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WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY

ERNEST F. BEAN, Director and State Geologist
A. R. WHITSON, In Charge Division of Soils

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

BULLETIN NO. 53C SOIL SERIES NO. 22

SOIL SURVEY

OF

GREEN COUNTY

BY

A. R. WHITSON, T. J. DUNNEWALD, M. J. EDWARDS, WALTER VOSQUIL AND KENNETH WHITSON OF THE WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY, AND A. C. ANDERSON AND F. J. O'CONNELL OF THE U. S. BUREAU OF CHEMISTRY AND SOILS

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INTRODUCTION

The State of Wisconsin, working in cooperation with the United States Department of Agriculture, is making a careful study of soils and agricultural conditions throughout Wisconsin and is preparing soil maps and soil reports of all counties in the state. A soil map shows the location and extent of the different kinds of soil. Tracts of 10 acres and more 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 take account of all variations. A report is also made, to accompany and explain the map, and this is based upon a careful study of the soils within the region surveyed and upon such other features as have a direct bearing upon the agriculture of the area.

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

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

Water-holding capacity and other physical properties of soil all depend chiefly upon texture, which refers to the size of the individual soil grains, or particles. A coarse

sandy soil, for example, will not retain moisture as 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 method of separating soil grains into seven different groups. 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 certain fine sand, for example, may be light colored and of alluvial origin, 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

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

Soils Containing Between 20–50% of Silt and Clay

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

Soils Containing More Than 50% of Silt and Clay

5. Loam—Less than 20% clay, and less than 50% silt.
6. Silt loam—Less than 20% clay, and over 50% silt.
7. Clay loam—Between 20 and 30% clay, and less than 50% silt.
8. 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 example, includes light colored, glacial soils, 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 with heavy types predominating. The Plainfield series includes light colored soils in regions where no limestone is present, and where the material occurs as outwash plains or stream terraces. The soils in this series also have a wide range in texture, but sandy types predominate. The name used for a soil series usually indicates the locality where that particular series was first recognized and mapped by the Soil Survey.

By uniting the name of the soil class, which refers to texture, with the name of the soil series, which refers chiefly to origin, we get the soil *type*, which is the basis or unit of classifying and mapping soils. A soil type, thus, is a soil which is uniform throughout its entire extent in texture, color, topographic position, and other physical properties, and which has a distinct agricultural unity—that is, it is adapted to the same crops and requires 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. It is sometimes necessary to show minor variations in types where a portion of the type is more stony than the rest, or less well drained, or has a steeper slope. Such minor portions are mapped as *phases*.

SOIL SURVEY OF GREEN COUNTY

CHAPTER I

GENERAL DESCRIPTION OF AREA, CLIMATE, AND SOILS

Green County is in the extreme southern part of Wisconsin bordering the Wisconsin-Illinois boundary line. It comprises an area of 585 square miles or 374,400 acres. Monroe, the county seat, is 36.5 miles from Madison and 138 miles from Chicago.

TOPOGRAPHY

Green County consists, topographically, of an undulating plain, the upland surface of which lies at an elevation of about 1,100 feet. The old elevated plain was level. The dissection or erosion has been carried so far that the watershed ridges are narrow and irregular. They are as a rule rounded and, where wide enough, have good soil on top. In the western part of the county the valleys are deeper and slopes steeper than in the eastern part of the area. The city of Monroe is located on a remnant of the old table land which covers a few square miles, the largest in the area. In a few other places the ridges widen to about one mile.

In the eastern part of the county, Sugar River has not only cut a valley into the plain but has, through the work of its lateral streams, developed a rather broad belt of undulating lowland on both sides of the stream. The surface of this lowland lies well above the level of the alluvial plain of the river, but is clearly the product of erosion. It extends along the main stream across the county, although tongues extend up the valleys to the tributary streams as blunt-

ended lowlands separated one from another by the projection of the upland inward along the watershed between the tributaries. Owing to the geological structures and stratigraphic character and succession of beds, the slope from the lowland to the upland is rapid in the upper part of the slope and more gradual below, merging imperceptibily into the undulating lowland.

Somewhat the same features have been developed along Little Sugar River and in places along Pecatonica River. The rest of the area, with the exception of a small part of the northeastern corner, consists merely of a well-dissected plain.

A small area in the northeastern corner of the county was run over by the ice sheet of the Wisconsin glacial period. Its relief is smoother than the rest of the region as a whole.

A special study was made of the land in two representative townships in the county: Decatur township, which represents the smoothest or least rolling land, and York township, typical of the roughest part of the county. The following table gives the classification and proportionate extent of each class of land in these townships and shows the effect of glaciation on the topography of the land:

CLASSIFICATION OF LAND IN YORK AND DECATUR TOWNSHIPS ON THE BASIS OF SURFACE RELIEF

Class	Description	Proportionate extent	
		York Township non-glaciated	Decatur Township glaciated
		Per cent	Per cent
A	Level to gently undulating (including wet lands)	8.0	53.0
B	Undulating to gently rolling	58.0	38.5
C	Rolling to hilly	25.0	5.5
D	Steep, rough, and broken land,—mostly rough stony land	9.0	3.0

Green County is entirely within the drainage basin of Rock River, and the county is well drained by Sugar and Pecatonica Rivers which come together in Illinois before entering Rock River near Rockton. The alluvial flood plains along the streams are the only poorly drained land.

CLIMATE*

Nearly all of Green County is located within the southern highlands, one of the eight climatic provinces in Wisconsin. "Southern highlands" is a term used to include the rough or rolling region, mostly over 1,000 feet in elevation, which extends from Clark County south to the Illinois line and lies between the Mississippi Valley on the west and the Wisconsin and Rock River valleys on the east. It is characterized by a somewhat cooler temperature than the adjoining valleys, the summer temperature being similar to that along the Lake Michigan shore, and the mean winter temperature about 4° lower than along the Lake Michigan shore. The frost-free season, averaging 145 days, is apparently from 10 to 20 days shorter than on the lower land of the State in the same latitude; and in the river valleys and ravines in this region the frost danger is still greater, the records there showing an average frost-free period of 140 days. In some years corn fails to mature, and the use of land for pasturage and hay production is encouraged both by the surface relief and the heavier rainfall.

The mean annual temperature at Brodhead, as shown by the accompanying table, is 47.3° F. with an absolute maximum of 111° and a minimum of —33°. Although these temperatures are extreme, they are of very short duration and seldom occur. The average annual rainfall at Brodhead is 33.77 inches, and the average snowfall 33.4 inches. The prevailing winds are from the southwest. Rainfall is well distributed throughout the growing season when it is most needed.

The average date of the last killing frost in the spring is May 3, and the average date of the first in the fall is October 8. The latest recorded frost in spring occurred on May 25 and the earliest in the fall on September 11.

The following table, compiled from data of the Weather Bureau station at Brodhead, gives the normal monthly, seasonal, and annual temperature and precipitation at that place:

* For further information on climate see Exp. Sta. Bulletin 223.

NORMAL MONTHLY, SEASONAL, AND ANNUAL TEMPERATURE AND PRECIPITATION AT BRODHEAD

(Elevation, 812 feet)

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1901)	Total amount for the wettest year (1907)	Snow, Average depth
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	23.1	62	—26	1.55	1.16	1.23	7.9
January	19.0	60	—33	1.44	1.47	3.13	8.4
February	19.4	56	—31	1.56	1.30	.40	8.0
Winter	20.5	62	—33	4.55	3.93	4.76	24.3
March	34.6	84	—13	2.33	2.83	2.13	5.4
April	47.5	89	15	2.91	.75	3.61	1.9
May	59.0	95	24	4.11	2.89	2.64	Trace
Spring	47.0	95	—13	9.35	6.47	8.38	7.3
June	67.8	103	34	3.95	1.43	4.71	.0
July	73.4	111	40	4.04	3.83	9.37	.0
August	70.8	103	35	3.46	.46	4.21	.0
Summer	70.7	111	34	11.45	5.72	18.29	.0
September	63.3	100	20	4.09	3.30	7.83	.0
October	51.9	87	15	2.49	1.57	1.25	---
November	37.6	77	— 4	1.84	.83	1.38	---
Fall	50.9	---	---	---	---	---	---
Year	47.3	---	---	---	---	---	---

SOIL FORMATIONS

Limestone and sandstone form the rock floor of Green County. The youngest and uppermost formation includes the Black River and Galena limestones which form the bedrock over most of the southern and western parts of the county. The two formations, being very similar, are usually spoken of together. A lower formation, St. Peter sandstone, predominates over most of the remainder of the county, giving rise to sandy soils in numerous places. The lower magnesian limestone, lying below this sandstone, is the uppermost rock formation in the vicinity of Sugar River, and it gives rise to heavier types of soil. All of these rocks have contributed to some extent to the soils of the region.

The eastern part—approximately half of county—is included within the area of pre-Wisconsin glacial drift. This drift is thin and has not influenced the soils to as great an

extent as has the late Wisconsin glaciation in southeastern Wisconsin. The western part of the county is unglaciated and rough.

Soils of silt loam texture make up nearly 90 per cent of the land surface of Green County, exclusive of rough broken land and peat. Beneath the silty surface layer of the well drained upland soils is a layer of heavier material, usually silty clay loam, from 12 to 20 inches thick, beginning at from 8 to 15 inches below the surface. This subsoil layer is underlain by the partly weathered parent material, which in Green County may be either disintegrated limestone, sandstone, or glacial drift, or stratified, waterlaid deposits. This is the normal texture profile of this region and other regions which are similar in soil-forming agencies and processes.

The color of the surface soil over the well drained uplands is not so uniform as is the texture. In fact, two distinct soil groups, based on fundamental color differences, are represented in the county; one group is made up of comparatively light colored soils, and the other of dark colored soils, the dark color extending to depths ranging from 8 to 12 inches. These soils are intermingled throughout the county. Soils of the light colored group, represented by the Knox and Miami soils, and others of minor extent, are generally on the areas originally covered by forest; the dark colored soils, represented by the Dodgeville and Carrington series, are prairie soils. Poorly drained mineral soils are all very dark colored or nearly black. They total a considerable area, particularly in the eastern part of the county.

From the point of view of the origin of soil materials, there are at least six different kinds of soils in Green County—residual, loessial, glacial, alluvial, colluvial, and marsh. Some of the soil-forming material has been modified in various ways since it was first formed or deposited. In the soil survey of Green County, these soils have been classed into 13 soil series which include 24 soil types and 14 phases, exclusive of peat and rough broken land.

The Knox series includes light colored upland forested soils which have developed from material originating from the weathering of limestone. These soils have silty or

loesslike surface layers. Two soil types, Knox silt loam, with a deep phase and a steep phase, and Knox loam, with a steep phase, were mapped.

The Dodgeville series includes dark colored prairie soils developed from the same parent material as Knox soils. Two soil types, Dodgeville silt loam, with a deep phase and a steep phase, and Dodgeville fine sandy loam, with a steep phase, were mapped.

Boone soils are light colored soils usually of sandy texture, derived from the weathering of sandstone. Boone loam and Boone fine sandy loam, each with a steep phase, were mapped.

Carrington soils are dark colored prairie soils derived from calcareous glacial drift. Carrington silt loam, with a gravelly phase and a steep phase, was mapped in Green County.

The Miami series includes light colored upland forested soils derived from deeply leached calcareous glacial drift. Three members of this series were mapped: Miami silt loam, loam, with a steep phase, and fine sandy loam.

The Fox series includes light colored soils on terraces or outwash plains chiefly in the region of glacial drift. The material has all been reworked and redeposited by water but now exists above present overflow. The members mapped in Green County are silt loam, loam, fine sandy loam, and sandy loam.

Clyde soils are dark colored soils in poorly drained depressions on the glaciated upland. In places the series was extended to include some material which was water-laid. Two soil types, Clyde silt loam and Clyde loam, were mapped in this county.

The Waukesha series includes dark colored prairie soils on outwash plains or stream terraces well above present overflow. The parent material is water-laid. Four members of the series, Waukesha silt loam, fine sandy loam, sandy loam, and sand were mapped.

Wabash soils are dark colored, poorly drained first-bottom soils, subject to annual flooding. Two soil types, Wabash silt loam with a colluvial phase and Wabash loam, were mapped in Green County.

The Lintonia series includes light colored soils derived

from alluvial and colluvial material in the region where Knox soils form the higher-lying lands. These soils occur at the base of slopes, and the surface is level or only gently sloping toward the stream bed. They may also occur on terraces in the loessial country, in which case they correspond very closely to soils of the Fox series except that they are outside the glacial region. Lintonia silt loam was the only member of this series mapped in Green County.

Rough broken land includes steep, rough, broken, or extremely stony land which is practically non-agricultural. In some places it consists entirely of rock outcrops, but in other places there is considerable soil material although the surface is very steep.

The Plainfield series includes light colored sandy soils which occur on terraces or outwash plains. The parent material is largely sand. Plainfield sand is the only member mapped.

The Coloma series includes light colored upland soils whose parent material is glacial drift which has developed chiefly from sandstone. Coloma sand is the only soil of this series mapped in Green County.

The Rodman series includes the gravelly, stony glacial drift material which occurs chiefly as kames and eskers where the surface is very rough and where little soil has developed. Rodman gravelly loam is the only member of this series mapped.

Peat consists of vegetable matter in varying stages of decomposition with which small quantities of mineral matter have been mixed. Peat, with a shallow phase, was mapped in Green County.

The following table gives the acreage and proportionate extent of each soil type mapped in Green County:

ACREAGE AND PROPORTIONATE EXTENT OF TYPES OF SOIL

Type of Soil	Acres	Per cent	Type of Soil	Acres	Per cent
Knox silt loam	40,832	31.1	Fox loam	3,776	1.0
Deep phase	45,248		Waukesha fine sandy loam	1,152	.7
Steep phase	30,400		Fox fine sandy loam	1,408	
Knox loam	3,008	1.0	Waukesha sandy loam	3,328	1.5
Steep phase	640		Fox sandy loam	2,176	
Dodgeville silt loam	37,056	30.0	Waukesha sand	1,216	.3
Deep phase	57,024		Clyde silt loam	8,960	2.3
Steep phase	18,304				
Dodgeville fine sand loam	1,984	.7	Clyde loam	1,216	.3
Steep phase	576		Waukesha silt loam	6,848	1.8
Boone loam	3,776	1.2	Wabash silt loam	42,496	12.9
Steep phase	704		Better drained phase	5,440	
Boone fine sandy loam	8,128	2.4	Wabash loam	1,344	.3
Steep phase	896		Lintonia silt loam	4,288	1.1
Carrington silt loam	5,888	1.8	Rough broken land	14,336	3.8
Gravelly phase	576		Plainfield sand	1,024	.3
Steep phase	128		Coloma sand	192	.1
Miami fine sandy loam	2,624	.7	Rodman gravelly loam	256	.1
Miami loam	4,352	1.3	Peat	4,672	1.4
Steep phase	384		Shallow phase	640	
Miami silt loam	5,440	1.5			
Fox silt loam	1,664	.4	Total	374,400	

CHAPTER II

SOIL IMPROVEMENT

Part 1—Chemical Composition and Improvement of Silt Loam Soils

This group includes the Knox, Dodgeville, Carrington, Miami, Lintonia, Fox and Waukesha silt loams and their deep and steep phases.

These soils are quite similar in the texture and structure of the surface soil and in some cases in the upper portion of the subsoil as well. There are some marked differences in the character of the deep subsoil. The most marked difference in the group, however, is in color. The Carrington, Dodgeville and Waukesha soils are dark colored prairie types while the Knox, Miami, Lintonia and Fox soils are light colored timbered soils rather low in organic matter. The types of the group are sufficiently related in agricultural value, adaptation, etc., so that, with a few exceptions, methods for the improvement of one will apply to the others.

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

The soil has been leaching for a large number of years and has lost much of the lime which it may have contained. Varying degrees of acidity have developed over the entire region. The loss of lime from the soil is caused by two distinct factors, both of which are important. Crops require lime in their growth. A five-ton crop of alfalfa requires one hundred and eighty-five pounds of lime, and two tons of red clover removes 61.6 pounds. A much larger amount is

removed by leaching each year, and these losses must be made up by the application of lime in order to maintain the fertility of this soil.

Failure of clover and alfalfa is in many places an indication of the need of lime. About 3 tons of ground limestone to the acre is the usual application on soils where alfalfa is to be grown, and 2 tons where clover is seeded. The amount to be used, however, may vary with the degree of acidity, the character of the soil, and the crop to be grown. Such crops as alfalfa, sweet clover, peas, cabbage, onions, and lettuce have a high lime requirement; clover, garden beans, barley, hemp, turnips, and radishes have a medium lime requirement; and vetch, white clover, oats, rye, bluegrass, potatoes, and sorgo (sweet sorghum) a low lime requirement. As a rule, heavy acid soils need more lime than sandy soils showing the same degree of acidity. Where a liberal supply of manure is available, the need for lime will not be so great. The second application which may be needed after six or seven years may be less than the first. The greater need will usually be on the higher places rather than on the lower slopes.

Ground limestone is doubtless the most economical form of lime for extensive use in Green County. Lime should be applied to plowed land in fall, winter, or spring, previous to planting, and thoroughly worked in by harrowing. Lime or manure spreaders may be used. An application of 3 tons of ground limestone for alfalfa or sweet clover and of two tons for other crops is sufficient for 8 or 10 years, after which two tons should be applied on the alfalfa land and one ton on other crops.

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

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

Thirteen samples of Dodgeville silt loam gave an average of 1466 pounds of phosphorus to the acre eight inches deep. Six samples of Carrington silt loam from Green County gave 1200 pounds per acre. Eight other samples of Dodgeville silt loam were found to contain an average of 1012 pounds per acre, and two samples of Waukesha silt loam contained an average of 1800 pounds per acre. In the light colored soils the amounts of phosphorus run somewhat lower. In twenty-two samples of Knox silt loam the average was 769 pounds, while in nine other samples of the Knox silt loam the average was only 640 pounds per acre. In eight samples of Miami silt loam the average supply of phosphorus was 805 pounds per acre eight inches deep. The number of pounds of phosphorus in the soil, however, cannot be taken to indicate the immediate need for phosphate fertilizer because its availability to crops varies. The system of farming followed, crops grown, type of soil, and conditions relative to acidity are all important factors in determining the need for phosphorus. It should also be borne in mind that where soils are acid, the amount of phosphorus which they do contain is not so readily available to plants as in soils which are not acid.

On good upland soil where dairying or general farming is practiced the use of 300 pounds of 20 per cent acid phosphate or 150 pounds of 45 per cent super-phosphate to the acre on each field every four or five years will maintain the

phosphorus supply. If much grain, potatoes, or other crops are sold, more phosphate should be used.

On the farm of Roy Marshall at Elkhorn in Walworth County, an application of one hundred pounds per acre of treble super-phosphate (45 per cent) on corn gave a yield of 15,570 pounds of silage while on the untreated plot the yield was 13,335 pounds per acre. In a test on the Miami silt loam soil on the Station Farm at Madison, a phosphate fertilizer applied at the rate of two hundred pounds per acre on oats gave a yield of 93.8 bushels, while the untreated yield was 70.4 bushels. This was on land where the fertility was quite high. In another case where 500 pounds of 16 per cent acid phosphate per acre was applied to prairie land which received both manure and limestone the yield of alfalfa was nearly doubled. The average of a large number of tests shows that the increase in yields due to phosphate has a value of three to four dollars for each dollar's worth of phosphate used. In some of these cases the increase is small, but it should be kept in mind that the fertilizer left over in the soil will be of considerable value to the following crop, especially clover and alfalfa.

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

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

Application of Phosphates

Phosphate fertilizers not only increase the yield; they also have a special tendency to hasten the rate of maturity. For the latter reason they are especially helpful to corn in this state. In order to get the maximum benefit from the smallest expenditure for phosphate on corn, it should be applied near the hill where it will be

taken up early and more completely than when broadcast. The use of from 100 to 150 pounds of a phosphate alone, or of a mixed fertilizer high in phosphate, is being found very helpful in this respect. It must be recognized, however, that phosphate applied in that manner for corn will leave little that can be of benefit to small grain or hay following the corn. For these crops the fertilizer must be applied either with a grain drill having a fertilizer compartment known as a fertilizer grain drill, or broadcast with a broadcast sower and worked in when preparing for seeding. Since all legumes, such as clover and alfalfa which are relatively high in protein, require relatively large amounts of phosphorus, it is very important that these crops be supplied with this element, and the only way in which this can be accomplished is by broadcast application at the time of seeding the grain crop. It is possible, however, to apply the phosphate as a top dressing on clover or alfalfa. Good results are secured in this method when care is taken that the fertilizer is applied before much growth has taken place in the spring, or even better, after growth has stopped in the fall. It is especially important to avoid spreading the fertilizer when there is any moisture on the crop*

POTASSIUM IN THE SOIL

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

* For further information on the use of phosphates, see Experiment Station bulletins.

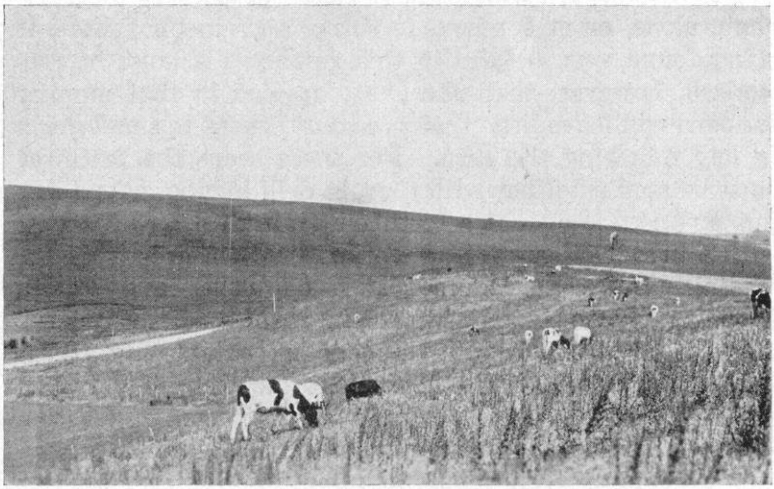

Fig. 1. Good pasture is the best and most economical summer feed for dairy cattle and it is the best means of prevention of erosion on steep hillsides. It requires fertilization to replace plant food removed by grazing.

Fig. 2. Brown Swiss cattle owned by dairymen of Swiss descent are quite at home in Green County.

needs large amounts of potash and does not get much manure will be benefited by potash in the fertilizer.

NITROGEN IN THE SOIL

Nitrogen is chiefly responsible for the dark green, healthy color and rapid growth of corn or other crops on well manured land. It is important to have sufficient amounts in the soil, but when in excess it is detrimental for some crops. The quality of the grain may be injured by too much nitrogen. When in excess, it causes grain to lodge, and the kernels do not fully mature.

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

The supply of organic matter and nitrogen in the prairie soils is considerably higher than in the light colored timbered soils. Eight samples of Dodgeville silt loam from Green County showed an average of 4365 pounds of nitrogen in the surface eight inches. Two samples of Waukesha silt loam were found to contain 7,000 pounds each, and Carrington silt loam showed an average of 4,768 pounds for five samples. The light colored soils show a marked difference. Twenty-two samples of Knox silt loam contained an average of 2,690 pounds. Miami silt loam showed 3,572 pounds in an average of eight samples. A question of importance in connection with the nitrogen of this soil, however, is its availability to plants, and in the soils which have been under cultivation for a long number of years, this nitrogen is somewhat inert. When in this condition, decaying vegetable matter, green crops, or manure plowed under will give a more readily available supply of nitrogen.

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

green manure to insure keeping up the supply of nitrogen and organic matter. When the manure from this feeding is properly handled, the nitrogen of the farm will be maintained.

Certain crops such as tobacco, potatoes, and vegetables are grown by farmers who do not keep much livestock and who do not rotate these crops with legumes. This is not a good practice. A rotation with a legume plowed under will secure nitrogen and reduce danger from diseases; and when supplemented with phosphorus and potassium fertilizers, the legumes thus treated will take the place of manure, which can then be used for other crops on the farm.

Some fertilizers contain only one of the plant food elements. Nitrate of soda or calcium and sulphate of ammonia contain nitrogen; acid phosphate and rock phosphates contain phosphorus; muriate of potash contains potash. Other fertilizers contain two or all three of the important elements. The composition of these fertilizers is indicated by a formula. A 3–10–4 fertilizer contains 3 per cent of nitrogen, 10 per cent of phosphoric acid and 4 per cent of potash. A 0–16–6 fertilizer contains no nitrogen, 16 per cent of phosphoric acid and 6 per cent of potash.

Where it is necessary to use commercial fertilizers which contain nitrogen, it is highly important that this fertilizer be applied with a fertilizer attachment on the planter, or in such manner that it will come within the root-feeding radius of the plant. Fertilizer attachments are used in the application of fertilizers to potatoes and corn. For sugar beets the fertilizer should be applied at the time of planting with a regular fertilizer beet drill. Fertilizer for tobacco and cabbage is usually broadcasted previous to setting, although it has proved desirable to apply a small quantity with an attachment on the tobacco or cabbage setter, and to broadcast the rest after the crop has developed a more extensive root system. For onions and other truck crops, it is usually desirable to broadcast the fertilizer previous to planting.

Soils vary greatly in the total quantity of plant-food elements they contain in available form and especially in the proportion of the various elements required by crops. Sandy and light colored soils are generally low in most ele-

ments, especially potash. Light colored clay soils are comparatively low in nitrogen and are moderately well supplied with phosphates. Prairie soils are high in nitrogen but are usually acid and respond to phosphate fertilizer. Heavy soils contain potash in comparative abundance.

Relation of Crops to Chemical Content of Soils

In the relation of crops to soils, the relative proportion of the different plant food elements required and the total quantity needed are deciding factors in fertilization. Although there are undoubtedly slight variations in the requirements of each individual crop, crops can be grouped fairly well into classes. Such crops as small grains and grasses, including timothy, require a comparatively large amount of phosphates and moderate amounts of potash and nitrogen. Such crops as corn, potatoes, tobacco, and sugar beets require large amounts of nitrogen and potash and moderate amounts of phosphate. Peas, clover, and alfalfa require large amounts of phosphate, potash, and lime, but under proper conditions they can secure most of their nitrogen from the air. The total quantity of plant food needed depends largely on the total weight of the crop produced.

Use of Commercial Fertilizers

In determining the proper fertilizers to use, all of these factors must be considered. Commercial fertilizers should be used only to supplement the natural fertility of the soils, Acid phosphate should be used on the heavier soils in a system of general farming where a sufficient amount of manure is produced to cover the cultivated land every fourth year. From 125 to 350 pounds to the acre of this phosphate fertilizer should be used. It should be broadcasted or applied with a fertilizer grain drill at the time of seeding. If the soils are acid and in need of lime, this condition must be corrected before the phosphate fertilizer will be most effective.

Mixed fertilizer high in phosphoric acid may be used on lighter soils where there is a small supply of organic matter. From 200 to 400 pounds of these fertilizers to the acre may be applied with small grains. From 75 to 125

pounds an acre may be used on corn and should be applied with fertilizer attachments on the corn planter. Fertilizer applied to corn in this manner should only supplement the usual manurial treatment.

Mixed fertilizers high in potash may be used for truck crops where barnyard manure is not plentiful. It is imperative that some legume, such as clover or soy beans, be grown with these crops in order to supply the necessary amounts of organic matter and some of the nitrogen needed. For potatoes, from 400 to 1,000 pounds of fertilizer an acre should be applied, and for onions, cabbage, beets, and tobacco the fertilizer may be broadcasted at the rate of from 400 to 1,500 pounds to the acre.

Phosphate and potash mixtures should be used on the dark colored soils having no need for nitrogen in the fertilizer. For more specific information on the use of fertilizers, see bulletins of the Wisconsin Experiment Station.

PERMANENT PASTURE

Pasture crops require plant food the same as other crops grown on the farm. In fact, pasture should be considered in the same class as a cereal or hay crop as far as fertility requirements are concerned. Many of the permanent pasture plots have been grazed for many years with no thought given to the return of plant food removed by the dairy animals and other livestock maintained. The droppings of the animal in only a small way return plant food removed by grazing.

Where clovers make up a considerable part of the pasture crop, little thought needs to be given to the question of nitrogen fertilizers since the legumes can secure their nitrogen by fixation. Some of the recent work of the Experiment Station indicates that clovers may be established by seeding early in the spring before the frost is out of the ground, providing the supply of plant food is sufficient to meet the requirements of the crop. Alsike and white clover can be seeded when there is a very poor stand of grass and where it will catch. Quite frequently land so seeded may be utilized for pasture purposes the same fall, but it has been

found desirable to pasture late in the spring the first year after seeding in order that a good system may be established.

On soils which show a medium acid reaction, limestone is needed and should be applied at the rate of two tons to the acre. The fertilizer treatment should consist of a liberal application of phosphate, together with a moderate potash application. A fair treatment consists of 300 pounds of 20 per cent superphosphate together with about 100 pounds of muriate of potash. In case ready mixed goods are used, about 500 pounds of an 0–14–14 fertilizer per acre may be used. This fertilizer may be applied broadcast in late March or early April, at the time of the seeding if any is done, or without reseeding. The fertilizer and lime will greatly increase the growth of clover already on the ground.

On good pastures in this region from one and one-half to two acres will supply the feed for an average cow for five or six months, but it is usually necessary to supplement pasture crops a part of the time without overgrazing in order to maintain the herd in a thrifty condition and at maximum milk production. Where it is possible to secure five months' feed from the pasture land, it is quite apparent that this type of land may be very profitably utilized for producing dairy feed. The same is undoubtedly true if used for grazing beef cattle and sheep. Thus pasture economy is at once apparent when one considers that cost of pasture land is only for interest, taxes, and fencing, amounting to approximately $10.00 for the pasturing period, or $2.00 per month. On the other hand, the cost of feed during the winter period may range from $8.00 to $10.00 per month. Moderate steepness of slope is, therefore, not such a serious handicap, providing this land does not constitute a larger portion of the farm than can well be utilized for pasture purposes.

The majority of farms in the County, as at present laid out, include a fair amount of tillable land associated with rougher land adapted for pastures. In order that this steep land may be used to best advantage, livestock must be kept, and this is one of the principal reasons why the livestock industry is developed on such a large scale in Green

County. Livestock farming, it may be stated, is about the only type of agriculture that can fully utilize the steep land as well as the low, poorly drained areas. Dairying is, therefore, being developed on a large scale, as it is able to utilize land which in a grain system of farming would have little or no value.

Soil Erosion

By hillside erosion is meant the removal by water of the more fertile part of the surface soil from fields which may have only a gentle slope. Not only are the soil particles removed, but the loss of the organic matter is of equal or greater importance.

Injurious washing due to hillside or sheet erosion may be controlled in a considerable measure by adopting proper cropping systems. Land subject to losses from this source should be kept as much as possible in grass, hay, or pasture and the ground devoted to cultivated crops as little as possible. Such crops as alfalfa may be grown, the crop left on the land continuously for a period of three to five years, followed by a cultivated crop, and then again reseeded.

It is also very desirable, wherever it is possible, to plow up only a section of the slope land, following the contour so that while the lower half, for example, is in cultivated crops, the upper half may remain in hay or pasture crops. Likewise, when the lower half is laid down to hay or grass, the upper section may be devoted to grain or cultivated crops. This practice has been followed by many farmers with good results.

Where there is any tendency for small gullies forming, these should be maintained in sod strips which protect the field from the flow of water during rains and prevent deep gullies which are sure to follow unless methods of protection are taken. These sod strips should be of sufficient width so that gullying does not begin at the side, resulting in two new gullies in place of the original one.

Increasing the supply of organic matter is one means of increasing the water-holding capacity of the soil, and thus of helping to prevent erosion. Plowing under of a green manuring crop, stable manure, and crop residues such as

straw and cornstalks, are processes that may be mentioned in this connection.

On much of the hillside land of this county which must be used for cultivated crops, the construction of terraces by the use of a plow and road grader will greatly lessen erosion. These terraces carry the water down the slope at a very low gradient so that it carries little silt or earthy matter with it and prevents the formation of gullies. Such terraces can be made on most of this land at an average expense of $1.50 to $2.00 per acre, which is very small compared to the benefit that it produces. They are broad and low so that farm machinery can be operated over the entire field as before.*

Gullies.—Erosion commonly leads to the formation of gullies unless prompt preventive measures are taken. Where these gullies are allowed to go unchecked, the entire field may soon be made practically useless for farming purposes.

It is, therefore, of the greatest importance that farmers in this region do everything possible to reduce and control losses from this source. Control measures include the prevention of the development of gullies in the early stages by filling in with brush, straw, or other material.

In many cases, gullies which have already been formed can be kept from further development through the construction of dams which will cause the accumulation of soil above them, yet will permit the water itself to continue down the slope. Different forms of dams have been used for this purpose. Under some conditions an earth dam may be satisfactorily used. In other cases a concrete dam is built but, in case of either the earth or the concrete dam, a tile sluice should be laid beneath the dam, extending down the gully so as to draw off the water above the dam before it reaches the top and carry it down a slope without permitting erosion losses.

Planting willows and brush on the sides and bottom of ditches too deep to fill often arrests the growth of the gully. Full information on the construction of dams will be found in the Experiment Station Bulletin on erosion.

* For further information on the construction of terraces, see Experiment Station bulletin on erosion.

Bottom land.—Many of the bottom lands along the streams in the County are badly cut up because of the meandering tendency of streams. The straightening out of the stream bed in these bottom lands will be of some help. During periods of spring freshets or after any heavy rainfall, an enormous quantity of water collects in these valley bottoms, rendering control measures difficult. Were more of the steep slopes maintained in timber or forest growth, the runoff would be materially reduced, and the losses to the bottom land would be less destructive.

Part 2—Chemical Composition and Improvement of Loams and Fine Sandy Loams

In this group of soils there are several types all of which are of minor importance individually, but collectively the group is important. These soils are somewhat lighter in texture than the silt loams but, where general farming is carried on, practically the same methods of improvement can be followed as outlined for the silt loam soils on page 19.

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

Tests and observations which have been made on these soils indicate that practically all of the types are in need of lime. The dark colored prairie soils show a greater need than the light colored soils. There are a few exceptions to this need and these are found where the underlying limestone comes close to the surface as it does in a few places in the western part of the county. Frequently, however, the soil will be in an acid condition even when the limestone is within one foot of the surface. See page 45.

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

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

Regarding the supply of potassium in the soil, the total amount is approximately 25,000 pounds per acre, or fully 20 times as much as the supply of phosphorus. Where general farming is conducted, and where there is maintained a good supply of vegetable matter in the soil, this will doubtless be sufficient. Where special crops are raised which require a large amount of potassium, this element may be supplied to advantage in the form of a commercial fertilizer.

Where general farming is practiced, the fertilizer recommendations for phosphorus and potassium given for the group of heavy soils should be followed. See page 22.

The principal characteristics of these types are that they hold somewhat less water than heavier soils do, and they warm up more quickly in the spring. This, together with the readiness with which they can be worked, adapts them to truck and special crops, the growing of which requires more hand labor than is involved in the growing of staple crops. In growing truck and special crops it is necessary to give these soils somewhat more attention to maintain fertility, partly because of the fact that they are lower in fertility than the heavier soils, but more especially because these special crops require a higher degree of fertility to produce satisfactory yields. When these soils are used for the production of special crops, their fertility can be maintained either through the use of somewhat heavy applications of stable manure or through the use of a rotation in which a legume is grown as the means of securing the necessary nitrogen and organic matter, while the other elements, chiefly phosphorus and potassium, are supplied in commercial fertilizers. When this latter system is fol-

lowed, one-third or one-fourth of the land should be sown to a legume such as clover or soy beans which have large powers of gathering nitrogen from the air, and a part of the phosphorus and potassium should be used for the growth of different green manuring crops. The fertility used in this way will become available for the succeeding crops through the decomposition of the legume when plowed under, and the remainder of the fertilizer to be used should be applied on this ground at the time of fitting it for the succeeding crops.* See pages 25, 26.

Part 3—Chemical Composition and Improvement of Sandy Soils

This group includes the Waukesha and Fox sandy loams and the Waukesha, Plainfield, and Coloma sands. These soils are quite similar in the texture of surface soil and subsoil but differ somewhat in their color and mode of origin. The Waukesha sand is darker colored than the Coloma and Plainfield and contains somewhat more organic matter. Taken as a group, the supply of nitrogen and organic matter is less than half that found in the Dodgeville silt loam, and it is also considerably lower than the average for the light colored silt loams. The phosphorus supply is markedly lower than in the heavy soils and often falls below 500 pounds per acre. The potassium supply is from one-half to two-thirds that found in heavy soils.

While these sandy soils are low in plant food and have a lower agricultural value than the heavy soils for general farm crops, there are certain advantages which they possess. They are easy to cultivate, they warm up early in the spring, and as a rule they respond readily and profitably to the application of fertilizers.

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

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* For further information on fertilizers for special crops see Experiment Station Bulletin.

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 livestock farming is practiced, it will be less difficult to maintain the supply of the essential elements of plant food,—that is, phosphorus, potassium and nitrogen. But even when stock is maintained, it is very probable that the moderate use of some form of phosphorus and potash 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.

The following fertilizer treatment for legumes and other general crops is recommended by the Experiment Station:

On light sandy soil with little or no livestock, the fertilizer should carry from two to four times as much potash as phosphoric acid, and it should be applied at a rate to supply about 75 pounds of *actual* potash per acre. Assuming the fertilizer to be used a 0–8–24, 300 pounds per acre would supply 72 pounds of *actual* potash.

On sandy loam soils without livestock, or on well managed light sandy dairy farms, a fertilizer with equal amounts of the two elements or up to twice as much potash as phosphoric acid, should be used and it should be applied at a rate to supply 50 to 75 pounds of *actual* potash. Rates should be gauged according to previous management. This fertilizer should carry 30 to 50 pounds of phosphoric acid. Two hundred fifty pounds of 0–20–20 would supply 50 pounds of each.

On the better sandy loam dairy farms, a fertilizer with one-half up to just as much potash as phosphoric acid may be used, and at rates supplying the needed amount of phosphoric acid, namely, 40 to 60 pounds per application. For example,—300 pounds, 0–16–8; 500 pounds, 0–12–12; etc.

Clear muriate of potash (50 per cent *actual* potash) and acid phosphates (16, 18, 20, 24 or 45 per cent phosphoric acid) may be used separately, or home mixed, and applied in amounts to meet the above recommendations.

When these soils are used for the growing of potatoes or other special crops to a considerable extent, 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 some commercial fertilizer containing phosphorus and potassium in order to secure a good growth of clover, and there is little loss in so doing since a large part 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. But another application should also be made for the special crop to get the largest yields.*

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

Part 4—Chemical Composition and Improvement of Poorly Drained Soils

These soils are all low-lying and poorly drained. They are quite extensive as a whole, covering most of the bottom lands of the county. These lowlands have received the

* See Experiment Station Bulletin—Fertilizers for Special Crops.

wash of lime-bearing water from the uplands for centuries, and the types therefore contain more lime than most of the upland soils. They are seldom in need of lime, especially the Clyde soils.

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

The phosphorus supply is usually ample for a number of years after drainage. Such land as this must be manured eventually, or commercial fertilizers containing phosphorus and potash must be used. There is relatively a much larger supply of nitrogen than phosphorus and potassium. For this reason it is good practice to use the manure on the upland soils which are deficient in nitrogen and apply mineral fertilizers to the low land when these are needed. In many cases where the soil is high in organic matter to the depth of a foot or less, a marked need of potassium is shown during the first few years of cropping. This need disappears later because, when the surface settles, deep plowing mixes some of the under soil high in potash with the surface soil.

The first step in the improvement of this group of soils is drainage, and when thorough drainage is established they will make some of the best corn land in the State. Fertilizing with phosphate and potash will greatly increase their productivity as pasture. Where the bottoms are large, diking to prevent overflow may be resorted to, but where the bottoms are narrow this expense would not be justified. In some cases the beds of the stream could be lowered, thus providing better drainage and insuring a good outlet for

tile drains. In the drainage and improvement of the larger areas of this class of land, the organization of drainage districts would be advisable, and in many cases absolutely necessary.

Improvement of Peat Soils

At present only a very small proportion of the peat soil in Green County is improved. The actual value of marshland depends upon the crops which can be grown upon it, which, in turn depends on the extent of drainage and the danger from frosts. When only a main outlet and lateral drainage ditches have been installed, only hay can be safely grown. When tilled crops such as corn, cabbage, potatoes, or small grains, are to be grown, the drainage must be more certain, and on the greater portion of the marshlands this necessitates the installation of open lateral ditches or tile drains not more than 10 or 15 rods apart.

In the case of peat land underlain by sand, well constructed and sufficiently deep ditches from 40 to 80 rods apart will, in most cases, give adequate drainage. When the peat soil is underlain by silt or clay, however, ditches not more than 20 rods apart are necessary, and these must lower the water in the ditch to a point 4 or 5 feet below the surface during part of the growing period.

Marshlands are more subject to early fall and late spring frosts than are uplands, partly because of their low-lying situation, and partly because the loose, spongy nature of the peat soil prevents the heat of the sun from penetrating much below the surface. This looseness of the soil can be somewhat improved by the use of a heavy roller which compresses the soil and gives it better heat conductivity. This tendency to frost reduces somewhat the availability of marshland for tender crops, but in Green County potatoes and corn on marshlands are seldom injured by frost.

On marsh soils commercial fertilizers containing phosphorus and potassium are more satisfactory than stable manure. Lime is not needed. Of the staple crops, hay and corn are best suited to such land. Special crops such as cabbage, hemp, and sugar beets also do well, but these will require larger quantities of potash and phosphate fertilizers.

CHAPTER III

GROUP OF SILT LOAM SOILS

KNOX SILT LOAM

Knox silt loam is a grayish-brown friable, smooth silt loam soil, from 6 to 10 inches deep, containing a small or moderate quantity of organic matter or humus. The upper subsoil is a yellowish-brown slightly heavy silt loam, grading into silty clay loam, 14 or 16 inches below the surface. With increasing depth the heavy subsoil usually becomes gritty with chert and small angular rock fragments, and at depths ranging from 18 to 24 inches, red gritty clay occurs resting on the bedrock of cherty limestone.

The texture and color of the surface soil are uniform, but there is considerable variation in the depth to the red clay and bedrock. In a few places on steep slopes, the surface soil has been eroded and the red clay exposed. In other places on ridge tops or nearly level areas, the depth to bedrock is much greater than usual. On some of the more shallow areas, chert fragments are present on the surface and through the soil mass, this condition being most common on slopes and ridge tops where erosion has removed part of the surface soil. Some outcrops of limestone bedrock occur, usually on the steepest slopes.

Knox silt loam is one of the most extensive and important types of soil in Green County. It occurs to some extent in nearly every township, although more than 90 per cent of it is in the western half of the county. It is the predominating soil in New Glarus and Jordan townships, and it occurs extensively in Washington, Monroe, Cadiz, Adams, and York townships. It is associated with soils of the Dodgeville series.

Small bodies of this land on ridge tops or plateaus are rolling or nearly level, but on the sides of ridge slopes and around the heads of drainage ways the surface becomes so

Fig. 3. Residual soil formed from limestone rock which it overlies. The surface soil is acid because of downward leaching of lime.

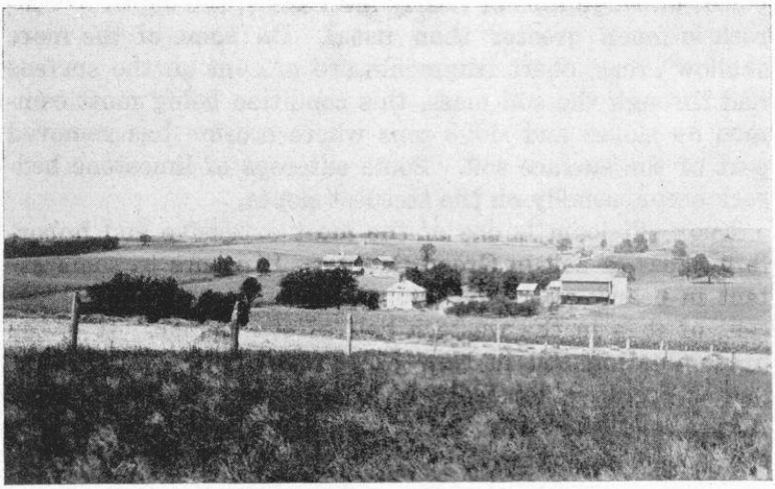


Fig. 4. A typical view on the rolling hills of Green County.

steep that it is subject to serious erosion. Most of the steep slopes have been mapped as a steep phase of the soil. Because of the slope the drainage is good, the texture of the soil is such that it retains moisture well, and crops seldom suffer from drought except during unusually long dry periods.

The native forest growth on this soil consisted chiefly of oak, with some hickory, elm, maple, basswood, ash, walnut, cherry, and hazel brush. Most of the timber has been removed from the gently sloping land, but on many of the steep slopes a forest growth still remains. The chief crops are hay, pasture grasses, small grains, and some corn.

KNOX SILT LOAM, DEEP PHASE

The surface soil of Knox silt loam, deep phase, has an average depth of 12 inches where cultivated. It consists of smooth, light-brown or grayish-brown silt loam, containing only comparatively small quantities of organic matter. The subsoil is yellowish heavy silt loam, grading into silty clay loam at a depth of about 18 inches and continuing as such to depths of 30 or 36 inches, where reddish clay or clay loam is usually present. This clay may contain fragments of chert. Both the surface soil and upper subsoil are free from coarse sand, gravel, and stones, and the texture as a whole is uniform. The soil is slightly acid in places.

Variations in depth of the soil and in surface contour, rather than in texture, occur in the mapped areas of Knox silt loam, deep phase. In most places the surface soil and subsoil have a total depth of 3 or 4 feet, but there are places where the underlying residual material comes within 2 or 3 feet of the surface, and there are some small areas where it is within one foot of the surface. The underlying rock is usually limestone. Where sandstone is the underlying rock, as in some places, the deep subsoil is sandy, and sand is more or less mixed with the silt. In such places the fine sand becomes more abundant as bedrock is approached. In portions of the county the limestone is somewhat sandy, and thin clay or shale layers may be present in the sandstone. In either case, a sandy or gritty clay loam or clay might be formed by the decomposition or weathering of the

rock. Some patches of light colored silt loam are also included with mapped areas of this soil where the region has evidently been glaciated. A color variation occurs where this soil borders the darker Dodgeville silt loam. In such places both surface soil and subsoil have a darker color than usual.

Knox silt loam, deep phase, is an important soil in Green County, covering a total area of 70.7 square miles. It forms part of every township, the largest areas occurring in Spring Grove, Clarno, Cadiz, Decatur, and Washington townships. The phase is closely associated with Dodgeville silt loam and with typical Knox silt loam.

The surface of this land is for the most part gently rolling, and the areas occur chiefly on ridge tops and long gentle slopes. In places these ridges are less than three-quarters of a mile wide, whereas in other places areas of this soil are several square miles in extent. The natural drainage of this land is good.

The native forest growth on this phase of soil was similar to that on the typical soil. At present, the greater part of the land is under cultivation. The acreage of desirable cornland is somewhat small because of the danger of serious washing even on quite gentle slopes.

KNOX SILT LOAM, STEEP PHASE

Knox silt loam, steep phase, is closely associated with typical silt loam, but it is not so extensive. The soil usually resembles the typical soil, but it is subject to greater variation and forms a thinner covering over the underlying rock. The surface soil is usually a light brown silt loam about 10 inches deep. This is underlain by a yellowish brown silty clay loam material which usually prevails to a depth of 3 feet or more. In many places, erosion has removed the surface covering, and the heavy silty clay loam material forms the surface soil. In other places, especially where the soil is shallow, rock fragments are present in the soil mass. Where the soil overlies sandstone, considerable fine sand is incorporated with the soil in many places, and the deep subsoil may consist of a fine sand or fine sandy loam. Where limestone is the underlying rock, the subsoil may be a red

or reddish-brown, heavy clay loam containing cherty fragments. Rock outcrops occur here and there on this soil.

The surface of this kind of land is rolling or hilly with steep slopes and sharp, narrow ridges where the danger from erosion is great. Because of the danger of erosion, not much corn is grown on the steep land. It is grown mostly on the gently rolling ridge tops and lower slopes below the steep land, and the steep slopes are utilized mostly for permanent pasture and for wood lots. Much of this land is in permanent pasture, the steep slopes producing grass of excellent quality for dairy cattle. Alfalfa also is grown, usually in the shallow soils on ridge tops where roots can readily penetrate to the lime-bearing subsoil.

The original forest growth consisted of maple, hickory, birch, basswood, and several varieties of oak. Only a small part of this soil is under cultivation. Most of it remains forested although where the timber has been partly or completely removed the land is generally in permanent pasture.

DODGEVILLE SILT LOAM

The surface soil of Dodgeville silt loam is from 6 to 10 inches deep. It consists of a dark brown or almost black silt loam with a high content of organic matter. Quantities of fine sand are present in the surface soil in places, and small fragments of chert are common. The upper part of the subsoil is a heavy silt loam, considerably lighter in color than the surface soil, and at a depth of about 16 inches this grades into a reddish-brown clay loam containing numerous chert fragments, which become more numerous with increasing depth. This is underlain by heavy clay loam or clay. The usual depth to bedrock ranges from 2 to 3 feet, although outcrops of bedrock along the slopes are numerous. Within a few inches of the underlying rock, which is limestone, the color is variegated. Many small pockets of sand occur in the subsoil, and in a few small areas the surface material is a fine sandy loam. Such areas usually occur on the slopes, but many are too small to be indicated on the soil map.

Dodgeville silt loam, with its deep and steep phases, is the second most extensive soil and probably the most impor-

tant in the county. Some of this soil is present in every township; it is the predominating soil in Jefferson, Sylvester, Monroe, York, and Adams townships. It is closely associated in many places with Knox silt loam and differs chiefly from that soil in the color of the surface soil and the content of organic matter.

The surface of areas of Dodgeville silt loam ranges from gently undulating to rolling. The undulating areas occur as ridge tops, and the rolling surfaces are found where streams have worked back into the land, carving valleys and leaving ridges, along the slopes of which rock outcrops are numerous. The natural drainage is well established; it is even excessive where the soil is shallow. On the steeper slopes some erosion occurs.

This soil is derived from the weathering of the underlying limestone, and its dark color is doubtless due to the decay of a rank growth of grasses under moist conditions. Dodgeville silt loam is a prairie soil, and the original vegetation consisted chiefly of prairie grasses, with only a scattered growth of trees along some of the slopes and bordering forested soils.

Probably about 65 per cent of this soil is under cultivation, the remainder being used chiefly as permanent pasture. The type of agriculture most extensively followed consists of general farming and dairying. The chief crops are oats, barley, wheat, clover, and timothy. The rotation most commonly followed consists of corn, which may be grown for two or three years, followed by a small grain crop possibly for two or three years, after which the land is seeded to timothy and clover and cut for hay for at least two years. Many farmers pasture the fields for a year or more before again plowing them for corn. Better results are obtained by reducing the length of the rotation.

The acreage of alfalfa is gradually increasing, and this crop does well where the soil contains plenty of lime. The application of ground limestone is necessary in many places for success with this crop. In fact much of this soil is acid and is benefited by the use of lime. The use of a phosphate fertilizer on alfalfa is also very important.

* See Experiment Station bulletin, "Liming Wisconsin Soils"

DODGEVILLE SILT LOAM, DEEP PHASE

The surface soil of Dodgeville silt loam, deep phase, consists of a very dark brown or almost black friable silt loam, from 8 to 14 inches deep, with a somewhat high content of organic matter. The surface of the soil is free from coarse sand, gravel, and stones, and the texture is uniform. The subsoil consists of a yellowish-brown heavy silt loam which grades into a silty clay loam or clay loam at a depth of about 20 inches. Below this depth the color in many places is a more pronounced yellow, or the subsoil may be a reddish-brown or red clay resting on limestone 3 or 4 feet below the surface. Where the soil section is deep, the yellow color usually prevails, and where the soil mass is less than 3 feet deep, a reddish color is more likely to occur. The soil phase is developed most extensively on undulating ridge tops and on long gentle slopes.

Although Dodgeville silt loam, deep phase, is generally uniform throughout most of its extent, a number of variations were noted. The most marked of these is the difference in the depth of the surface soil and the depth of the soil mass to the underlying rock. The deepest dark brown surface soil occurs on the smooth ridge tops and along gentle slopes, and on some lower slopes there are small areas where wash from the higher lands has accumulated. The dark soil is shallower on the more pronounced slopes, and the red or yellow clay comes nearer to the surface. Along narrow ridge tops and on some of the steeper slopes where the soil is not so deep as typical, chert fragments occur on the surface and in the soil. In the eastern half of the county, a few glacial bowlders may be present on the surface, and in isolated tracts limestone fragments may occur.

Accompanying these variations in the depth of the soil there is also a variation in the degree of acidity. On the ridge tops where the surface soil is deepest a medium degree of acidity usually prevails, and even where the limestone comes close to the surface an acid condition may exist. The least acidity is usually found on steep places where the heavy limey subsoil is exposed, and on lower slopes where the soil receives wash from limestone ledges above.

The surface is gently undulating or rolling, usually ap-

pearing as gently rolling prairie land. Natural drainage is well established, although on some of the more gentle slopes it is probable that tile drainage might be advantageous. On the steeper slopes some damage from erosion has taken place, but this can be checked by care in cultivation and in the selection of crops.

Dodgeville silt loam, deep phase, like typical Dodgeville silt loam, is derived mainly from the weathering of the underlying limestone. On some of the hillsides the surface material has been removed by erosion, and the reddish, residual material usually lying just above the limestone is exposed. This material is also seen in many road cuts. The small area of this soil, mapped in the south-central part of the county where the pre-Wisconsin glacial drift is present, may differ slightly in origin from the other bodies because it is partly derived from glacial drift. But the old glacial drift is very thin, and the soil is practically the same as in the driftless area. A few crystalline bowlders occur in this region, and their presence is usually the only indication of glacial action.

Dodgeville silt loam, deep phase, is a prairie soil, and the native growth consisted chiefly of prairie grasses. There are some trees, as oak, hickory, basswood, and some maple on some of the steeper slopes and along the edges of other kinds of land. Hazel brush is abundant in places. Probably about 90 per cent of this soil is in cultivation, and the remainder is in permanent pasture. The same crops are grown, and about the same rotations followed, as on the typical soil. Less steep land is included in the deep phase than in the typical soil; consequently less erosion has taken place and the average value is higher.

Dodgeville Silt Loam, Steep Phase

The steep phase of the Dodgeville silt loam occurs in small, usually narrow and irregular areas which are so steeply sloping that the land is not adapted to cultivated crops and is largely in pasture. Slopes of 10 or 15 per cent are subject to erosion when cultivated.

The soil of the steep phase of Dodgeville silt loam is essentially like the typical soil, except where erosion has car-

ried away the surface silty layer and exposed the heavier subsoil. On uneroded areas the surface silty soil may be thinner than is typical, and the total depth of weathered material over the bedrock may be less.

The steep phase soil is associated with typical Dodgeville silt loam throughout its distribution in the county. The individual bodies are small but numerous, and the total area is 28.6 square miles.

CARRINGTON SILT LOAM

The surface soil of Carrington silt loam consists of a dark brown or almost black, friable silt loam, comparatively high in organic matter. It usually contains some fine sand, and in many places a small quantity of gravel. Tests indicate that the surface soil is acid. The subsoil consists of a somewhat friable, dingy-brown silt loam material which grades downward into yellowish-brown silty clay loam material containing some fine sand and gravel. At a depth of 20 or 30 inches a sandy clay or a sandy loam material occurs. The deep subsoil usually grades into glacial till, composed of mixed clay, sand, gravel, and bowlders. In some areas where the limestone bedrock is within 4 feet of the surface, the lower subsoil is a reddish-brown clay, carrying fragments of the weathered limestone from which it originated. In places, limestone fragments occur in both soil and subsoil.

Where this soil borders Knox silt loam or Miami silt loam, it is lighter in color and lower in organic matter than elsewhere; and where it borders fine sandy loam soils, both soil and subsoil contain more fine sand. On some of the steep slopes the soil has been removed by erosion and the underlying till exposed, and in other places the clay loam subsoil comes to the surface. The soil, as mapped, includes small areas of Carrington loam and fine sandy loam. This soil is similar to Dodgeville silt loam, but it differs from that soil chiefly in being underlain by glacial till.

Carrington silt loam is not so extensive in Green County as Dodgeville silt loam, but it is widely distributed, occurring chiefly in Brooklyn township in the northeastern corner of the county and in Clarno township in the south-cen-

tral part, both areas lying within the glacial region where the Carrington soils are developed. The surface of these areas varies from gently rolling to hilly, the surface features having been developed almost entirely by erosion. On account of the sloping surface and the open nature of the soil and subsoil, the natural drainage is good.

Carrington silt loam comprises prairie soils developed principally on glacial drift. The pre-Wisconsin glaciation is evident in this region, but the amount of glacial till within this old glacial belt is small, and in many places it seems to be lacking. In such places soil types representing the residual material are mapped, and it is evident that some of the material included with Carrington silt loam is also of residual origin from the underlying limestone. In some places the surface soil is developed on glacial drift, and the subsoil is residual material derived from limestone. Frequently, the boundary between areas of Carrington and Knox soils is difficult to establish as the change from one soil to the other is not marked. The parent glacial material is the distinguishing feature of the Carrington soils, and a heavy red substratum is usually an indication of residual material.

Probably 80 per cent of Carrington silt loam land is under cultivation, the remainder being devoted to permanent pasture. General farming is practiced in conjunction with dairying. This is prairie soil, and the native growth consisted almost exclusively of prairie grasses. Corn, oats, barley, and hay are grown successfully on this soil, and it is handled and fertilized in the same way as Dodgeville silt loam.

CARRINGTON SILT LOAM, GRAVELLY PHASE

The surface soil of Carrington silt loam, gravelly phase, consists of a dark brown or black fine sandy loam, loam, or silt loam which prevails to a depth between 8 and 12 inches. A small amount of gravel is usually present on the surface. The yellowish-brown or chocolate-brown loam subsoil grades through gritty clay loam into gravelly sandy loam. In a few places a gravel bed occurs within 3 feet of the surface and may even be exposed at the surface, whereas in

other places the soil is nearly free from gravel. The parent material is largely calcareous glacial drift.

This gravelly soil is very inextensive and therefore of minor importance. Most of it is associated with Carrington silt loam although in some places it is associated with Dodgeville silt loam, the gravel ridges being all that give evidence of the old glaciation, whereas the surrounding soils appear to be residual. The gravelly phase of this soil occurs in Clarno, Monroe, Decatur, and Albany townships.

Carrington silt loam, gravelly phase, occurs chiefly in long, narrow ridges, and in isolated gravelly hills. The natural drainage is good or even excessive. Because of its small total area, the soil is of little agricultural importance. Some of it is well suited to alfalfa because it is well supplied with lime. Although the subsoil may be high in lime, however, the surface soil is sometimes so acid that liming may be necessary in growing clover or alfalfa. The chief crops grown are corn, oats, barley, and hay, and the uncultivated portion of the land is mostly in permanent pasture. Crop yields are fair, although inferior to those on Carrington silt loam.

Carrington Silt Loam, Steep Phase

A very small total area of Carrington silt loam is indicated on the soil map as a steep phase. It differs primarily from the typical soil in its steeply sloping surfaces which restrict the usual farming practices and render the land better adapted to pasture than to cultivated crops.

Miami Silt Loam

The surface soil of Miami silt loam consists of a grayish-brown silt loam, 8 or 10 inches deep, low in organic matter because it was originally wooded. The upper subsoil is yellowish-brown heavy silt loam material grading into silty clay loam, which at a depth of 18 or 20 inches is usually underlain by brown gritty clay loam or clay. In many places this material contains some rounded gravel; it may also carry some chert fragments. A small amount of gravel and some glacial bowlders may be present upon the surface, especially on the knolls and steeper slopes. The soil is variable and in many places contains fine sand.

Miami silt loam is confined to the glaciated part of the county, the largest tract occurring in Albany township and in the adjoining part of Decatur township. Other small patches are in Brooklyn, Mount Pleasant, Sylvester, and Clarno townships. This soil is closely associated with Knox silt loam and closely resembles that soil type. The chief difference is the presence of drift, stone, and gravel in the Miami soil.

The surface of this land ranges from nearly level to rolling, and the natural drainage is usually good although it may be slightly deficient near low places where the surface is nearly level.

Miami silt loam is derived from calcareous glacial debris from the pre-Wisconsin or early Wisconsin ice sheet, and the deposit in Green County is very thin. The parent material is entirely lacking in many places, and elsewhere the glacial material has become so mixed with residual material that it is difficult to distinguish which material predominates. The old till has been thoroughly leached, and in most places an acid condition prevails in the surface soil.

The native forest growth was chiefly of oak, basswood, and maple, with some hickory, elm, and ash. Practically all merchantable timber has been cut, and most of the land is in improved farms. The chief crops grown are corn, oats, barley, timothy and clover, and some alfalfa. The soil is of similar agricultural value to Knox silt loam, and the same farming practices and methods of improvement apply to both.

Fox Silt Loam

The surface soil of Fox silt loam consists of light-brown or grayish-brown silt loam from 8 to 12 inches deep, which, owing to its very low content of organic matter, has a whitish appearance when dry. The material is almost free from sand and gravel and has an extremely smooth feel. The upper subsoil is brownish-yellow silt loam, grading at depths of 16 or 20 inches into yellow silty clay loam which may continue to a depth of 3 feet or more. In many places a silty fine sandy loam is encountered between depths of 2 and 3 feet. It is underlain by stratified beds of sand or gravel.

This soil is not extensive and occurs chiefly in the valley of Sugar River in the eastern part of the county. A few scattered areas occur elsewhere, but they are practically all within the region covered by the ice sheet.

The surface is level or very gently undulating, and the natural drainage is sufficient except where the underlying beds of sand and gravel are 3 feet or more below the surface. In many places bordering areas of Clyde soils, the drainage is deficient.

The original forest growth consisted of oak, elm, hickory, and some ash, but practically all of this land is now cleared and forms parts of highly improved farms. The chief crops grown are corn, oats, barley and hay. The same systems of farming and cultural methods are followed as on Miami silt loam and Knox silt loam, and the soil has about the same degree of productiveness.

WAUKESHA SILT LOAM

The topsoil of Waukesha silt loam is about 12 inches in depth. It consists of a black velvety silt loam containing a high percentage of organic matter. The upper part of the subsoil is chocolate-brown heavy silt loam or silty clay loam material which gradually becomes yellowish-brown with increasing depth. Below a depth of 24 inches the subsoil in many places is clay loam material slightly mottled; elsewhere the subsoil contains some fine sand. At depths ranging from 2 to 5 feet stratified beds of sand and gravel are present, the depth to the coarse material usually being more than three feet. The surface soil is quite uniform and is free from gravel, stones, and bowlders.

This is an important soil in the county, but it is not so extensive as other black prairie soils. It is most extensively developed in the eastern part of the county in the valley of Sugar River and its tributaries, although it may occur in small patches along any of the watercourses within the county. Some of the most important bodies are in Decatur and Spring Grove townships on what is known as Jordan Prairie. Others are Sylvester, Exeter, and Mount Pleasant townships, as well as in other localities.

The surface of this land is level or very gently undulating

and the natural drainage is fair or good, except that, where the surface is flat or slightly depressed and where the depth to sand and gravel is 3 or 4 feet, the drainage is somewhat deficient. Waukesha silt loam occurs chiefly on terraces or outwash plains, the material doubtless having been worked over by ice action and carried out from the front of the ice sheet by water. This debris was deposited in the flood plain of glacial streams, constituting the parent material from which this and several other soils of the county have developed. It is certain that the stratified portion was deposited as indicated above, but the extremely silty covering forming the surface soil and part of the subsoil may be of different origin, since it has some of the characteristics of wind-blown or loessial material. The dark color is due to the growth and decay of a rank grass vegetation. The surface soil is acid. This is a prairie soil, and the native growth consisted chiefly of grasses.

Waukesha silt loam is the highest-priced farm land in the county. It is practically all tillable and is all in well-improved farms, devoted to general farming and dairying. Corn, oats, barley, and hay are the principal crops, corn having the largest acreage. Some wheat also is grown.

Although this is highly productive land, it can be improved for growing clover and alfalfa by the use of lime. The soil also responds to the use of phosphate fertilizers.

LINTONIA SILT LOAM

The surface soil of Lintonia silt loam, to a depth of about 10 inches, consists of brownish-gray, friable silt loam which becomes lighter in color when dry and frequently has a whitish appearance. The quantity of organic matter present in the surface soil is comparatively small and accounts in part for the light color of the soil. A slightly acid condition has developed in places in the topsoil. The subsoil consists of yellowish-brown or buff-colored material having a silt loam texture. This usually becomes somewhat heavier and more compact with depth, and at depths between 24 and 30 inches it may grade into a silty clay loam. Below a depth of 3 feet considerable stratified sandy material containing some gravel exists, and it may prevail to depths

varying from 4 to 6 feet. The depth to this sandy material varies between 2 and 6 feet but averages about 3 feet. This soil closely resembles Knox silt loam in texture, structure, and color to a depth of 3 feet.

Lintonia silt loam occurs in several parts of the county but is confined chiefly to the valley of Sugar River. The largest tracts are in Clarno, Decatur, Brooklyn, Albany, Exeter, and Cadiz townships. The soil is developed on stream terraces, and the surface is for the most part level or has a gentle slope toward the stream along which it occurs. It frequently occurs on narrow benches, varying in width from a few rods to one-half mile, between the bottom land subject to overflow and the steep slopes forming the valley walls. The terraces are above present flood plains, and the natural drainage is usually fair or good. However, in places where the depth to sand is more than 3 feet and the surface level, the natural drainage may be deficient. Gullies and ravines have been cut across the terraces by water rushing down the valley slopes. The material composing Lintonia silt loam is largely of alluvial origin, although it is probable that the surface material, especially close to the foot of the bluffs, is partly colluvial, having been washed down the steep slopes from areas of Knox silt loam lying at higher elevations.

Although the surface soil is slightly acid in places, the land nearest the bluffs is slightly calcareous, especially where it occurs adjacent to uplands underlain by limestone from which there is a wash.

Most of the original timber has been cut, and this land is practically all highly improved and very desirable. It is devoted to general farming and dairying, as is Knox silt loam. The same crops are grown, and about the same yields are secured as on Knox silt loam. The same methods of improvement regarding fertilization and rotation will apply to both soils. Lintonia silt loam is of slightly higher value than Knox silt loam land.

ROUGH BROKEN LAND

Rough broken land includes rock exposures, cliffs, and land which is too steep and rough to plow or cultivate. It

may be considered non-agricultural, and it is of value only for the small quantity of timber and pasturage it supplies.

This land occupies many of the steep walls bordering the valleys and forms a border between the valley bottoms and the high land of the ridges. It is developed in narrow bands, many miles in extent, winding in and out with the valleys and coves, but it is confined to the steep slopes. A part of it occurs as narrow ridges upon which are areas of arable land too small to be mapped. The bluffs and cliffs are highest along the western border of the county, and many of them attain an elevation of 200 or 300 feet above the valley bottoms.

Rough broken land is quite uniformly distributed throughout the central and western parts of the county; it is intimately associated with Knox silt loam and with the Boone soils. The greater part of the rock consists of St. Peter sandstone, Black River limestone, and Galena dolomite.

The remaining forest growth consists of white oak, red oak, pine, and hickory, with considerable undergrowth and brush in places.

CHAPTER IV

GROUP OF LOAMS AND FINE SANDY LOAMS

KNOX LOAM

Knox loam consists of grayish fine sandy loam or loam, 8 or 10 inches deep, underlain by yellowish or reddish-brown sandy clay loam which prevails to depths ranging from 18 to 24 inches and becomes very sticky at depths of 30 or 32 inches. This is underlain by disintegrated limestone. The texture of the soil and subsoil is variable, although consistently lighter than that of Knox silt loam. This soil occurs chiefly in Jordan and Cadiz townships, although other small tracts, too small to be shown on the soil map, are present in other parts of the county. This type of soil, with its steep phase, covers a total area of 3,648 acres.

The surface contour of this land is similar to that of Knox silt loam; it has the same native vegetation, is farmed in about the same way, and has practically the same agricultural value.

KNOX LOAM, STEEP PHASE

A steep phase of Knox loam is mapped where areas are so steep that ordinary agricultural practices are difficult. Only a few small patches in the western and southwestern parts of the county are mapped. Land of this kind has a lower value than typical Knox loam, and most of it is left in forest or used as pasture.

DODGEVILLE FINE SANDY LOAM

The surface soil of Dodgeville fine sandy loam is a dark-brown, or almost black, fine sandy loam or loam about 10 inches deep. The soil is acid and high in organic matter. In places, a small quantity of gravel and some limestone and chert fragments are scattered over the surface and mixed with the soil. The upper subsoil is usually a yellowish-

brown fine sandy loam, grading at depths of 16 or 20 inches into a sandy clay loam or sandy clay, which prevails to a depth of 3 feet or more; but in many places the underlying limestone is within 3 feet of the surface and is immediately covered by 4 or 6 inches of reddish-brown, rather plastic sandy clay containing particles of decomposed limestone. Both soil and subsoil are subject to numerous variations.

This soil is of small extent in the county but is widely distributed. It occurs principally in Adams, Sylvester, Clarno, Washington, and Cadiz townships.

The surface of this soil is rolling, but the slopes are not steep. Because of the loose, porous nature of the subsoil and the broken underlying rock, the natural drainage is excellent or even excessive. This condition also prevails where the limestone occurs near the surface.

This soil is largely residual from the underlying limestone, and in some places this rock is so sandy that it imparts a sandy texture to the soil material. Part of this soil occurs within the region which was glaciated, but the influence of the ice-laid material on the soils is slight although some ice-deposited granitic bowlders and some gravel occur.

This is a prairie soil, and the natural vegetation included only a few scattered trees and prairie grasses. About 80 per cent of this soil is under cultivation and devoted to general farming. It is considered a fair soil, and it is easy to work, but it is not equal in productiveness to Dodgeville silt loam. The general farm crops common to the region are grown, potatoes being grown more extensively than on the heavier soils of the county. The acid condition of the soil in many places causes failures with clover and alfalfa.

Dodgeville Fine Sandy Loam, Steep Phase

Areas of Dodgeville fine sandy loam which are so steep as to be especially susceptible to erosion when cultivated are indicated on the soil map as the steep phase. They are small and irregular in shape, occurring on the steeper valley slopes in association with typical Dodgeville fine sandy loam in the western part of the county. The total area is less than one square mile.

BOONE LOAM

The surface soil of Boone loam has a depth of about 10 inches. It consists of a light brown or grayish-brown loam, having a comparatively low content of organic matter. It is underlain by a lighter colored loam or fine sandy loam which gradually becomes heavier with depth and grades into a sandy clay about 2 feet below the surface. This heavy subsoil may continue to a depth of 3 feet or more where it rests on bedrock; or it may grade into a fine sandy loam or fine sand where the bedrock is less than 3 feet below the surface. Immediately over the rock the subsoil, in many places, has a mottled reddish color. The soil is variable in texture, and the surface soil is generally acid.

This soil is of small extent but widely distributed. It occurs in Adams, Albany, Cadiz, Jordan, Exeter, and Washington townships, as well as in some other parts of the county. It occurs mostly on lower slopes below outcrops of sandstone rock.

The surface is rolling, and there is some danger of erosion on the steepest slopes. The natural drainage is good, or even excessive, where the rock is near the surface.

This soil is derived largely from the underlying limestone and sandstone rock formations. The sandstone has contributed most largely to its formation.

The natural forest growth consisted of hickory, basswood, birch, some poplar, and several varieties of oak. The merchantable timber has been removed, but a large part of the land is still uncleared.

About one-third of this soil is under cultivation, largely for general farming similar to that on Knox silt loam with which it is frequently associated. Corn, oats, barley, and hay are the chief crops grown. The methods of cultivation, crop rotation, and fertilization followed are practically the same as on Knox silt loam, and this soil responds to the same treatment.

BOONE LOAM, STEEP PHASE

The steep phase of Boone loam includes those areas on slopes which are too steep for cultivation under present ag-

ricultural methods. The bodies are small and are associated with typical Boone loam, chiefly in the western part of the county.

At present the land is utilized for pasture or is forested.

Boone Fine Sandy Loam

The surface soil of Boone fine sandy loam, 8 or 10 inches deep, consists of a light brown or brown fine sand or fine sandy loam, very low in organic matter and somewhat acid. The subsoil is a yellow fine sandy loam which becomes heavier with depth; and at a depth of 20 or 24 inches it is a yellow sandy clay which continues to a depth of 3 or more feet. Fragments of sandstone are present in places in both soil and subsoil. In some places, especially near the base of slopes, the surface soil is underlain by a layer of yellow fine sand which may continue to a depth of 24 or 30 inches before the yellow fine sandy loam is encountered. On the slopes immediately below sandstone outcrops, irregular fragments of sandstone are scattered over the surface and mixed with the soil in sufficient quantities to hinder cultivation.

This soil is rather inextensive, but the bodies are widely distributed, occurring in at least half of the townships of the county. Probably the largest body is in Albany township directly west of the village of Albany and extends along the south side of Little Sugar River for a distance of several miles. Boone fine sandy loam, together with its steep phase, covers a total area of 14.1 square miles.

The surface of this soil is nearly level along the lower slopes and steep and broken on the ridge tops and hillsides, the larger areas on the steep slopes being mapped as the steep phase. It usually occurs on lower slopes below outcrops of sandstone or low secondary ridges from which the capping of limestone has been removed by erosion. On the steep slopes considerable damage is caused by washing, deep gullies having been developed in a number of places.

This soil has been derived chiefly from the weathering of sandstone, although, judging from the quantity of chert lying in places upon the surface, it is probable that some material from the limestone rock has been incorporated with

it. Most of the soil derived from sandstone is deficient in lime, but there are some places where wash from higher-lying limestone material has prevented this soil from becoming acid or has corrected acidity. Sorrel grows very generally over both this soil and the loam.

About 30 per cent of this land is cultivated, and the remainder is in forest and permanent pasture. Corn, oats, rye, buckwheat, and some hay are grown, but yields are rather low. The soil is deficient in organic matter, and also in the mineral plant food elements, and requires special treatment to secure best results.

BOONE FINE SANDY LOAM, STEEP PHASE

Boone fine sandy loam, steep phase, includes areas of Boone fine sandy loam which are too steep for successful cultivation under the present system of farming. The soil is similar to typical Boone fine sandy loam, except where erosion has carried away the surface layers. This phase occurs in small, linear, irregular areas associated with Boone fine sandy loam.

The agricultural value of this soil is low, and the best present utilization of it is for forest and pasture land.

MIAMI LOAM

The cultivated surface soil of Miami loam averages 9 inches in depth and consists of grayish-brown loam containing only a moderate amount of organic matter. The subsoil is usually yellowish-brown loam grading into a gritty clay loam which may take on a reddish-brown color below a depth of 2 feet. Gravel and chert fragments are somewhat abundant in the subsoil and may be present on the surface on knolls and rather steep slopes. The soil varies in texture from silt loam to fine sandy loam, and sandy material may occur in the subsoil. In some places bowlders are present on the surfaces, but not in sufficient numbers to interfere with cultivation.

Miami loam occurs most extensively in Brooklyn township; it also occurs in Albany, Clarno, Decatur, Exeter, and Mount Pleasant townships.

The surface varies from nearly level to rolling, and the

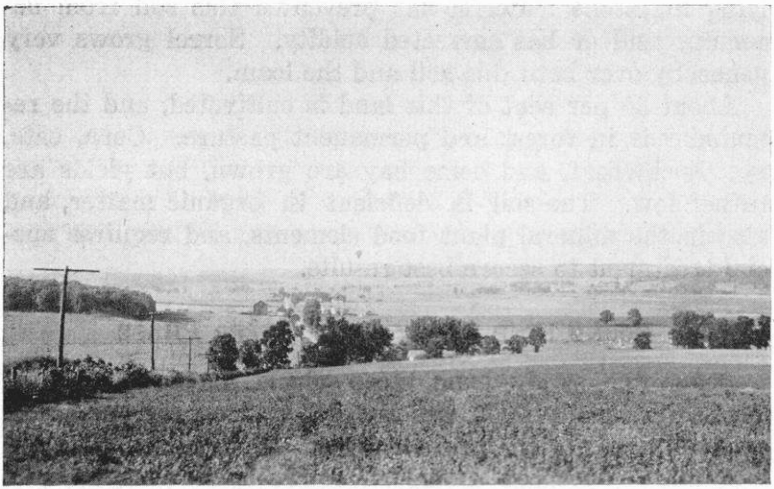


Fig. 5. A view of the Valley of Pecatonica River.

Fig. 6. View of New Glarus where the Swiss made their first settlement.

natural drainage is good although in a few places bordering on the lowlands drainage is slightly deficient.

This soil, like the silt loam, has been derived chiefly from unassorted glacial material of the older Wisconsin or pre-Wisconsin ice sheet. This deposit was thin, and considerable residual material from limestone rock now occurs with the glacial debris, resulting in soils which are partly glacial and partly residual. The soil material has been leached to a considerable extent, and the surface soil in most places shows varying degrees of acidity.

Most of the Miami loam is in farms and is highly improved. The farms are devoted to general farming and dairying, and the chief crops are corn, small grains, and hay. The same cultural methods are followed as on Miami silt loam and Knox silt loam, and suggestions for improvement of those soils will apply equally well to this soil.

Miami Loam, Steep Phase

The steep phase of Miami loam includes small areas on slopes so steep as to prohibit production of the ordinary cultivated crops of the region, and under present conditions the land is best utilized as pasture.

Miami Fine Sandy Loam

The surface soil of cultivated Miami fine sandy loam is light brown or grayish-brown to depths varying from 8 to 12 inches. In a few places the texture approaches a fine sand, although in other small areas the material is nearly as heavy as a loam. The subsoil is heavier than the surface soil and usually consists of loam or gritty clay loam material. In some places sandy layers are present in the deep subsoil.

This soil is of small extent, covering only 4.1 square miles, or 2,624 acres within the county. It occurs most extensively in Brooklyn township, and in smaller patches in Albany, Decatur, Exeter, and Clarno townships. The soil is closely associated with other soils of the same series and also with Knox silt loam.

The surface is undulating or gently rolling, and the natural drainage generally good. The soil has developed

largely from the same old glacial debris as Miami loam and Miami silt loam, and it also includes some residual material derived from the underlying limestone. Chert and glacial gravel are common in the subsoil, and on slopes or knolls it may also be present on the surface.

This soil is nearly all in improved farms and is devoted to general farming and dairying. About the same cultural methods and crop rotations are followed as on Miami loam and Miami silt loam. Fine sandy loam soils are considered better adapted to truck crops than Miami silt loam.

Fox Loam

Fox loam consists of a brown loam which passes at a depth of about 10 inches into a heavy, yellowish-brown loam or light sandy clay loam and grades downward into yellow-brown or brownish-yellow gravelly sandy clay. In general, at depth of 30 inches stratified beds of yellow gravel and sand are encountered although in some places the beds of gravel and sand are within 20 inches of the surface, and in other places they do not occur within a depth of 3 feet. Some areas of Fox silt loam and Fox fine sandy loam, too small to map separately, are included with this soil.

Most of this soil is in the eastern part of the county within the glaciated region, chiefly in the valley of Sugar River in Brooklyn, Exeter, Albany, and Decatur townships. It is associated with other members of the Waukesha series and in places merges into them. Patches of fine sandy loam are included in mapped areas of this phase of Fox loam. In these patches the soil consists of about 10 inches of light-brown or brown fine sandy loam, underlain by pale yellow sandy loam which becomes heavier with depth. The pale yellow subsoil, encountered at a depth of 12 or 14 inches, ranges in texture from heavy fine sandy loam to sandy clay. In some places it prevails to a depth of more than 3 feet, whereas in others a bed of stratified medium and fine sand or gravel is encountered at a depth of 2 or 3 feet.

The surface ranges from almost level to gently sloping or undulating, and the natural drainage is usually good. The soil is open and porous and readily absorbs the normal rainfall.

Nearly all of this land is under cultivation; it is devoted chiefly to corn, oats, barley, rye, and hay. The methods of cultivation followed and the yields secured are similar to those on Fox silt loam. The soil is deficient in organic matter and is somewhat acid.

FOX FINE SANDY LOAM

The surface soil of Fox fine sandy loam consists of light-brown or grayish-brown fine sandy loam from 6 to 10 inches deep, underlain by a yellowish-brown material of about the same texture. Below 18 inches, a gritty clay loam or sandy clay layer prevails in many places, and at a depth of about 2 feet this grades into stratified sand and gravel.

The soil is somewhat variable, containing small tracts of loamy soil and also some sandy areas. It is confined mainly to the valley of Sugar River. It occurs principally in Brooklyn, Exeter, Albany, and Mount Pleasant townships and is closely associated with Fox loam, silt loam, and sandy loam.

The surface is level, or nearly so, and because of the open nature of the subsoil, it is well drained. The areas are situated well above the present flood plains and seldom suffer from excess water.

This soil has developed from water-laid material and nearly always occurs on terrace formations along streams. The material has been leached to a considerable extent, and the surface soil is usually somewhat acid.

Fox fine sandy loam is a good soil. It is devoted principally to general farming and dairying, corn, oats, and hay being the chief crops.

WAUKESHA FINE SANDY LOAM

Waukesha fine sandy loam consists of a mellow dark-brown or nearly black loam or fine sandy loam, about 10 inches deep, with a high content of organic matter. The subsoil grades through chocolate-brown loam or fine sandy loam to a yellowish-brown material of about the same texture. At a depth of 2 feet the subsoil is either a gritty clay

loam or sticky sandy loam material and grades into stratified sand and gravel not more than 3 feet below the surface.

This soil is of small extent and is confined chiefly to the eastern part of the county in the valley of Sugar River. The areas are small and widely scattered.

Waukesha fine sandy loam is derived from alluvial deposits laid down by streams when the water was at a much higher level than at present. Although much of the material may have originated from limestone, the soil has been leached to so great an extent that an acid condition has developed. In farming the land, limestone is needed, especially for clover and alfalfa.

Waukesha fine sandy loam is a prairie soil, and the natural growth was largely prairie grasses. Practically all of this soil is now in improved farms and produces fair crops. Corn, hay, and small grains are the chief crops, although the soil is also well suited to special truck crops and would respond well to special fertilization. The improvement of this soil should be conducted along the same lines as the other prairie soils of the county.

CHAPTER V

GROUP OF SANDY SOILS

WAUKESHA SANDY LOAM

Waukesha sandy loam consists of a dark-brown or almost black sandy loam underlain at a depth of 16 or 20 inches by a brownish-yellow sandy clay loam. This becomes lighter in texture with increasing depth and grades into yellowish sandy loam at a depth of about 28 inches. This is underlain by gravelly sand and, at a depth of about 3 feet, by stratified beds of gravel and sand. The topsoil is acid. The surface layer of this soil varies in texture from sand to loam, and the stratified beds of gravel and sand are within 18 inches of the surface in some places and below a depth of 3 feet in others.

This soil is confined to the valley of Sugar River and occurs most extensively in the southeastern part of Decatur township in the vicinity of Brodhead. In fact, the city of Brodhead is situated on a terrace of Waukesha sandy loam.

The surface of this land is level or undulating, and the natural drainage is good, or excessive, because of the coarse open nature of the lower subsoil.

This is an unforested prairie soil, and prairie grasses constituted the native vegetation. Practically all of this land is devoted to general farming in conjunction with dairying. Potatoes are grown more extensively than on the heavier soils, and fair yields are usually obtained. Yields of general farm crops are somewhat lower than on Waukesha loam and Waukesha silt loam, and the soil has lower agricultural value. More tobacco is grown on Waukesha sandy loam than on any other soil in the county. Rye is also grown to a greater extent than on the heavier soils.

WAUKESHA SAND

The surface soil of Waukesha sand consists of light to dark-brown fine sand, 8 inches deep, which contains only a low percentage of organic matter. This is underlain by a yellowish fine sand which prevails to a depth of 3 or more feet. Some of the soil is coarser in texture, and gravel commonly occurs in the subsoil.

This soil is confined to the valley of Sugar River and is most extensive in the northeastern corner of Spring Grove township. A smaller body is in Decatur township.

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

Most of this land is cleared and under cultivation. The remainder is in brush and second-growth forest and is used to some extent for pasture. Most crops common to the region are grown, but yields are low. Tobacco of fairly good quality is grown to some extent on this soil, although yields are low. The soil is deficient in organic matter as well as in the mineral plant food elements, but the texture of the soil is such that its productivity may be improved.

FOX SANDY LOAM

The topsoil of Fox sandy loam consists of brown sandy loam of medium texture 8 or 10 inches deep. The soil is somewhat loose and open, and as a rule the supply of organic matter is low. The subsoil is a yellowish sand or sandy loam material which may contain sufficient clay in places to make it somewhat sticky when wet. Below a depth of 2 feet, beds of stratified sand with some fine gravel usually are present. Mapped areas of this type of soil contain patches of Fox loam and fine sandy loam. Where it borders the typical Waukesha sandy loam, it is darker in color than usual and contains more organic matter.

Fox sandy loam is most extensive in the eastern part of the county and is confined chiefly to the valley of Sugar River. It covers a total area of 3.4 square miles and is closely associated with other soil types and soil phases of the Fox series.

The surface of this land is level or gently undulating, and the natural drainage is good, or somewhat excessive. The soil occurs on terraces well above present overflow. The soil material is of alluvial origin; it was probably deposited during glacial periods when much larger quantities of water were carried by the streams than at present. The soil has been leached considerably, and an acid condition prevails.

Fox sandy loam has a somewhat lower agricultural value than Fox loam and silt loam, but it may be considered a fair soil. It is devoted to general farming and dairying, and some tobacco is grown. Corn, rye, and some hay and oats are produced, but yields are lower than on the heavier soils.

PLAINFIELD SAND

Plainfield soil has a surface soil about 6 inches deep of brown sand of medium texture. It contains only a moderate amount of organic matter and has a loose open structure. The subsoil is light-brown or yellowish medium sand with which there may be mixed a small amount of fine gravel. It is loose and open in structure and very pervious to water. The soil is uniform in texture and color, although in a few places the texture approaches a fine sand, and in others the material is slightly loamy at the surface. Near heavier soils a small amount of clay occurs here and there in the subsoil.

This sand is of very small extent and is confined largely to a few areas in the valley of Sugar River. The largest tracts are in Decatur, Albany, and Exeter townships. A number of smaller tracts are in the eastern part of the county.

The surface of Plainfield sand is level or very gently undulating, and the natural drainage is usually excessive. In many places the soil suffers from lack of moisture during the latter part of the growing season. This soil occurs on terraces or bench land and is well above the present flood plain of streams. It is all of alluvial origin and has been carried and deposited by streams. The material was originally derived in part from sandstone formations, and the surface is usually acid.

Virgin land of this kind was forested with oak and some

pine, but practically all of the timber has been cut and the land placed under cultivation. Most of the general farm crops of the region are grown on this soil, but yields are usually low. The land has a low agricultural value, and lime and commercial fertilizers are needed to improve it.

Coloma Sand

Coloma sand consists of light-brown mediums and containing only a small amount of organic matter; it is underlain by yellowish sand of medium texture intermixed with some fine gravel. The sand prevails to a depth of more than 3 feet. This soil is of very small extent, covering less than one-half square mile of land. One small tract occurs in Decatur township, and a few other small tracts are scattered through the eastern half of the county, mostly east of Sugar River. It is a soil derived from glaciated sandstone material which has been affected to some extent by a mixture of material from limestone formations. The soil is acid.

The surface of this land is gently rolling, and the natural drainage is excessive, owing to the loose open character of the soil material and to the surface contour.

This soil is of low agricultural value, differing from Plainfield sand only in the surface configuration. The same crops are grown, and the soil will respond to the treatment suggested for Plainfield sand.

Rodman Gravelly Loam

The surface soil of Rodman gravelly loam consists of brown gravelly or sandy loam 8 or 10 inches deep; it is underlain by brownish-yellow sandy or gritty loam which gradually becomes yellowish with depth and is yellowish brown below 15 inches. The gravel content increases with depth, and beds of stratified sand and gravel usually occur about 2 feet below the surface, continuing to undetermined depths. Some gravel appears upon the surface, and glacial bowlders are not uncommon.

The soil is of very small extent and covers a total area of less than one square mile. It is rather widely distributed, however, and is mapped in Decatur, Albany, and Mount

Pleasant townships, with a few other small tracts in the eastern half of the county. It occurs in small patches usually of less than 40 acres and frequently on knolls only a few square rods in extent. It is developed chiefly on kames and eskers whose surfaces are bumpy and irregular, and whose slopes are usually steep and seldom cultivated. These hillocks occur in groups, and areas of the Rodman soil are separated by patches of Miami silt loam. Because of the rough surface and the gravelly nature of the subsoil, this soil is well drained, and where the soil is shallow, the drainage is excessive.

Some of the areas are forested, mostly with oak; others are used for pasture land. This land can best be utilized for pasture since most of it is too steep to be used for cultivated crops.

Being underlain by deposits of gravel, this soil is the source of supply for gravel for road building. Good quality gravel for road construction enhances the value of this land.

Fig. 7. A few trees are needed for shade, but a good woodlot cannot be maintained if cattle are allowed to roam through it at will, destroying seedlings.

CHAPTER VI

GROUP OF POORLY DRAINED SOILS

CLYDE SILT LOAM

Clyde silt loam may consist of a 12 or 14 inch layer of dark-brown or black silt loam, very high in organic matter and underlain by a subsoil of dark-gray silt loam material mottled with drab and yellow. At a depth of about 24 inches the material is mottled brownish-yellow or drab silty clay loam material which may continue to a depth of 3 or more feet.

This soil as mapped is not uniform. In many places the first 8 inch layer consists of peaty material. In flood-plain areas a layer of peaty material, from 1 to 10 inches thick, may occur in either the upper or lower part of the subsoil. Here and there along streams, black silt loam has been deposited over loam and fine sandy loam; in other places the surface material, to depths ranging from 1 to 10 inches, is a light-brown silt loam, underlain by black silt loam or peaty silt loam material made up of wash from adjoining high land. The uniform features of this soil are poor drainage, dark color, and high content of organic matter. Much of the parent material has been deposited by water or has been modified to some extent by water action since its deposition by other agencies. The Clyde soils are confined to the region influenced by glacial ice. Since most of the material came originally from limestone, the soils are not usually acid, and as the waters draining into the lowlands usually carry some lime from the higher lands adjoining, the soil material is somewhat calcareous.

Clyde silt loam is developed most extensively in the eastern part of the county and is confined chiefly to the valley of Sugar River and its tributaries. The largest areas are in Brooklyn, Exeter, Albany, Decatur, Spring Grove, and Sylvester townships.

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

The original forest growth consisted of elm, ash, soft maple, willow, some sycamore, and some bur oak. Most of the merchantable timber has been cut, but in a few places where the land has not been drained, timber of good quality is still standing.

Some of this soil has been reclaimed by drainage, but the major part of it is too wet for the successful production of cultivated crops. With proper drainage, however, this would be one of the best corn soils in Wisconsin, and on drained areas corn is the chief crop, although hay is also extensively grown. Alsike and timothy are the most common hay grasses.

This soil is also well suited to sugar beets and to cabbage, but these crops are grown but little. Small grains make a rank growth but are likely to lodge, and the quality of the grain is never so good as on the light colored heavy upland soils.

CLYDE LOAM

The surface soil of Clyde loam has a depth of about 12 inches and consists of black or nearly black loam or fine sandy loam which contains a high percentage of organic matter or humus. The subsoil is variable in texture, but it is usually lighter in color than the surface soil. In many places it consists of drab or bluish loam or fine sandy loam material which may become a silty clay loam or sticky sandy clay at a depth of 18 inches. The deep subsoil may contain considerable sand, and stratified material occurs in many places below a depth of 2 feet.

Clyde loam is confined largely to the eastern part of the county, chiefly to the valley of Sugar River in Brooklyn, Exeter, Albany, and Decatur townships. Other small areas are in some of the adjoining townships. The total area is only 1,216 acres.

The soil is low, the surface is level or slightly depressed, and the natural drainage is poor, although the land is seldom flooded. It is usually on low, poorly drained terraces,

although in a few places it comprises depressions in the upland.

This soil is of little agricultural importance because of its small extent. Most of it is undrained, and it is utilized chiefly for pasture. When thoroughly drained, it will make excellent farm land well suited to corn, grass, and hay, as well as to truck crops.

WABASH SILT LOAM

The surface soil of Wabash silt loam has a depth of about 14 inches and consists of black or dark-brown silt loam containing a high percentage of organic matter. It is underlain by brownish-drab or bluish silt loam, or silty clay loam material, which is mottled with iron stains below a depth of 18 inches. This material prevails to a depth of more than 3 feet and usually becomes heavier in texture with depth. Variations in this soil are common, occurring especially along the smaller streams. In some places the black surface soil continues to a depth of more than 2 feet; in other places the surface soil is light brown, and the black silt loam occurs a few inches below the surface; in still other localities there is a peaty covering, a few inches deep, over the silt loam; and in some small patches both soil and subsoil are somewhat sandy. All these variations mentioned are of such small extent that they could not be indicated on the soil map. The soil is usually slightly acid.

This soil is developed along practically all streams and comprises the most extensive first-bottom land in the county. The largest tracts occur along Sugar River in Spring Grove, Decatur, Albany, Brooklyn, and Exeter townships, and also along the smaller tributary streams, such as Jordan Creek and Little Sugar River. In the western and southwestern parts of the county it occurs along Pecatonica River and its tributaries.

The surface of the land is level, or gently sloping toward the stream; it is subject to overflow and the natural drainage is poor. Before cultivated crops can be grown successfully, much of the land will require tiling.

Wabash silt loam is of alluvial origin, the alluvium having been washed from the adjoining higher land, carried by

the streams, and deposited within the present flood plain. The decay of rank vegetation developed under moist conditions accounts for the dark color and the high organic matter content of the soil. In some of the narrow valleys it is partly colluvial in origin.

The original forest growth consisted of willow, sycamore, elm, soft maple, and ash. Some of the timber is still standing, but the best has been cut.

On account of the poor drainage and the danger from overflow, this soil is not used extensively for farming. It affords good pasturage, however, and is highly prized for this purpose where dairying is carried on extensively. In a few places where the soil is properly drained, crops yield well, corn averaging as much as 60 bushels an acre. The chief need of this land is drainage, and with the construction of open ditches and tile drains, it should become one of the most productive soils of the county.

WABASH SILT LOAM, BETTER DRAINED PHASE

The areas of Wabash silt loam which have better drainage than the typical soil are mapped as a better drained phase. Most of this land occurs along intermittent streams where there is less danger from flooding, and where much of the land can be cultivated without tiling. The soil is partly colluvial and partly alluvial, and in some places extends up the lower slopes for a short distance so that the natural drainage is fair. The soil is practically the same as typical Wabash silt loam, but the black surface layer frequently continues to a depth of 2 or 3 feet where wash from adjoining dark-colored upland soils has accumulated. This land is excellent, and parts of it are in cultivated crops each year.

WABASH LOAM

The topsoil of Wabash loam has an average depth of 14 inches and consists of dark-brown or black loam. The subsoil usually is a drab or somewhat bluish loam or fine sandy loam material mottled with yellow in the lower part. The soil is extremely variable and in some places the surface soil has a fine sandy loam texture; but because of its small

extent and variability, this soil was mapped with the loam. There is a thin covering of peat over the surface in places, and fine gravel frequently occurs in the lower subsoil.

This soil is developed along the first bottoms of streams, most of it in the valley of Sugar River in the eastern part of the county. It is of much smaller extent than Wabash silt loam and of minor importance.

The surface of this land is low and flat, or it has only a gentle slope toward the stream along which it occurs, and the natural drainage is poor. The land lies within present flood plains and is subject to overflow. The moist conditions have favored a rank growth of vegetation, the decay of which accounts for the dark color of the soil. The original growth, in addition to grasses, consisted chiefly of elm, ash, soft maple, and willow.

On account of its low position, poorly drained condition, and the danger from floods, this soil is used only for pasturage and to a small extent for marsh hay. If drained, this soil would be suited to the same crops as Wabash silt loam and it may be managed in the same way. In its present condition its use as pasture land is probably the most practicable. Draining and protecting the land from floods are the first steps necessary in improving this soil.

PEAT

Peat, as mapped ln Green County, consists of vegetable matter in various stages of decomposition mingled with varying proportions of mineral matter. It consists of black or dark brown, fibrous or finely divided vegetable matter, mixed with a small amount of fine sand and silt. It ranges in depth from 1½ to 10 feet but averages 4 feet. Most of the peat is fairly well decomposed and when dry resembles a black, carbonaceous clay. In areas of sandy soils, peat is generally underlain by sandy material, whereas in regions of heavy upland soils the underlying material is clayey. Most of the peat in Green County is underlain by material as heavy as, or heavier than, loam.

Peat is widely distributed in Green County; it is mapped in nearly every township and occurs in every tract ranging from a few acres to one-half square mile or more in

extent. In many cases peat occurs in long narrow strips along stream channels; in fact most of the peat is found in in such places; and only a small proportion occurs as depressions in the upland old lake, and pond beds as it is very scarce in this old glacial region of the pre-Wisconsin drift. It is most extensively developed in the valley of Sugar River and its tributaries in Decatur, Albany, Brooklyn, Exeter, and New Glarus townships; and some is mapped along Pecatonica River and its branches in the southwestern part of the county.

The surface is low, level, and very poorly drained. During early spring some of the marshes are entirely covered with water, but later in the summer many areas of peat are dry and firm so that they can be used for pasture, or the wild grasses cut for hay.

Peat has been formed through the growth and partial decomposition of a rank vegetation in the presence of water. Around the margins of the larger marshes, and over the greater part of the smaller ones, varying quantities of mineral soil from the adjoining higher land have been washed in and incorporated with the vegetable matter. Although most of the peat occurs within the region where the upland soils are partly made up of limestone material, some of it, particularly in the larger marshes, is acid.

The native growth in these marshes consists of several varieties of grasses and sedges, arrowhead, cattail, various reeds and rushes, and sphagnum moss. Tamarack grows in a few marshes.

Only a few of the peat beds have been ditched and reclaimed but, where thoroughly drained and properly handled, they produce good yields of corn, mixed timothy and alsike hay, oats, potatoes, onions, celery, and cabbage.

PEAT, SHALLOW PHASE

The shallow phase of peat consists of black or dark-brown vegetable matter in varying stages of decomposition, ranging in depth from 8 to 18 inches, and mixed with more or less sand, silt, or clay.

The shallow peat is much less extensive than the other; it occurs chiefly in Albany, Brooklyn, and Exeter townships,

in association with the deeper peat and soils of the Clyde series. It covers a total area of 640 acres. It is similar, in topography, drainage, and character of vegetation, to typical peat, although some of the marshes are underlain with clay, clay loam, or silt loam at a depth of only 12 or 15 inches.

CHAPTER VII

AGRICULTURAL DEVELOPMENT OF GREEN COUNTY

History of Settlement, Transportation, and Markets

Early settlement in Green County was stimulated by mineral deposits which were thought to exist in this region. The first settlement is reported to have been made in 1828 at Sugar River Diggings, located near Sugar River in Exeter township. Green County was organized in 1836, at which time it was separated from Iowa county. The first important industry to receive attention was the mining of lead and zinc, but larger mines were located in adjoining counties, and the mines in Green County were soon exhausted. Following the early mining activities, agriculture was given more attention, and the region early became a thriving agricultural community.

The first extensive agricultural development in Green County was made by a colony of Swiss who settled at New Glarus and developed one of the most prosperous agricultural communities in the United States.

The population of the county in 1920 was 21,568. It is well distributed over the entire county. Of the total population, 3,187, or 14.8 per cent, are foreign-born white people. Monroe, the county seat, has a population of 4,788. Other important railway and shipping points within the county are Browntown, Martintown, Monticello, New Glarus, Belleville (partly in Dane County), Albany, Brodhead, and Juda.

The county is fairly well supplied with railroads. Most farms are within 10 miles of a shipping point. Dirt roads are for the most part good when they are kept graded, and several State Trunk highways, kept in excellent condition, cross the county.

In the earliest settlement of Green County, wheat was grown exclusively and continuously for several years by the Swiss settlers until some of the land was practically worn out. Not until then did they turn to dairying which

has since become the principal industry. Dairying is carried on in all parts of Green County. It is by far the most important enterprise conducted in the region although general farming is also engaged in by most farmers.

With the development of dairying came a more diversified system of cropping. The acreage of wheat was greatly reduced, and the acreage in hay and corn increased. Small grains are grown on nearly every farm. However, on the gently rolling prairie lands throughout the county and on the smoother lands in the eastern part of the county, there is a larger acreage of corn, oats, and barley than in the western part where the slopes are steep and where there is more danger of washing in cultivated fields. On the other hand, more land is in pastures in the steeper parts of the county. Adams township has more pasture land than Washington township, for Adams township is more rolling and has much more steep land than Washington township. In Spring Grove township and also in other townships traversed by Sugar River, pasture land is low wet land rather than steep land.

Tobacco farming is a special industry followed to a small extent in this county, but it is confined almost entirely to sandy soils in Decatur and Brooklyn townships. Potatoes are also grown in the eastern part of the county and in other areas of sandy soils.

Farm Products and Agricultural Statistics

Of the farm crops grown in Green County the cereals, including corn, lead in acreage and value. The total value of all cereals grown in the area in 1919, as given by the census was $3,861,645. This represented approximately half of the value of all crops in that year. Hay and forage crops had a total value of $3,699,932. The value of the dairy products produced in the county in 1919 amounted to $5,585,782.

The following table, taken from the census reports, gives the acreage and production of the leading crops for five census years. This table shows the importance of the various crops and the changes in acreages of the different crops during the last forty years.

ACREAGE AND PRODUCTION OF THE PRINCIPAL CROPS IN GREEN COUNTY FOR FIVE CENSUS YEARS

Crops	1879		1889		1899		1909		1919	
	Acres	Tons	Acres	Tons	Acres	Tons	Acres	Tons	Acres	Tons
Hay and forage	44,390	67,252	56,516	88,705	47,797	63,978	58,022	96,685	88,283	281,090
		Bushels		Bushels		Bushels		Bushels		Bushels
Oats	37,166	1,348,942	44,832	1,829,351	55,628	2,116,250	35,421	1,147,266	40,916	1,355,532
Corn	59,745	2,187,550	52,399	1,595,922	68,162	2,692,680	56,915	1,880,987	34,664	1,401,880
Rye	3,334	51,100	4,011	65,322	2,907	40,860	892	11,429	1,511	19,763
Barley	635	12,544	1,180	37,055	2,516	79,460	14,132	368,636	12,303	345,603
Wheat	11,774	192,983	2,859	33,568	1,191	21,790	494	10,137	4,802	70,031
Potatoes	----------	142,103	1,693	158,033	1,354	151,270	1,163	121,365	889	44,836
		Pounds		Pounds		Pounds		Pounds		Pounds
Tobacco	122	117,571	243	277,703	323	419,470	257	294,210	91	110,048

AGRICULTURAL DATA

In 1928, there were in Green County 63,900 cattle. Of this number there were 46,200 producing cows. The average production per cow in 1927 was 5,800 pounds of milk. By far the greater proportion of the dairy products are sold in the form of cheese. In 1925 there were 15,912,320 pounds of cheese produced in Green County. Of this more than 7,000,000 pounds were Swiss cheese, 4,251,680 pounds were Limburger, more than 3,000,000 pounds were brick cheese, and more than 1,000,000 pounds were American cheese. There were, in 1926, 143 cheese factories and 6 creameries, and 24 receiving stations in the county.

Butter produced in creameries amounted to 167,977 pounds.

There were in the county in 1927 a total of 2,116 silos. A number of farms have two silos.

In connection with the dairy industry the growing of alfalfa is receiving considerable attention. In 1927, there were 13,600 acres devoted to this crop. In 1927, there were 63,970 acres devoted to corn, and of this acreage 33,910 acres were for the silo. That same year oats had an acreage of 42,540 acres, and barley was grown on 13,590 acres. All tame hay covered an acreage of 62,271 acres, while of this acreage clover and timothy covered 46,760 acres. Special crops are not grown to any extent. There were in 1927 about 110 acres of tobacco and 20 acres of canning peas.

ADAPTATION OF CROPS TO SOILS

Farmers in general recognize that certain crops are best adapted to certain soils. In this county the light colored heavy upland soils are well adapted to the production of small grains as well as to grasses. A better quality of grain is produced here than on the black soils, and danger from lodging is not so great. The black prairie land, having an undulating or gently rolling surface, and the drained, heavy, black lowland soils are well suited to corn. Rye is grown most extensively on soils of light texture, and in Green County tobacco also is usually grown on light soils, chiefly in the vicinity of Brodhead. Tame hay is grown on

all kinds of soils, but it makes its best growth on the heavy soils. Clover and alfalfa do best where the supply of lime in the soil is greatest.

Although soils influence considerably the crops which can be grown to best advantage, topography is a very important factor in the selection of crops to be grown and the farming methods followed.

The largest acreage of corn is grown in Spring Grove township where there is much reclaimed lowland and also extensive tracts of heavy upland where the surface is gently rolling and not too steep for the cultivation of corn. There is also considerable gently rolling prairie land in this township. Decatur township was second in acreage of corn. This township contains part of Jordan Prairie which is excellent cornland, and very little of the township is rough and steep. Clarno township, producing 4,755 acres of corn, occupies high, rolling land, much of which is prairie. On the other hand, in New Glarus township where there is much steep land, only 2,571 acres of corn were grown, the least in any township of the county and less than half the acreage grown in Spring Grove township. These differences are due chiefly to the marked differences in topography.

The effect of topographic difference is particularly evident on pasture land, especially the pasture land which is not plowed, as this includes most of the steepest land in the county.

Farm Equipment

Farm buildings and equipment in Green County are in general of very high grade and reflect the prosperity of the farmers. Barns are large, well constructed, and designed to provide roomy, comfortable quarters for dairy cattle. In 1927, there were 2,116 silos in the county on a total of 2,330 farms.

Tractors are coming into common use, and, although they are not used so generally as in more level regions, there is a total of 354 tractors in the county. Tractors are least used in sandy and extremely rough parts of the county; they are most common in Spring Grove township where there is considerable fairly smooth prairie land.

Farmhouses are well built, especially where the dairy industry is most highly developed. They are kept in good repair, and many are supplied with such modern conveniences as electric lights, modern heating plants, and running water. Practically all farms have rural mail service, telephone service, and most of the farmers own automobiles.

Farm Tenure and Labor

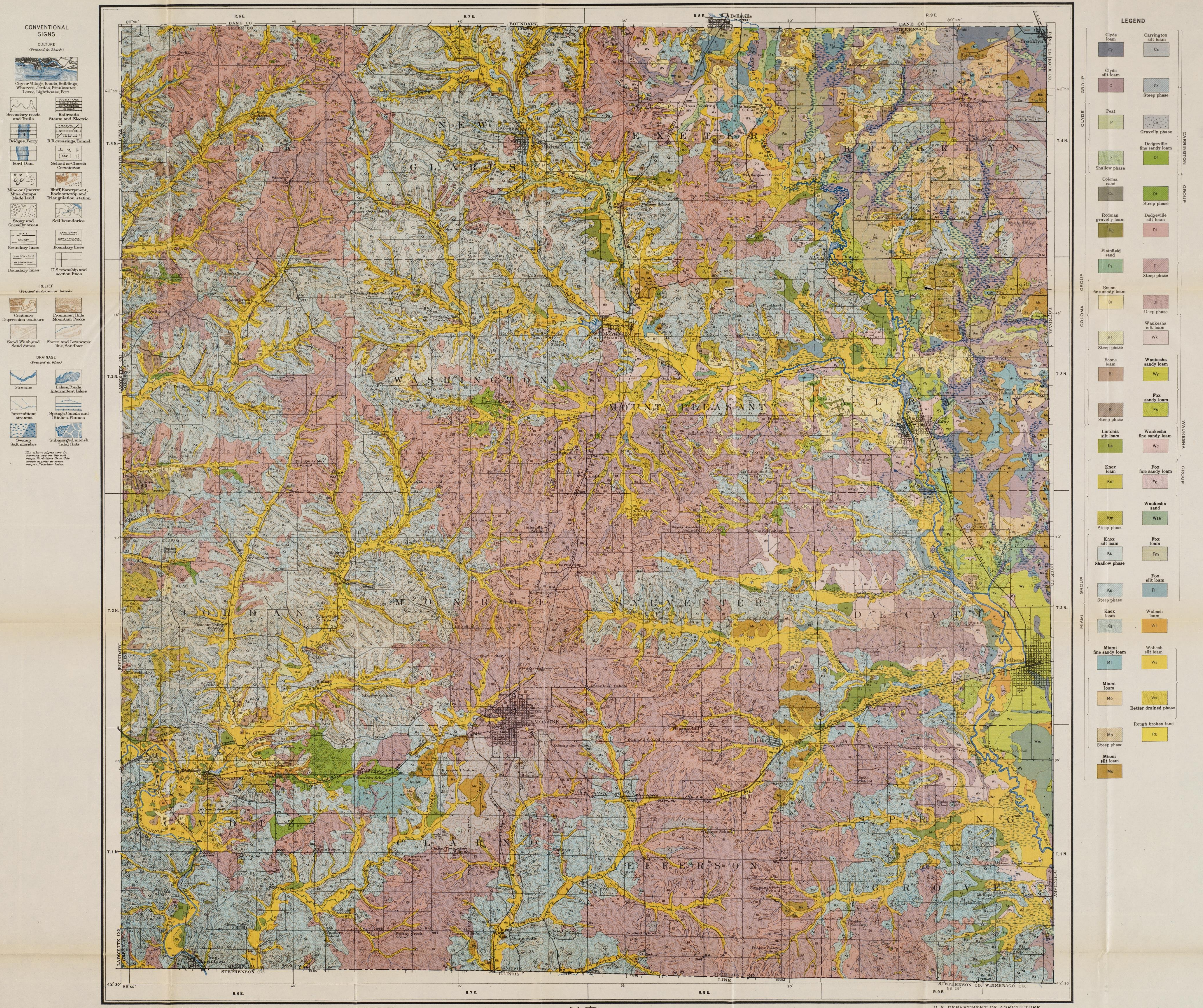
According to the 1920 census, 1,694, or 72.7 per cent, of the 2,330 farms in Green County were operated by the owners; 601 farms, or 25.8 per cent, were operated by tenants; and 35 farms by managers. Of the 601 tenant farmers, 413 were share tenants, 180 were cash tenants, and 8 were classed as share-cash tenants. Farms comprise 90.8 per cent of the land area of the county, and 78.6 per cent of this farm land is improved.

Land Values

The value of farm lands in Wisconsin was not inflated so greatly during the war period as it was in some other parts of the Middle West, and as a result the decline in land values has been moderate.

The census of 1920 reported that the average value of land and buildings to the farm in Green County was $23,784. Thus, the average farm of 148 acres had a value of about $160 an acre. The average value of the land alone is given as $127.91 an acre.

SOIL MAP OF GREEN COUNTY, WISCONSIN



STATE OF WISCONSIN
GEOLOGICAL AND NATURAL HISTORY SURVEY
E. F. BEAN, DIRECTOR
COLLEGE OF AGRICULTURE, UNIVERSITY OF WISCONSIN
H. L. RUSSELL, DEAN   A. R. WHITSON, IN CHARGE SOIL SURVEY

BASE MAP FROM
U. S. GEOLOGICAL SURVEY SHEETS

Scale $\frac{1}{62500}$

1 ½ 0 1 2 3 4 Miles

1 ½ 0 1 2 3 4 5 Kilometers

Contour interval 20 feet.
Datum is mean sea level.

Soils surveyed by W. J. Geib, T. J. Dunnewald, M. J. Edwards, Walter Vosquil, and Kenneth Whitson of the Wisconsin Geological and Natural History Survey, and A. C. Anderson, and F. J. O'Connell of the U. S. Department of Agriculture Bureau of Soils

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