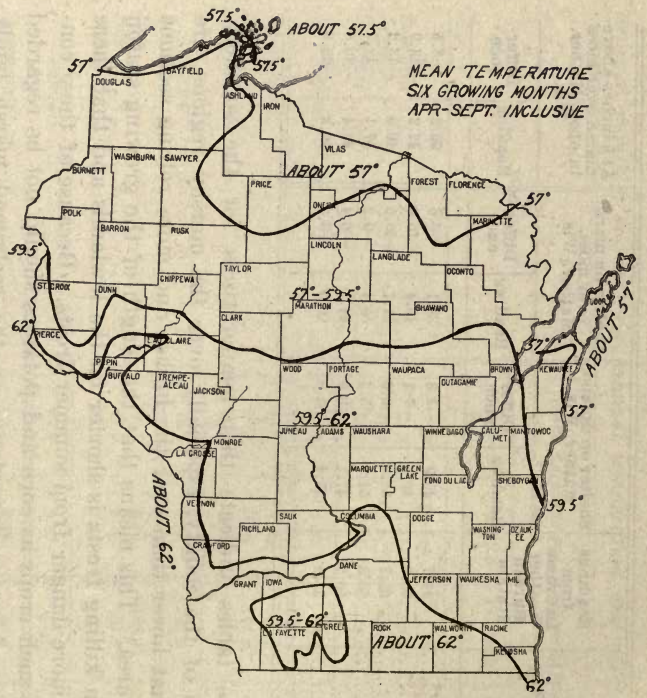

Fig. 3.—Map showing average temperature for the six growing months April to September, inclusive. Note that the difference between the average temperature for the area surveyed, and the southern portion of the State is only slight.

SUMMARY

Wood County is situated in the central part of Wisconsin and comprises a total area of 809 square miles or 517,760 acres. It includes two physiographic divisions, separated by a line extending east and west a short distance north of the Green Bay & western Railroad. North of this line the surface is nearly level to rolling. The soils are heavy and for the most part of high agricultural value. Many localities are well improved. There are but few marshes and no lakes in this region. South of this line the country is level. The soil here is quite sandy, marshes are numerous, and the land in general has an agricultural value considerably lower than in the northern part of the county.

The Wisconsin River receives the drainage of practically all the county. An area equal to about two townships in the west-central part drains through the East Fork of the Black River into the Mississippi River.

Wood County in 1910 had a population of 30,583. Grand Rapids, the county seat, and Marshfield are the two largest cities, with populations in 1910 of about 6,500 and 5,800 respectively. The county has excellent railroad facilities, and many large cities are within easy reach.

The soil material of Wood County has been derived from glacial, residual, alluvial, and, possibly in part, from loessial material. The soils have been classified into 10 series and 18 types, exclusive of Peat and Muck, each of which has characteristics by which it can be recognized.

The best land occurs in the northern half of the county, where Colby, Kennan and Vesper silt loams are the predominating types of soil. The most improved farming section is in the vicinity of Marshfield. Agriculture is least developed in the southern part of the county. Sandy and marshy soils predominate there. Large drainage projects under way are reclaiming extensive areas of marsh land.

The chief crops grown in Wood County are hay, oats, corn, rye, barley, and buckwheat. Cranberries are produced quite extensively in the southern part of the county, chiefly on Peat

lands. Wood County is first in the State in the production of cranberries. General farming is the leading type of agriculture in Wood County, and dairying is the most important branch. The dairy output is chiefly in the form of cheese and butter. The number of cheese factories is increasing quite rapidly, while the number of creameries is slowly decreasing. The northern two-thirds of the county is especially well adapted to the production of hay and grasses, and dairying is most highly developed throughout this region.

Of the total area of the county, about 54.8 per cent, according to the 1910 census, consists of farm land, of which 38 per cent is improved. The average size of farms is 105 acres. About 93 per cent of the farms are operated by owners, 6 per cent by tenants, and 1 per cent by managers. The average value of all farm land in 1910 is reported as $32.36 an acre, showing an increase in the preceding 10 years of approximately 125 per cent. The most highly improved farms in the northern part of the county have a selling value of $100 to $125 or more an acre, while hardwood cut-over lands sell for $20 to $30 an acre. Partly improved lands in the southern part of the county have a selling value of $25 to $50 an acre. Unimproved lands in the sand and marsh country have a selling value considerably lower than unimproved hardwood land.

The mean temperature for the year, as recorded at Grand Rapids, is 43.5°. The mean for the winter is 15.9°, for the spring 43.3°, for the summer 67.9°, and for the fall 46.9°. The months from April to September, inclusive, have an average rainfall of over 2.5 inches each, and May and June each have over 3 inches on the average. The average length of the growing season is 126 days.

KEEP THE MAP

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