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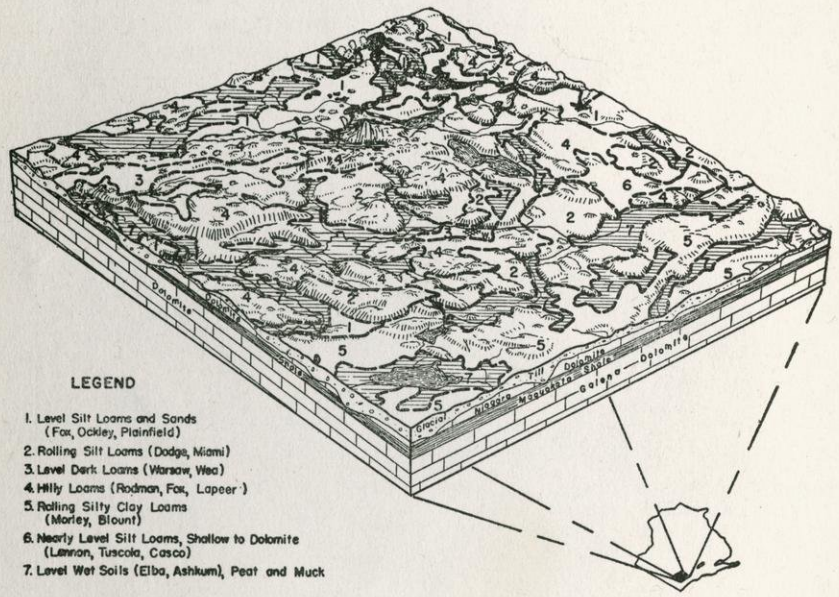
Hole, Francis Doan, 1913-
Madison, Wis.: The State, 1956

SOIL SURVEY OF WAUKESHA COUNTY, WISCONSIN

AN INTRODUCTORY REPORT



THE UNIVERSITY OF WISCONSIN
WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY
SOIL SURVEY DIVISION

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SOIL SURVEY IN COOPERATION WITH THE SOILS DEPARTMENT, COLLEGE OF AGRICULTURE

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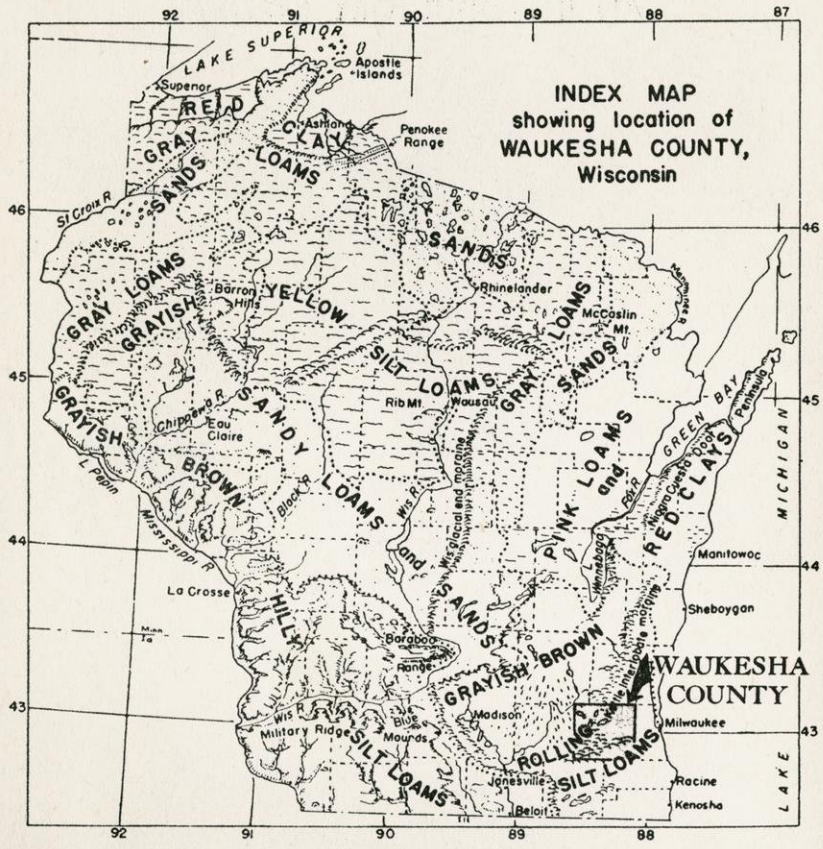

Figure 1. Each kind of soil has a characteristic profile (cross-section) showing definite horizons (soil layers), and a characteristic landscape. This is illustrated by the two examples on page 2, representing two very different soils of Waukesha County.

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Bulletin No. 81 **Soil Series No. 56**

SOIL SURVEY

OF

WAUKESHA COUNTY WISCONSIN

AN INTRODUCTORY REPORT

by

FRANCIS D. HOLE
Soil Survey Division
Wisconsin Geological and Natural History Survey
in cooperation with
The Soils Department, College of Agriculture
and
The Soil Conservation Service, U. S. D. A.

MADISON, WISCONSIN
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1956

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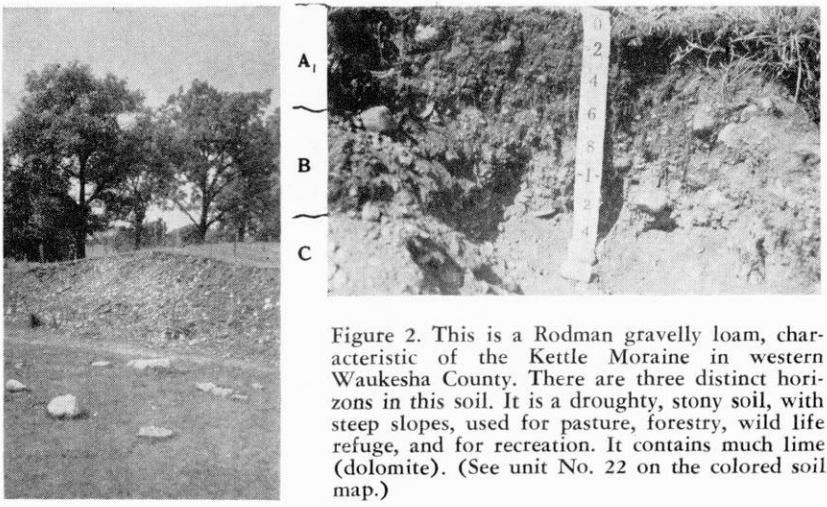

Figure 2. This is a Rodman gravelly loam, characteristic of the Kettle Moraine in western Waukesha County. There are three distinct horizons in this soil. It is a droughty, stony soil, with steep slopes, used for pasture, forestry, wild life refuge, and for recreation. It contains much lime (dolomite). (See unit No. 22 on the colored soil map.)

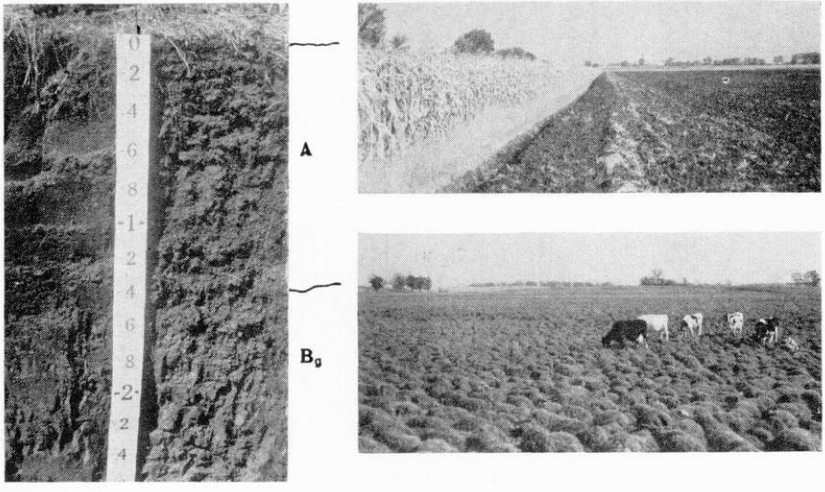

Figure 3. This is an Elba silt loam, found in level, depressional areas which are naturally wet. There are two distinct horizons. The black topsoil (A_1) is very deep. Limey substratum (not shown) occurs at a depth of about $3\frac{1}{2}$ feet. The lower view shows an undrained body of Elba being used for pasture. The upper view shows the use to which this soil is put after artificial drainage. (See units Nos. 4 and 18 on the colored soil map.)

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VI. Soil Descriptions. Page

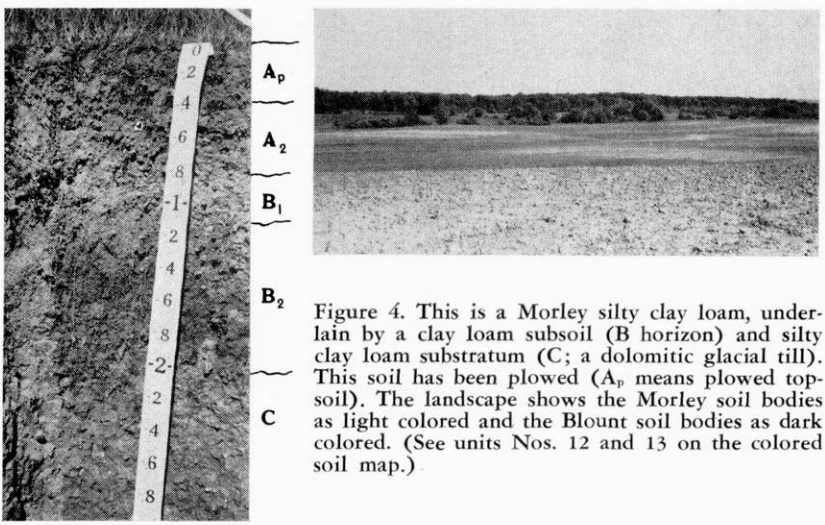

Figure 4. This is a Morley silty clay loam, underlain by a clay loam subsoil (B horizon) and silty clay loam substratum (C; a dolomitic glacial till). This soil has been plowed (A_p means plowed topsoil). The landscape shows the Morley soil bodies as light colored and the Blount soil bodies as dark colored. (See units Nos. 12 and 13 on the colored soil map.)

SOIL PHOTO-MAP

of a Portion of the Town of Oconomowoc, Waukesha County, Wisconsin

Field sheet of the Soil Conservation Service, reproduced by permission. Parts of Secs. 13, 14, 23, 24, T. 8 N., R. 17 E. Area, about 800 acres.

Soils surveyed by J. A. Steingraber and Bruce Watson, Soil Scientists.

Figure 5.

LEGEND

Sample symbol: 73 — 3 — 1
Soil Slope Erosion
Fox silt loam—3% slope—slightly eroded

Soil Numbers	Soil Names
3	Stony colluvium
9W	Peat and muck
55	Miami silt loam
58	Lapeer loam
59	Casco gravelly loam
70	Fox sandy loam
72	Fox loam
73	Fox silt loam
84	Ockley silt loam
172	Casco loam
186	Shallow peat over sand
215	Elba silt loam
282	Casco and Rodman gravelly loams, intermixed
327	Wallkill silt loam
328	Washtenaw silt loam

Slope Letters and Numbers

A = 0 to 2% slope gradient
3, 4, 5, 6, etc. = slope gradients in per cent (feet of fall per 100 ft. of horizontal distance)
N, M, K = Irregular or complex slopes

Erosion Symbols on the Map

0 = No erosion, or slight deposition
1 = Slight erosion
2 = Moderate erosion
3 = Severe erosion

Other Symbols

Diamond = small pit or "kettle"
Dart = wet spot

SOIL SURVEY OF WAUKESHA COUNTY, WISCONSIN

AN INTRODUCTORY REPORT

By FRANCIS D. HOLE
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Wisconsin Geological and Natural History Survey
203 Soils Building, University of Wisconsin

I. THE SOIL MAP

The soil survey of Waukesha County (38, 10)[1] was completed in 1910 and published by A. R. Whitson as Wisconsin Geological and Natural History Survey Bulletin No. 29. This survey was reviewed and revised in 1954–56 and a colored map prepared, a copy of which is in the back pocket of this report. This is an introductory map, presenting the general soil pattern of the county.

Figure 5 is a picture of an actual soil surveyor's field map as made during a modern detailed survey, showing individual soil bodies (see legend below

[1] Numbers in parentheses refer to items in the bibliography.

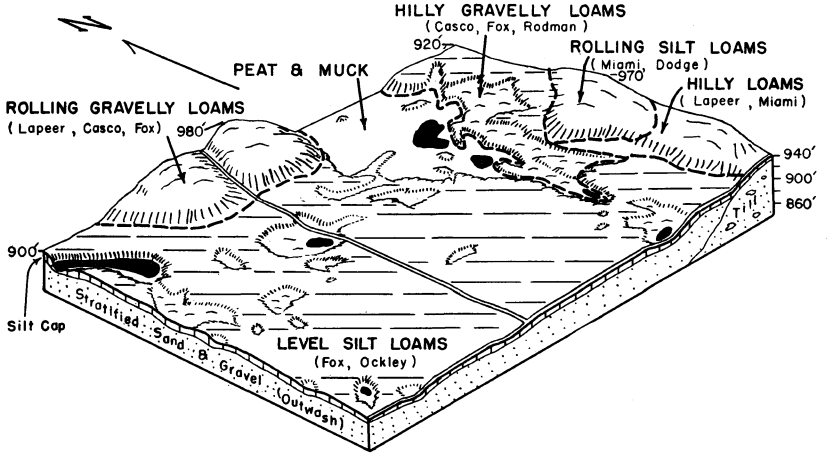

Figure 6. This is a block diagram of the same area shown in the map of Figure 5. The view is from the southwestern corner of the map.

the map). Detailed soil maps like that in Figure 5 can be obtained for individual farms from the Soil Conservation Service at Waukesha, and have been used in the preparation of the soil map accompanying this report.

Figure 6 is a sketch of the same area (Fig. 5) in the Town of Oconomowoc, as viewed from the southwest, and labeled with the general soil groupings used on the colored soil map. Several distinct kinds of landscapes or "soil communities" are shown. On the north is an upland of rolling gravelly loams. To the east of this is an old lake basin occupied by peat and muck. Adjoining it on the southeast is some rough country with hilly gravelly loams. Still farther east, at the edge of the area is the beginning of another upland, consisting of rolling silt loams on the north and hilly loams on the south. The plains, which are shown in the sketch with parallel lines, are occupied by level silt loams. These plains were formed by melt waters running out of the great glaciers, long ago. Here and there, large blocks of ice were buried in the gravels and later melted, leaving holes or pits (34), known as "kettles", in some of which lakes (shown in black) still exist.

WAUKESHA COUNTY AGRICULTURE

Agriculture in Waukesha County is dominantly dairy agriculture. More than half of the cash farm income (5) is from the sale of milk, and a third of the cash income is from the sale of livestock and livestock products other than milk. Of the harvested acreage of the county, 1945–49, 31.1 percent was in corn, 28.2 percent was in oats and 36.4 percent was in tame hay. Alfalfa is the predominant hay crop. Other crops grown are barley, rye, wheat, potatoes, buckwheat, flax, canning corn and peas, cabbage, sugar beets, strawberries, raspberries, vegetables, apples, cherries, and grapes. Some maple sirup is produced. Eighty-four percent of the land area of Waukesha County was in farms in 1950. There were 3,049 farms. The average acreage of a farm was 97.6 acres. Sixty percent of the farmland was in cropland harvested (5).

THIS REPORT

This report was prepared to accompany the map, and to provide further information about the soils and soil materials of the area. There are nine parts to the report: 1) generalized keys to the soils of the County, 2) a table of soil productivity rating estimates, 3) general soil ratings for engineering uses, 4) a brief discussion on how the soils formed, illustrated by several maps of the county, 5) a number of detailed soil profile descriptions, 6) a brief discussion of "soil communities" (soil associations), 7) a bibliography, 8) acknowledgements, and 9) a list of publications of the Soil Survey Division of the University.

Generalized SOIL KEY FOR USE in OUTWASH TERRACE and LAKE PLAIN LANDSCAPES of WAUKESHA COUNTY, WISCONSIN

(Note: A soil key for your farm will be simpler. Your agricultural leader can help you prepare a soil key for your vicinity.)

LAY OF THE LAND				SOIL PROFILE		SOIL NAME
ALL SOILS IN THE LANDSCAPES	Soils not in flood plains or on overwash slopes	Soils on high ground; water does not stand long after rain	Steep, hilly soils; much gravel near surface	Somewhat clayey subsoil at shallow depth	Very dark topsoil	LORENZO
					Medium dark topsoil	CASCO
				No clayey subsoil, largely gravel below surface		RODMAN
			Nearly level soils on benches or terrace plains	Silty soil, 3-5 feet deep to gravel	Dark deep topsoil	WEA (deep Warsaw)
					Medium dark, shallow topsoil — No rusty spots in subsoil	OCKLEY (deep Fox)
					Medium dark, shallow topsoil — Rusty spots in subsoil	HOMER
				Silty soil, about 2 feet deep to gravel	Dark deep topsoil	WARSAW
					Medium dark shallow topsoil	FOX
				Sandy soil	Light colored sandy loam, with heavier subsoil layer at about 2 feet	OSHTEMO
					Medium dark loamy fine sand, with heavier subsoil layer at about 16 inches	HACKETT
					Light colored fine sand with no heavier subsoil layer	PLAINFIELD
			Nearly level old lake plains	on stratified silts and fine sands		TUSCOLA
		Soils on low ground; water stands after rain	Depressions in benches or terraces	Deep black A_1 over blue-gray subsoil	on deep silts over sand and gravel	ABINGTON
			Depressions in old lake plains	Deep black A_1 over blue-gray subsoil	on deep silt deposits	ELBA
					on stratified silts and fine sands	KEOWNS
					on sands	MAUMEE
	Soils of foot slopes, ravines, stream and river valleys, sometimes flooded		On foot slopes and in depressions	Local alluvium (overwash)		COLLUVIAL SOILS
			Alluvial soils in flood plains			WET ALLUVIUM

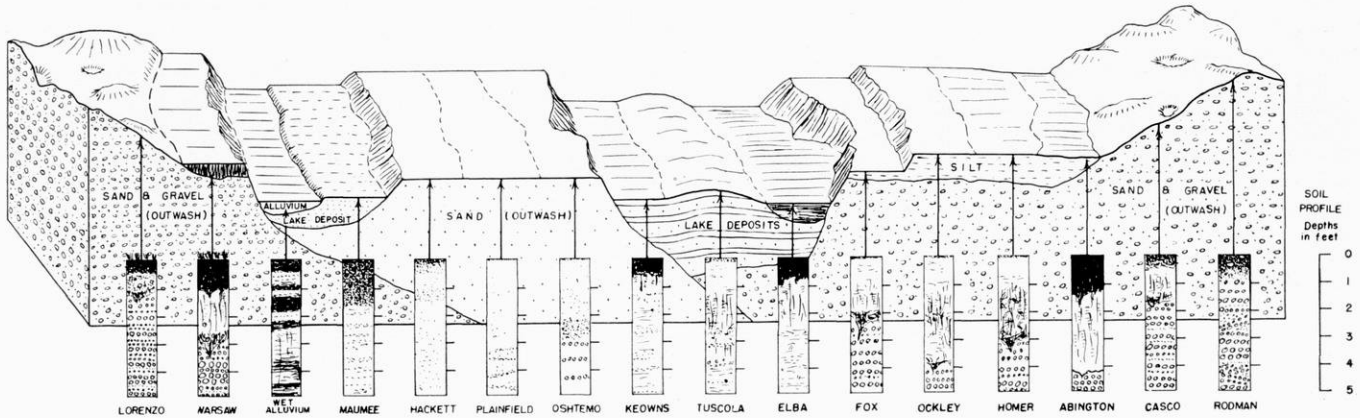

Figure 7.

GENERALIZED SOIL KEY FOR USE IN THE UPLAND LANDSCAPES OF WAUKESHA COUNTY, WISCONSIN

(Note: A soil key for your farm will be simpler. Your agricultural leader can help you prepare a soil key for your vicinity.)

LAY OF THE LAND			SOIL PROFILE			SOIL NAME
ALL SOILS OF THE LANDSCAPES	Soils well above streams, not flooded	Soils rolling	Substratum is sandy loam till, dolomitic	Loam A over clay loam B		LAPEER
				Sandy loam A over loam B		METEA
			Substratum is dolomitic loam till	Silty soil less than 24" deep		MIAMI (Light)
						PARR (Dark)
				Silty soil 24-42" deep		DODGE
				Silty soil 42" + deep		DANE (Light)
						WAUPUN (Dark)
				Subsoil shows rusty spots	Spots are below 18"	CALAMUS
					Spots are below 9"	CLYMAN
		Soils gently rolling	Substratum is dolomitic silty clay loam till	Dark brown A_1 silty clay loam, deep, moderately well drained		BEECHER
				Light brown, thin A_1	Moderately well drained subsoil	MORLEY
					Mottled below 10", imperfectly drained	BLOUNT
			Substratum is dolomitic bedrock	Light brown, thin A_1		LANNON
		Soils on low ground, water stands after rains	Over silty clay loam till	Deep (8") black A_1 over bluish gray silty clay		ASHKUM
			Over loam till	Deep (12") black A_1 over bluish gray silty clay loam		KOKOMO
	Soils of foot slopes, ravines, and stream valleys; subject to over-wash and flooding					COLLUVIAL SOILS
					Overwash on peat	WALLKILL
					Overwash on wet black mineral soils (Elba, Kokomo)	WASHTENAW

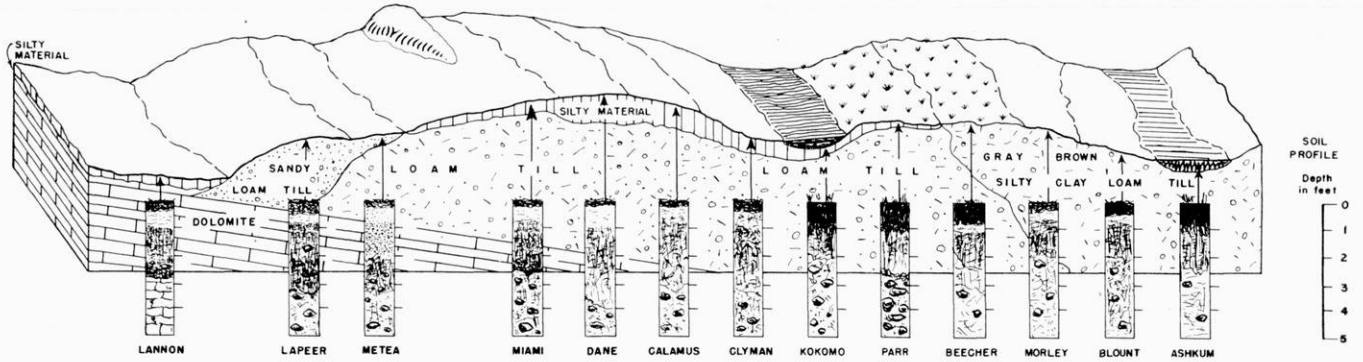

Figure 8.

II. SOILS OF WAUKESHA COUNTY: GENERALIZED KEYS

Introduction to the Soil Key

Waukesha County has a land area of 355,840 acres (6) and the Introductory Soil Map shows 12,380 acres of water, making a total of 368,220 acres for the county.[2]

Thirty-eight different soil units and 3 miscellaneous land units are listed in the legend of the introductory soil map, which groups them under 25 map symbols (numbers). Twelve units cover 67 percent of the area of the county. A complete list of the 41 separations is given on page 32.

Two types of soil keys, graphic keys and tabular keys, are included in this report. Figures 7 and 8 are examples of graphic keys (15) which show the landscape positions of the soils described in this report. A graphic key can be taken to the field by an observer, who stands on a soil body, and reads across the upper half of the key from left to right to find the soil name. Choices are based on his observations made with the help of a spade or auger (18). The symbol "A_1" refers to dark topsoil, and "B" is a synonym for somewhat clayey subsoil.

The soil key on pages 12 and 13 is in table form, and is divided into four parts for I) upland soils, II) natural terrace or bench soils, III) old lake flat soils, and IV) bottom soils. At the left side of each table are listed "parent materials" from which the soils formed. The probable original vegetation is indicated. This is of some importance to agriculture, because most well drained forest soils, when cultivated, have a lower organic matter content in the plow layer, and are lighter in color than well drained prairie soils. The remaining columns, from left to right, arrange the soils in order from the most droughty to the wettest. In this table, natural drainage or aeration relationships are assumed, which means that the soils are classified by their natural condition before tiling and ditching or irrigation have been introduced. Because most soils do not change color noticeably, even after drainage, the tabular key is useful in classifying soils according to their original characteristics.

It can be seen from the tabular key that Waukesha County has a great variety of soils, from shallow droughty ones to deep, wet peats and mucks. Droughty soils are underlain by sand and gravel or bedrock at shallow depth, and are far above water table. Well drained soils are deeper to coarse material, but are still free of mottling of rusty brown and light gray spots. Moderately well drained soils show mottling in the lower section of the soil profile. Marsh border soils have thick dark A horizons overlying gray subsoils. The A horizon is about 7 inches thick in wet marsh-border soils, and about 14 inches thick in very wet marsh border soils.

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[2] A variety of figures are available for the total area of the county, ranging from 549 square miles or 351,360 acres (21) to 371,840 acres (5). Waukesha County consists of 16 government townships, which coincide with 16 civil towns. If the 36 sections in each township were exactly 640 acres in area, the county would have an area of 368,640 acres.

TABLE I. SOIL KEY, PART I, WAUKESHA COUNTY, WISCONSIN: SOILS OF UPLANDS (MORAINES)

Parent Materials from which Soils Formed			Probable Original Vegetation	Shallow, Droughty Soils (10–24″ to Gravel and Sand)	Well Drained Soils	Moderately Well Drained Soils	Somewhat Poorly Drained Soils	Wet Marsh-Border Soils	Very Wet Marsh-Border Soils	Peats and Mucks
Silty clay loam till, dolomitic			Forest			12, 13. Morley silt loam	12, 13. Blount silty clay loam	17. Ashkum silty clay loam	17. Ashkum silty clay loam	
			Forest-Prairie Transition			13. Beecher silt loam		17. Ashkum silty clay loam	17. Ashkum silty clay loam	
Silty layer (weathered loess)	42″+ of silty material		Forest		Dane silt loam	9. Calamus* silt loam	18. Clyman* silt loam		18. Elba* silt loam	
			Prairie		Waupun silt loam					
	24–42″ of silty material	over stony loam till, dolomitic	Forest		9, 11. Dodge* silt loam				18. Kokomo silt loam	
			Prairie		10. Parr silt loam, deep					
	12–24″ of silty material	over stony loam till, dolomitic	Forest		9, 11. Miami silt loam 16. Miami loam				18. Kokomo silt loam	23. Badoura peat Carlisle muck
			Prairie		10. Parr silt loam, shallow					
		over sandy loam till, dolomitic	Forest		16. Lapeer lo. 21. Lapeer gr. lo.					
		over dolomite rock	Forest		8. Lannon* silt loam					
Sandy loam till, dolomitic			Forest	20. Metea loamy	20. Lapeer sandy loam					

*Tentative series names, not established by correlation as of 1956.

TABLE I. SOIL KEY, PART II, WAUKESHA COUNTY, WISCONSIN: SOILS OF TERRACES (OUTWASH)

Parent Materials from which Soils Formed		Probable Original Vegetation	Shallow, Droughty Soils (10–24″ to Gravel, Sand)	Well Drained Soils	Moderately Well Drained Soils	Somewhat Poorly Drained Soils	Wet Marsh-Broder Soils	Very Wet Marsh-Border Soils	Peats and Mucks
Silty layer	42″+ deep	Forest		2. Ockley silt loam		18. Homer silt loam		18. Abington silt loam	
		Prairie		1. Wea silt loam					
	12–42″ deep over sand and gravel	Forest	8. Casco silt loam	2, 8. Fox silt loam		18. Matherton silt loam			
		Prairie		1. Warsaw silt loam					
Loam layer	over sand and gravel	Forest	21, 22. Casco grav. loam	7. Fox loam, level 22. Fox loam, steep					
		Forest-Prairie Transition	22. Rodman grav. loam						
		Prairie	14. Lorenzo sandy loam	6. Warsaw loam					
Sandy loam layer over sand and gravel at 42″+		Forest		15. Fox sandy loam					
		Prairie		14. Warsaw sandy loam					
Sand over sand and gravel at 42″		Forest		19. Oshtemo loamy sand					
Deep sand		Forest	19. Hackett* loamy sand 19. Plainfield sand						

TABLE I. SOIL KEY, PART III, WAUKESHA COUNTY, WISCONSIN: SOILS OF OLD LAKE FLATS

Deep silts	Forest						18. Elba* silt loam	
Stratified fine sands, silts and clays	Forest		8. Sisson silt loam	8. Tuscola silt loam		18. Keowns* silt loam		
Sands	Reeds, Grasses						25. Maumee sand	

TABLE I. SOIL KEY, PART IV, WAUKESHA COUNTY, WISCONSIN: SOILS OF VALLEY BOTTOMS

Recent alluvium, eroded from upland soils which were originally forested	Forest				24. Wet alluvium			

*Tentative series names, not established by correlation as of 1956.

III. SOIL PRODUCTIVITY RATING ESTIMATES FOR WAUKESHA COUNTY SOILS: GENERALIZED TABLES

Introduction to the Soil Productivity Rating Table

Crop yields vary from soil to soil. The best soils may be regarded as "blue-ribbon" soils, which, like stock-show animals, excel in productivity. Like a superior animal, a superior soil has a fine heritage (see Figure 9) and has received good care from its owner. A poor soil, like the Rodman gravelly loam, cannot be eliminated from a farm, as a poor stock animal can, except as it is excavated and hauled off the farm by sand and gravel trucks. But such a soil may be eliminated from cultivation. It can be put to the use best suited to it and to the economy of the farm. In this sense, no soil on the farm is a poor soil. The Rodman gravelly loam is probably better suited to woodland and wildlife than to any other uses. Some soils which are not well suited to agricultural crops respond amazingly to improved or intensive management. Plainfield sand, of low natural productivity, can with irrigation and fertilization, be improved from a ninth to a fifth rate soil, according to Table II. This shows a greater response than in the case of Wea silt loam, a highly productive soil, which can be improved with lime and fertilizers from a second rate to a first rate soil for corn.

Soil tests, made by the Soils Department of the College of Agriculture, indicate[3] that the plow layer of many fields in Waukesha County is acid and low in available phosphorus and potassium. With changes in fertilizer

[3] Information from Professor H. H. Hull, Soils Department, College of Agriculture, at Madison, Wisconsin.

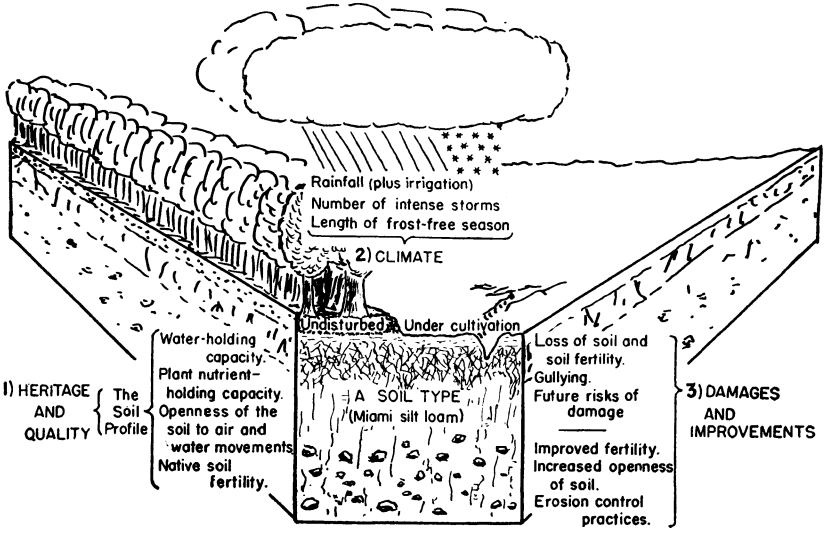

Figure 9. Important factors affecting the productivity of a soil.

TABLE II. SOIL PRODUCTIVITY RATING ESTIMATES, WAUKESHA COUNTY, WISCONSIN

Map Symbol	Soil types, listed in order[1] as given in the legend of the Introductory Soil Map	Approximate % of county by area	General productivity rating[2]	Crop Productivity[3]			
				Corn (bu.)	Oats (bu.)	Alfalfa (tons)	Pasture (cow-days/acre)
1	Wea silt loam	0.1	2(1)	65(100)	48(100)	3(4)	135
1	Warsaw silt loam	0.2	3(2)	60 (90)	45 (90)	2½(3½)	130
2	Ockley silt loam	2.8	3	62(100)	47 (95)	2¾(4)	130
2, 8	Fox silt loam	4.1	4	58 (88)	43 (85)	2½(3½)	125
3, 17	Ashkum silty clay loam	3.4	7(3)	35(100)	30 (85)	----	130
4, 18	Kokomo silt loam	4.0	7(3)	35(100)	30 (85)	----	130
4, 18	Abington silt loam	0.6	7(3)	35(100)	30 (85)	----	130
4, 18	Elba silt loam	3.0	7(3)	35(100)	30 (85)	----	130
4, 18	Homer silt loam	0.2	6(3)	60 (90)	40 (90)	---(2½)	125
4, 18	Matherton silt loam	0.3	6(3)	60 (90)	40 (90)	---(2½)	125
4, 18	Clyman silt loam	2.0	6(3)	60 (90)	40 (90)	---(2½)	125
4, 18	Keowns silt loam	5.5	6(3)	42 (95)	30 (85)	----	130
5, 23	Peat and muck	7.8	9(2)	--(100)	----	----	----
6	Warsaw Loam	3.7	5(2)	55 (80)	40 (80)	2(3)	125
7	Fox loam	4.3	5(3)	40 (75)	35 (70)	2(3)	125
8	Lannon silt loam	0.7	6	45 (70)	30 (60)	1½(2½)	105
8	Casco silt loam	0.5	7	30 (50)	25 (45)	1½(2½)	95
8	Tuscola silt loam	0.7	3	62(100)	47 (95)	2¾(3½)	130
9, 11	Dodge silt loam	5.5	3	60 (90)	45 (90)	2½(3½)	130
9	Calamus silt loam	1.1	3	60 (90)	45 (90)	2¾(3¼)	130
9, 11	Miami silt loam	6.0	4	58 (85)	42 (85)	2½(3½)	125
10	Parr silt loam	0.2	3	60 (95)	45 (90)	2½(3½)	130
12, 13	Blount silty clay loam	6.0	5(4)	40 (65)	34 (75)	2½(3½)	128
12, 13	Morley silty clay loam	6.3	4(3)	45 (70)	38 (80)	2(3)	128
13	Beecher silt loam	0.1	4(2)	50 (75)	40 (80)	2½(3)	130
14	Warsaw sandy loam	0.2	5	40 (70)	35 (75)	2(2½)	90
14	Lorenzo sandy loam	0.2	8	30 (50)	25 (45)	1½(2½)	80
15	Fox sandy loam	0.9	7(4)	38 (70)	30 (70)	1½(2½)	85
16	Miami loam	5.4	5	45 (70)	35 (70)	2½(3)	90
16	Lapeer loam	7.0	7	40 (65)	30 (65)	1½(2)	80
19	Oshtemo loamy sand	0.6	8(4)	30 (50)	25 (45)	1¾(2½)	80
19	Hackett loamy sand	0.5	8(5)	28 (45)	23 (43)	1¾(2¼)	75
19	Plainfield sand	0.5	9(5)	25 (40)	20 (40)	1½(2)	70
20	Lapeer sandy loam	0.3	6(4)	30 (50)	25 (45)	1½(2)	80
20	Metea loamy sand	0.3	8(4)	25 (40)	20 (40)	1½(2)	75
21, 22	Fox loam, shallow	3.4	6(5)	20 (35)	20 (40)	1½(2)	70

TABLE II. SOIL PRODUCTIVITY RATING ESTIMATES, WAUKESHA COUNTY, WISCONSIN—Continued

Map Symbol	Soil types, listed in order[1] as given in the legend of the Introductory Soil Map	Approximate % of county by area	General productivity rating[2]	Crop Productivity[3]			
				Corn (bu.)	Oats (bu.)	Alfalfa (tons)	Pasture (cow-days/acre)
21	Lapeer gravelly loam	1.4	7				
21, 22	Casco gravelly loam	4.7	8			1½(2)	70
22	Rodman gravelly loam	4.0	10			1½(2)	
24	Wet alluvium	0.7	9			1(1¾)	60
25	Maumee sand	0.7	9	-- (50)	-- (40)		60
							90

[1]Those soils which appear twice in the map legend are named only once here. For example, "5" is the symbol for Peat and Muck, artificially drained, and "23" is the symbol on the map for the same soils, undrained. In the table above the two are listed together, and the first rating applies to the wet soil and the second, in parentheses, applies to the drained soils. The order of listing in the legend is determined in part by the association of soils in the landscapes.

[2]Soils having the highest general agricultural productivity in the agricultural region in which they occur are rated grade "1" for that region. Ratings in parentheses are those resulting from improvement of the soil, by fertilizer application, artificial drainage or irrigation, or protection from floods.

[3]Dashes (--) indicate that the crop is usually not grown on the soil due to unfavorable conditions. Yields in parentheses are those resulting from very high level of management. Other yields are for a moderately high level of management.

applications and management practices, the fertility levels of the soils will change. Therefore, the general productivity ratings in the table, pages 15 and 16, are estimated on the basis of "1" for the most productive and "10" for the soil least productive of agricultural crops common to the region. Soils differ as to reserves of moisture and plant nutrients which they carry in the subsoils. These differences are taken into account. Estimated average yields for corn, oats, alfalfa are given, both for an average level of management and for a moderately high level of management. The reader will need to consult the County Agricultural Agent and the Soils Department of the University to determine current crop yields for crops or management levels not shown, or for years later than the date of this publication. Detailed management recommendations can be obtained from the College of Agriculture, the Soil Conservation Service, and the County Agricultural Agent.

IV. SOIL RATINGS FOR ENGINEERING USES: GENERALIZED TABLE

Soil bodies, like lakes, are of various sizes and shapes. But all bodies of a given kind of soil behave about the same when subjected to pressure, as under a highway. A soil also has a characteristic rate of water movement through it. Figure 10 shows a stretch of concrete pavement on Miami silt loam, while Figure 11 shows a near-by portion of the same highway, in this case resting on a body of Clyman silt loam. The absence of irregular cracks in the pavement at the naturally drier Miami site, and the abundance of failure cracks at the naturally moist Clyman site reflect the lower stability of the wetter soil.

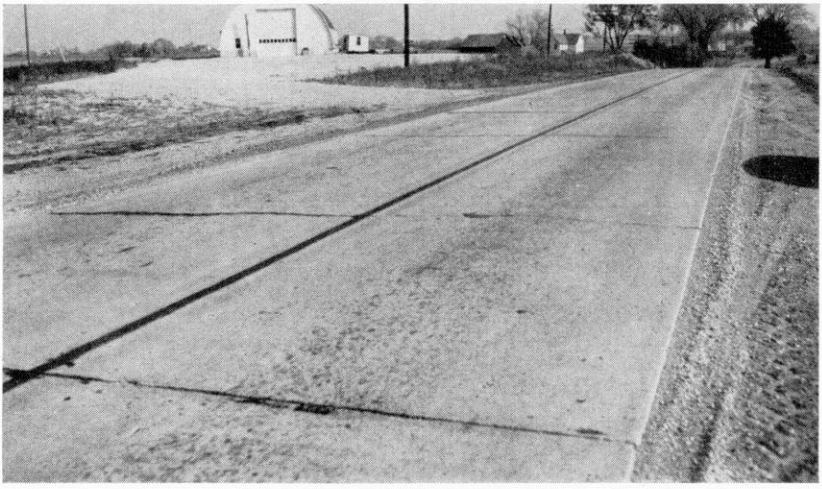

Figure 10. Highway pavement over Miami silt loam, a naturally well drained and aerated soil which gives good support to the highway. The pavement is in good condition. (See units Nos. 9, 11 on the colored soil map.)

TABLE III. GENERAL RATINGS OF SOILS WITH REGARD TO SOME ENGINEERING PROPERTIES OF THE SOILS

Soil name and horizons	drainage or aeration index[1]	Natural soil Estimated permeability rate[2]	Highway research board Subgroup and Group index numbers[3]							Frost Susceptibility rating[4]	Pumping Susceptibility rating[5]
			A-3 A-2-4	A-2-6	A-4	A-5	A-6	A-7-6	A-8		
Rodman gravelly loam	—10	15.0″	[A-3(0)]							[F-0]	[N]
Hackett sand	—10	10.0	[A-3(0)]							[F-0]	[N]
Plainfield sand	—10	10.0									
A_2, sand, 2–10″		10.0	A-3(0)							F-0	N
B, sand, 10–23″		10.0	A-3(0)							F-0	N
C, sand, 23–48″		10.0	A-3(0)							F-0	N
Oshtemo sandy loam	—5	8.0	[A-2-4(0)]							[F-2]	[N]
Metea sandy loam	—5	8.0	[A-2-4(0)]							[F-2]	[N]
Casco silt loam	—4	5.0	[A-2-4(0)]							[F-2]	[N]
Lorenzo silt loam	—4	5.0	[A-2-4(0)]							[F-2]	[N]
Lapeer sandy loam	—2	3.0									
A_2, sandy loam, 4–11″		4.0	A-2-4(0)							F-2	N
B_2, loam, 19–31″		0.1		A-2-6(1)						F-3	N
C, sandy loam, 36″+		4.0	A-2-4(0)							F-2	N
Miami silt loam	+1	2.0			[A-4(8)]					[F-4]	[Y]
Warsaw silt loam	+1	1.3			[A-4(8)]					[F-4]	[Y]
Fox silt loam	+1	1.2			[A-4(8)]					[F-4]	[Y]
Dodge siltl oam	+1	1.0									
A_2, silt loam, 3–8″		0.5			[A-4(8)]					[F-4]	[Y]
B_3, sandy cl. lo., 18–24″		0.08					A-6(11)			F-4	Y
D, light loam, 38″+		1.0	A-2-4(0)							F-2	N
Lannon silt loam	+1	1.0			[A-4(8)]					[F-4]	[Y]
Tuscola silt loam	+1	0.5			[A-4(8)]					[F-4]	[Y]
Waupun silt loam	+1	0.5				(A-5)				F-4	Y
Dane silt loam	+1	0.4			[A-4(8)]					[F-4]	[Y]
Ockley silt loam	+1	0.4			[A-4(8)]					[F-4]	[Y]
Calamus silt loam	+2.5	0.3				(A-5)				F-4	Y
Morley silty clay loam	+4.0	0.10					[A-6(10)]			[F-4]	[Y]
Beecher silty clay loam	+4.0	0.10					[A-6(10)]			[F-4]	[Y]
Elliott silty clay loam	+4.0	0.10									
B_{22}, clay loam, 17–24″		0.05						A-7-6(17)		F-3	Y
C_2, si. cl. lo., 24–27″		0.15					A-6(10)			F-4	Y
Clyman silt loam	+4.0	0.08					A-6(9)			F-4	Y
Keowns silt loam	+7.0	0.06				(A-5)				F-4	Y
Maumee loamy sand	+8.5	0.06			[A-4(8)]					[F-4]	[Y]
Elba silt loam, over sand	+8.5	0.05									
G_2, si. cl. lo., 21–31″		0.03					A-6(14)			F-4	Y
G_3, f. sdy. cl. l., 31–42″		0.04			A-4(2)					F-4	Y
D_2, lo. f. sand, 42–48″		0.08	A-2-4(0)							F-2	N
D_3, v. f. sdy. cl. l., 80–84″		0.05			A-4(6)					F-4	Y

TABLE III. GENERAL RATINGS OF SOILS WITH REGARD TO SOME ENGINEERING PROPERTIES OF THE SOILS—Continued

Soil name and horizons	drainage or aeration index[1]	Natural soil Estimated permeability rate[2]	Highway research board Subgroup and Group index numbers[3]							Frost Susceptibility rating[4]	Pumping Susceptibility rating[5]
			A-3 A-2-4	A-2-6	A-4	A-5	A-6	A-7-6	A-8		
Kokomo silt loam	+8.5	0.05			[A-4(6)]					[F-4]	[Y]
Wet alluvium	+7.0	0.05			[A-4(8)]					[F-4]	[Y]
Blount silty clay loam	+5.5	0.08					[A-6(10)]			[F-4]	[Y]
Peat and Muck (undrained)		0.05							[A-8]	[F-4]	[Y]
Ashkum silty clay loam		0.03						[A-7-6(20)]		[F-4]	[Y]

NOTE: In the above table, to the right of the first three columns on the left, actual data are given without brackets, but interpolated estimates are given in brackets. The attempt is made to give ratings for entire profiles, although actually individual horizons or materials alone can receive accurate ratings.

[1]Natural aeration or drainage index (17) refers to the general degree of wetness (symbols preceded by "+") or dryness (symbols preceded by "—") of a soil. Natural aeration is controlled, among other things, by texture of material, position of the soil with respect to water table, and influence of various layers or horizons conducive to seepage. Artificially drained soils are not listed in the table. Artificial drainage changes the aeration index from a natural one to an artificial one.

[2]Estimated permeability rates of water movement in inches per hour through saturated undisturbed soil under a ¼-inch head of water. Estimates based on unpublished report by James A. Pomerening, "Relative Infiltration Rates of several soil types in Wisconsin" (27).

[3]Highway Research Board system for the classification of soils (now known as the American Association of State Highway Officials system) for subgrade purposes includes group and subgroup classes and group indexes. These are based on laboratory tests of soil samples. Examples from the table: Group classification--- A-2, Subgroup classification--- A-2-4, Group Index., (0). "A-8" in the above table is obsolete and is borrowed from an older system. Public Road Classification of Soils, an early form of this type of classification, is as follows: A-1, well-graded granular material with suitable binder, highly stable under wheel loads. A-2, coarse and fine materials, improper grading. A-3, Cohesionless sand. A-4 Cohesionless silts, friable clays, moderately plastic, non-elastic. A-5, similar to A-4, but appreciably elastic. A-6, Cohesive clays, relatively highly plastic, non-elastic. A-7, similar to A-6, but appreciably elastic. A-8, peats and mucks, unsuitable for subgrade purposes (14).

[4]Frost susceptibility ratings of the Corps of Engineers are 5 in number and may be given the following general designations and descriptions as suggested by Professor W. M. Haas (14): F-0, generally not frost-susceptible; F-1, slightly frost-susceptible; F-2, moderately frost-susceptible; F-3, severely frost-susceptible; F-4, very severely frost-susceptible. Note that the above frost ratings are based on soil texture alone, and not on availability of moisture. The natural soil drainage or aeration index does take availability of moisture into account. A combination of soil texture and moisture availability gives a measure of the frost susceptibility of a soil in the field.

[5]Pumping is a process of ejection of water and soil from beneath a pavement under pressure from wheel loads. The soil and water may be pumped by traffic up through cracks or laterally from beneath pavement. The net result is damaging to the pavement because of the local removal of supporting subgrade. Some soils are subject to pumping more than others In this table two classes of soils with regard to pumping (Ohio criteria) are indicated as follows: N—no pumping; Y—yes, pumping occurs.

The general groupings of soils in the Soil Keys, given earlier in the bulletin, can be given general interpretations with respect to engineering structures.[4] Bodies of colluvial soils and wet alluvium record past floods and show sites where engineering structures need protection from flood damage. The Elba, Keowns, Tuscola, and Maumee soils formed from stratified deposits of lake flats, and are unusually subject to frost action, a hazard to pavements. Abington, and Homer soils are formed from silty deposits overlying porous gravel and sand beds with a high water table, and are subject to severe frost action. All silty soils are likely to show frost heaving where moisture is introduced during the freezing period, as in Clyman, and Calamus soils. Imperfectly and poorly drained silty clay loam soils, such as Morley, Blount and Ashkum, are also troublesome with respect to frost disturbance.

Table III presents some data and some estimated indexes for soils of Waukesha County, with respect to engineering properties, based on information supplied by Professor Wilbur M. Haas, of Michigan College of Mining and Technology, Houghton, Michigan (12, 13, 14). Percolation figures are estimated, and serve to indicate the relative rates at which water will move downward through the soils in place in the field.

It should be noted that the natural soil drainage or aeration index (17) has a range from a minus value (—10, extremely dry) through an optimum condition (+1), to a maximum positive index (+10, extremely wet). This differs from, but can be related to, the engineers' concept of positive values ranging from dry to wet.[5]

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[4] Communication from Professor Wilbur M. Haas.
[5] Communication from Professor Wilbur M. Haas.

Figure 11. Highway pavement over Clyman silt loam, a naturally somewhat poorly drained soil with a seepage condition, which gives imperfect support to the highway. The pavement is in poor condition. (See units Nos. 4 and 18 on the colored soil map.)

Since bodies representative of soil series occur in repeating patterns up and down hills in a given landscape, the highway engineer is confronted with a succession of soil situations which duplicate themselves many times over. Therefore, information obtained on a given soil series is applicable many places in a relevant landscape. The Soil Keys show that soil series are related to each other in dry-to-wet sequences, such as the Miami-Calamus-Clyman-Kokomo-Carlisle sequence, which are found in regular order on hillside after hillside. Soil maps show where these repeating soil conditions are located, and the more detailed the map (see Figure 5), the more useful the soil map is to engineers.

Although soils are used chiefly as media for plant growth, in agricultural and forestry and wild life programs, as well as in many recreational programs, increasing acreages of soils are being used to support roads and buildings. Because soils differ in their capacities to perform properly as supports to pavements or structures, this short chapter is introduced here, and relevant titles are listed in the bibliography (4, 12, 13, 14, 22).

V. HOW THE SOILS OF WAUKESHA COUNTY FORMED

Differences between soils may be traced, in many instances to differences in underlying geologic materials, or in topography, or native vegetation. The maps in this section of the report help explain the formation of the soils of Waukesha County, Wisconsin.

BEDROCK FORMATIONS. Figure 12 shows the principal geologic formations of the area. These are all sedimentary rocks: dolomite and shale, originally laid down as sediments in ancient seas. The bands of Maquoketa shale in the southeastern part of the state mark the position of a part of an old valley, called the pre-glacial Troy Valley, now largely filled with glacial drift.

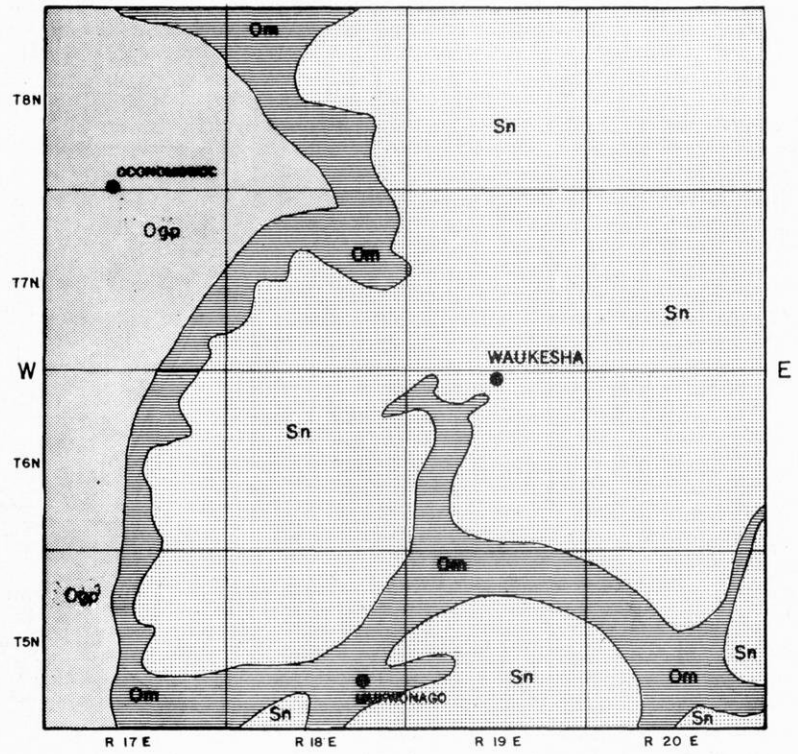
SURFICIAL DEPOSITS. Thousands of years ago, possibly 20,000[6] years ago according to geologists, a continental glacier or ice-sheet moved southward across the area now called Waukesha County. Two tongues or lobes of ice entered the county, one from the Green Bay lowland, and one from the Lake Michigan basin. Along the boundary (see Figure 13) between the two ice masses, a series of hills and ridges was built, called the Kettle Moraine. In many places, this overlies the Niagara escarpment, which is a buried cliff or steep slope, at the west edge of the Niagara dolomite.

The glacier brought in some granite and schist boulders, from Canada northern Wisconsin, or Michigan but most of the loose materials which the ice left behind, are derived from the bedrock of the county. Since there is much dolomite bedrock underlying the county, the glacial deposits have a large content of dolomite. The clayey till of eastern Waukesha County, is probably derived from Maquoketa shale, which the glacier very likely encountered in the Lake Michigan basin.

There are three major kinds of glacial deposits: till (ice-laid), outwash (deposited by running water) and lacustrine deposits (lake-laid). Most of the till in the county has a loam texture, but a strip of till on the east is

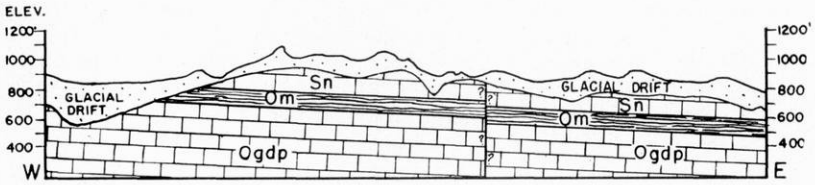
[6] Estimates range from 12,000 years (by radio-active carbon dating) to 27,000 years (by varve dating) to 32,000 years (by estimated rate of melting of the Cary glacial ice).

GEOLOGY OF WAUKESHA COUNTY, WISCONSIN



LEGEND

Sn	Lower Silurian	Waubakee Dolomite / Niagara Dolomite	477 feet thick
Om	Upper Ordovician	Maquoketa Shale	130 ± ft thick
Ogp	Middle Ordovician	Galena Dolomite	230 feet thick
		Platteville Dolomite	60 feet thick



Geologic data after Alden, 1906, and Foley, Walton and Drescher, 1953.

Figure 12.

GLACIAL GEOLOGY

OF

WAUKESHA COUNTY, WISCONSIN

(Revised from Alden, 1918, and from the 1956 Soil Map)

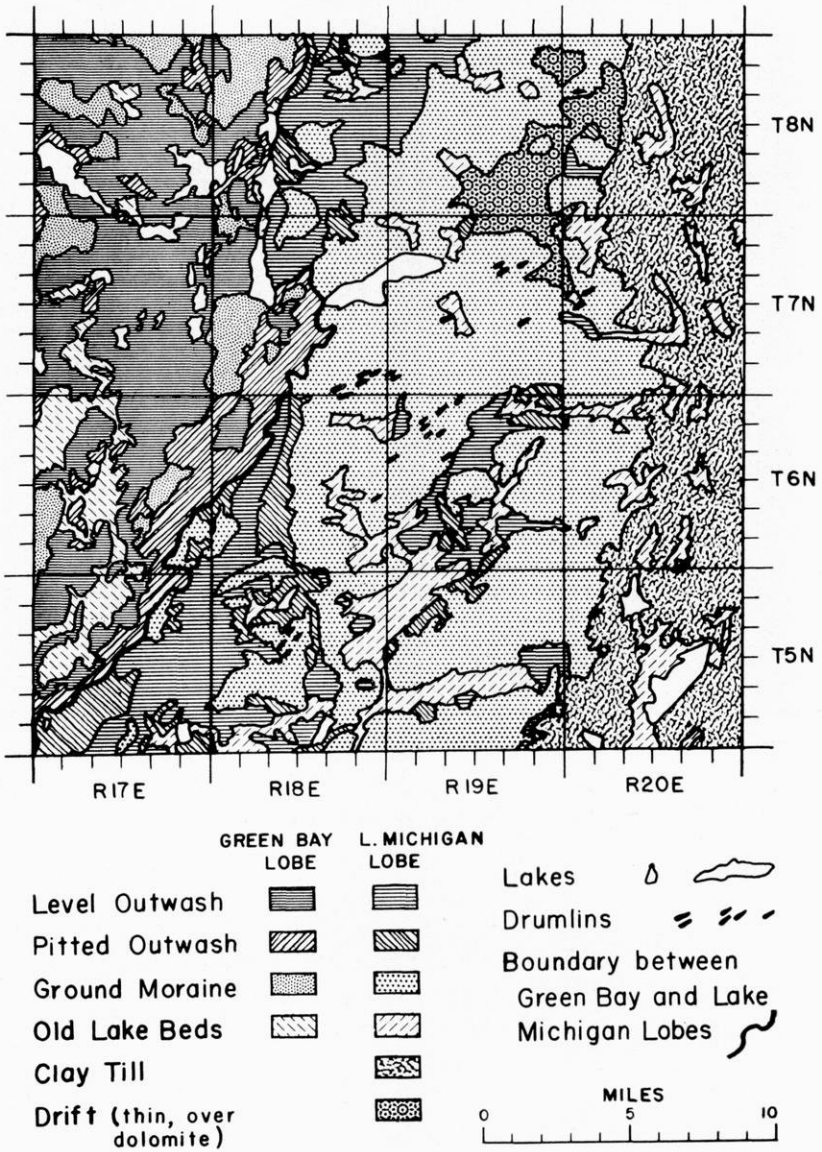


Figure 13.

SURFACE SOIL TEXTURES

OF

WAUKESHA COUNTY, WISCONSIN

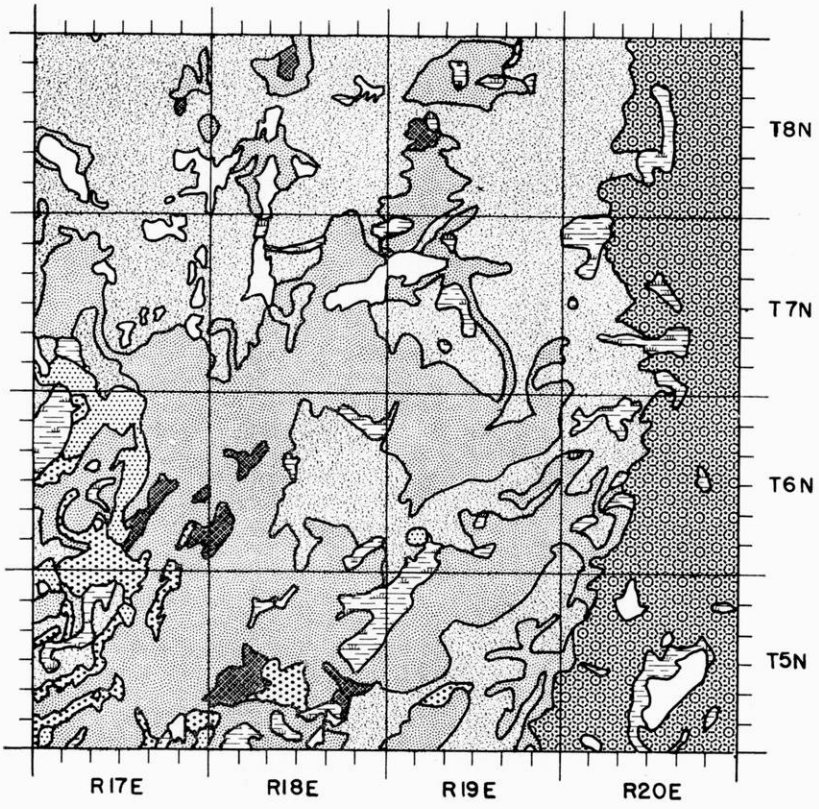


Figure 14.

high in content of clay. Outwash is a stratified sand and gravel deposit, which "washed out" of the melting glacier. In places, till overlies outwash, as shown in Figure 25, though usually the reverse is the case. Lacustrine deposits and peat and muck bodies have level surfaces, and occupy flats of old glacial lakes.

Across the hills and plains left by the glacier, winds deposited a fertile dust, called "loess", to a depth of as much as 4 feet in parts of northern Waukesha County (see Figure 14). In southwestern towns, sandy materials are exposed at the surface, without any silty covering. Where the silt covers gravel outwash or stony till, soil resources for agriculture have been improved by this wind-laid deposit.

SOME LAND FORMS OF WAUKESHA COUNTY

The bedrock and surficial unconsolidated formations present a variety of land forms, as illustrated in Figure 15. Till is found in nearly level to hilly terrain, with drumlins well developed locally. Outwash ranges in land form from level plains to prominent hills and hollows (kettles). Level outwash plains occur in places at different levels, rising one above the other, like stairsteps. This can be seen as one drives on the north county line westward from Lake Five.

Figure 15 suggests the relationships of the geologic materials, land forms, and soil series, which latter are listed beneath the diagram. The soils were named after places (villages, lakes, etc.) near which they were first studied (18).

TOPOGRAPHY

The drainage pattern, shown in Figure 17 is irregular in Waukesha County, as would be expected in a glaciated area. Lakes are numerous, streams are widely spaced and devious in the routes which they follow. A northeast to southwest trend is plainly visible, produced by the two glacial lobes previously mentioned. The generalized topographic map (Figure 16) illustrates further the irregularity of the topography of Waukesha County, which contrasts with that of Grant County, for example, in southwestern Wisconsin (16).

CLIMATE

Waukesha County lies near the northwestern limit of the humid climatic zone of eastern North America. The drier subhumid climatic zone begins 125 miles west of Waukesha, near the Mississippi River (35).

Snow covers the landscape approximately 90 days out of the year, and the average snow fall is about 40 inches. The average frost-free season ranges from 160 to 170 days. Average frost penetration in open fields is about 40 inches. The last killing frost in the Spring at Waukesha occurs on the average about May 4 (15), although 10 times out of 100 it is as late as May 19. The first fall frost comes October 6, on the average, but 10 percent of the time it may come as early as September 26. According to

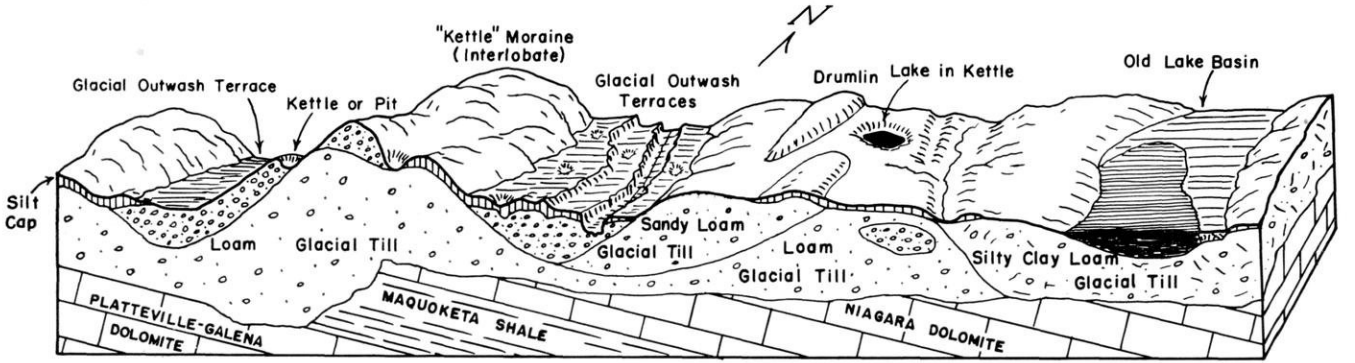
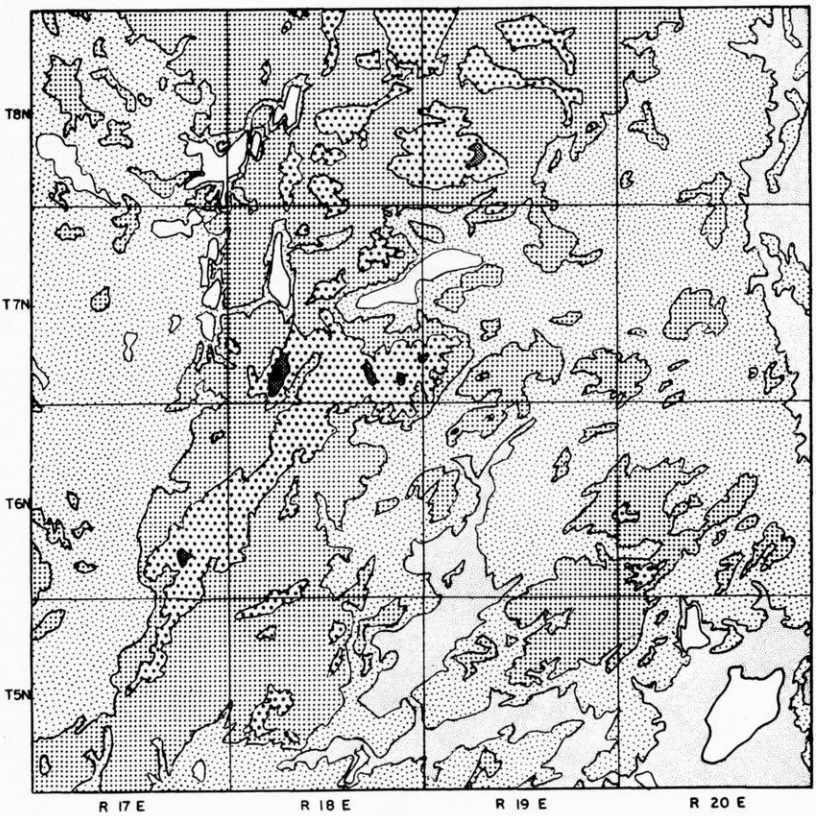


Figure 15. Sketch showing some typical land forms and geologic materials of Waukesha County, Wisconsin. Soils formed from these materials are as follows: 1) On glacial outwash terraces: Fox, Ockley, Warsaw, Plainfield, Hackett; 2) On gravel hills of the Kettle Moraine: Rodman, Casco, Fox; 3) On silt cap over loam glacial till: Dane, Dodge, Miami, Parr; 4) On sandy loam glacial till: Lapeer, Metea; 5) On silty clay loam glacial till: Morley, Blount, Elliott, Beecher; 6) In old lake basins: peat and muck, Elba, Maumee, Keowns.

TOPOGRAPHY OF WAUKESHA COUNTY, WISCONSIN



LEGEND

1200-1300 feet

1100-1200 feet

1000-1100 feet

900-1000 feet

800-900 feet

700-800 feet

Lake

Elevation of Government Hill (Lapham Hill) . . . . . 1233 ft

Elevation of the south-east corner of the county . . . . . 775 ft

Total relief . . . . . 458 ft

This generalized map is based on U.S.G.S. Quadrangle sheets.

Figure 16.

Climate and Man (35), temperatures as high as 109° and as low as —27° have been recorded in the county. There are about 37 days each year with thunderstorms, some of which produce rainfall intensities as high as 2.4 inches per hour. There is hail on the average of 3 days, annually. There are on the average 110 clear days each year, and 15 days with dense fog. On a winter day, there are on an average 4.25 hours of sunshine, or 42 percent of the possible sunshine. In summer, there are on the average about 10.2 hours of sunshine daily, or 68 percent of the possible sunshine.

Before the arrival of European settlers, there were apparently three main kinds of vegetative cover in Waukesha County: oak-hickory forest in the south and west; some scattered prairies in the oak-hickory forest; and maple forest in the northeast (7, 8, 15). Figure 18 shows the distribution of vegetative types about 100 years ago. The upland prairie soils are naturally well drained, and are northeastern outliers of the great prairie of the midwest and west of the United States. It is possible that some of these dark soils developed under beech-maple-basswood forest. On the present

LAKES and STREAMS of WAUKESHA COUNTY, WISCONSIN

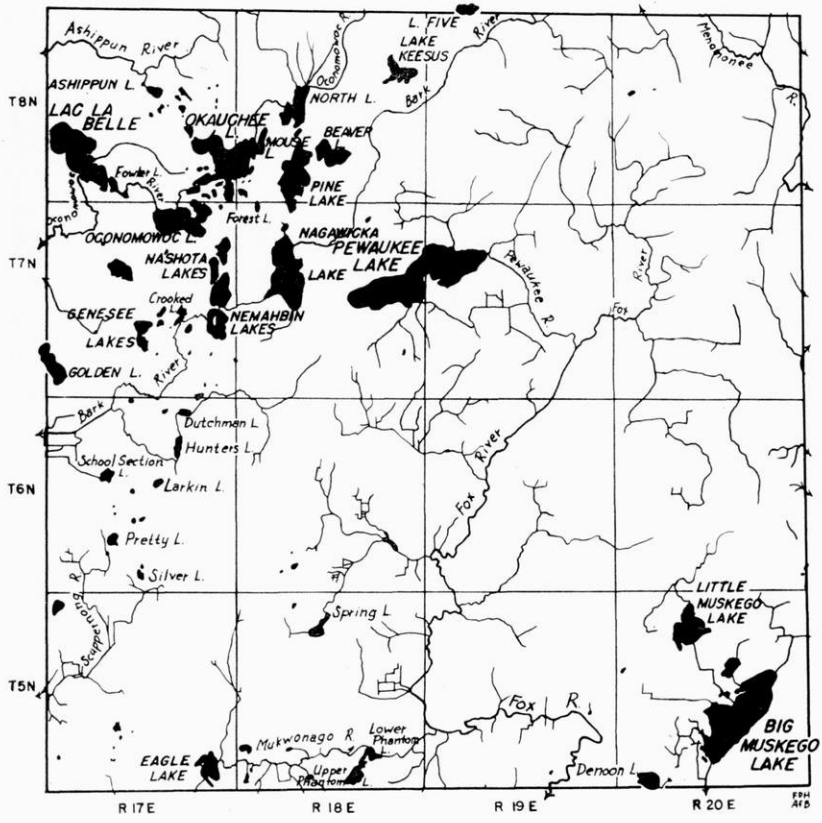


Figure 17.

colored soil map, a few prairie soil bodies appear which do not show in Figure 18, as in T. 7 N., R. 17 E. and T. 5 N., R. 18 E. This suggests that oak forest had invaded these old prairies by the time of the land survey. Prairie vegetation, oak woods and beech-maple-basswood forest have probably shifted positions for centuries in Wisconsin. Fires may have extended the prairie areas at the expense of the woodlands, at times.

TABLE IV. TEMPERATURE AND PRECIPITATION: MONTHLY, SEASONAL, AND ANNUAL AVERAGES FOR WAUKESHA, WAUKESHA COUNTY, WISCONSIN (5)

Month	Average Temperature °F		Average Precipitation Inches	
December	24		1.4	
January	20		1.6	
February	21		1.3	
WINTER		21		4.3
March	32		2.2	
April	45		2.7	
May	57		3.7	
SPRING		45		8.6
June	66		3.5	
July	72		2.8	
August	69		3.0	
SUMMER		68		11.6
September	62		3.6	
October	50		2.4	
November	37		2.1	
AUTUMN		50		8.1
YEAR		46		30.0

MAN AS A SOIL FORMING FACTOR IN WAUKESHA COUNTY

Man as a soil forming factor has changed the soils of Waukesha County by tillage and other earth-moving operations, by changing the vegetation, by raising or lowering fertility levels, and by protecting the soils, or by exposing them to frost and direct sunlight, and to erosion by wind and water. The past 200 years have seen increasingly intensive use of the soils of the county. The French fur traders in the early eighteenth century were followed by English settlers in the early nineteenth century. Norwegians settled near Big Muskego Lake in 1839, and Welsh in the Kettle Moraine near Government Hill, now called Lapham Hill. Scotch and Irish followed, and German farmers came between 1840 and 1860. In 1878, the farmers of the county produced more wheat than in any other year before or since (5). Also, the first creamery was built, indicating the change from emphasis on wheat production to livestock and dairying. Dairying meant return to the soil of plant nutrients and organic matter in the form of manure. The increased use of lime and commercial fertilizers, and the adoption by farmers of erosion control practices have improved both soil conditions and crop production. It still cannot be said, however, that man-induced soil erosion has been brought under control in Waukesha County.

NATIVE VEGETATION OF WAUKESHA COUNTY, WISCONSIN

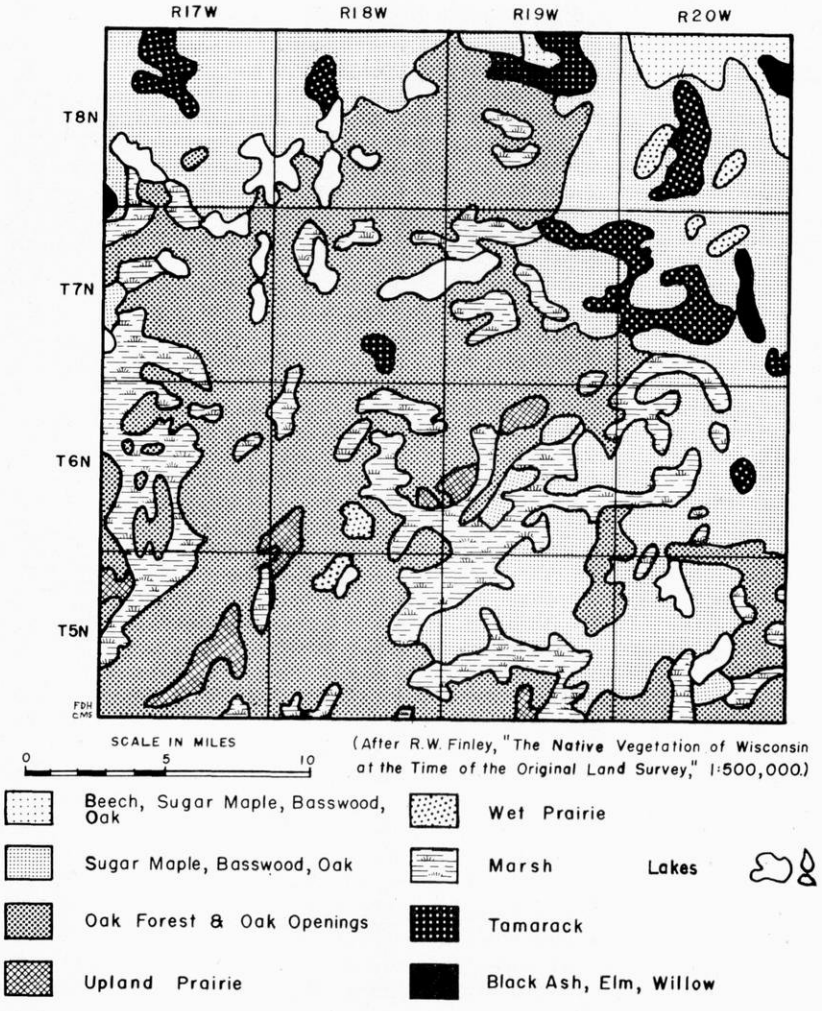


Figure 18.

SOIL DESCRIPTIONS

Introduction

Table V lists the 41 soil separations shown on the colored soil map. Each soil is defined by its cross-section to a depth of about four feet, as shown in Figure 19. This cross-section is called the soil profile (18), and shows the various soil layers, called soil horizons, in which plant roots develop and feed. A soil body of which the four-foot profile is a narrow, representative vertical cross-section, is a large sheet, irregular in shape, measuring 300 to 3,000 or more feet across. Soil bodies of each kind of soil have a typical range in profile characteristics, slope, susceptibility

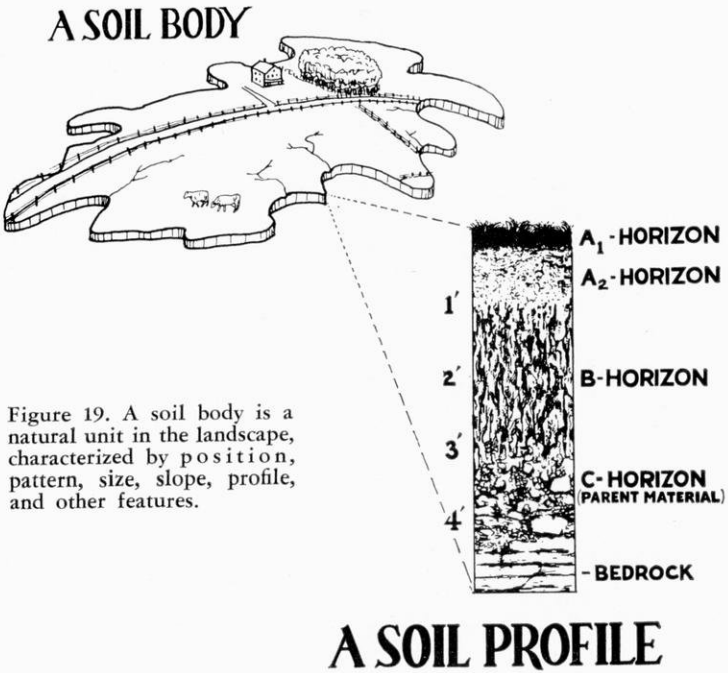


Figure 19. A soil body is a natural unit in the landscape, characterized by position, pattern, size, slope, profile, and other features.

to erosion under various conditions, native fertility, and response to amendments. It may be said that soil management is simpler on fields which consist of one soil. In such a case, the same treatments can be applied to the entire field with uniform results. However, many soil bodies are irregular ribbons in shape and even a strip in a strip-cropped field may cross two or more bodies of different soils. Where two soils in a field have extremely different management requirements, the operator may handle each portion of the field differently, or may treat the whole field in accordance with the requirements of the least productive part.

Individual soil profile descriptions are arranged in alphabetical order in the following pages. In some cases, exact locations are given for the sites at which detailed descriptions were made in the field. For most of the soils,

TABLE V. ESTIMATED PROPORTIONATE EXTENT OF MAJOR SOILS OF WAUKESHA COUNTY, WISCONSIN

Map Number	Unit Name	Estimated Extent	
		% of Area of County	Acres
5, 23	Muck and peat	7.8	27,980
16	Lapeer loam	7.1	25,170
12, 13	Morley silt loam	6.3	22,340
12, 13	Blount silty clay loam	6.0	21,410
9, 11	Miami silt loam	6.0	21,410
9, 11	Dodge silt loam	5.5	19,630
4, 18	Keowns silt loam	5.5	19,630
16	Miami loam	5.4	19,290
21, 22	Casco gravelly loam	4.7	16,810
7	Fox loam	4.3	15,360
2	Fox silt loam	4.1	14,760
22	Rodman gravelly loam	4.0	14,310
4, 18	Kokomo silt loam	4.0	14,310
6	Warsaw loam	3.7	13,230
21, 22	Fox loam, shallow	3.4	12,050
3, 17	Ashkum silty clay loam	3.4	12,050
4, 18	Elba silt loam	3.0	10,060
2	Ockley silt loam	2.8	9,940
4, 18	Clyman silt loam	2.0	7,100
21	Lapeer gravelly loam	1.4	4,970
9	Calamus silt loam	1.1	3,920
15	Fox sandy loam	0.9	3,200
8	Tuscola silt loam	0.7	2,480
24	Wet alluvium	0.7	2,480
8	Lannon silt loam	0.7	2,480
25	Maumee sand	0.7	2,480
4, 18	Abington silt loam	0.6	2,130
19	Oshtemo loamy sand	0.6	2,130
8	Casco silt loam	0.5	1,770
19	Hackett loamy sand	0.5	1,770
19	Plainfield sand	0.5	1,770
20	Metea loamy sand	0.3	1,060
20	Lapeer sandy loam	0.3	1,060
4,18	Homer silt loam	0.3	1,060
10	Parr silt loam	0.2	710
14	Warsaw sandy loam	0.2	710
4, 18	Matherton silt loam	0.2	710
14	Lorenzo sandy loam	0.2	710
1	Wea silt loam	0.1	350
1	Warsaw silt loam	0.1	350
13	Beecher silt loam	0.1	350
X	Gravel pits; made land	0.1	350
		100.0%	355,840
	Water	3.4%	12,380
	Land	96.6%	368,220

however, descriptions have been based on observations made at several sites.

A soil profile description provides important information, because our scientific classification of soils (19, 29), as well as our agriculture is based on these kinds of soils. Great Soil Groups (19), such as "Gray-Brown Podzolic", and "Brunizem", are technical terms used by soil scientists in classifying soils throughout the world. As more research is done on the soils, both in the laboratory and in the field, more complete descriptions and data will become available. Present data have been compiled by workers of the Soil Survey Division, the Soil Conservation Service, and of Agricultural Colleges of the region.

The reader is referred to the glossary of terms in the 1938 Agricultural Yearbook (36) and to the Soil Survey Manual (32) for detailed explanations of the technical terms used in the soil descriptions. Each description consists of two parts, an introductory paragraph and a description of soil horizons. The introductory paragraph gives information about the parent material from which the soil formed; the thickness and approximate clay content of the subsoil or B horizon, and the overlying and underlying horizons; the common types and phases mapped; and names of associated soils. The loess from which the silty upland and terrace soils formed was deposited in post-Cary time. The description of soil horizons gives colors with corresponding scientific "Munsell notations", such as 10YR 4/2 for moist soil, taken from the color chart books (25) used by soil surveyors, the texture (sandy loam, silt loam, clay, and so on), structure (granular, blocky, platy, prismatic), reaction or pH (degree of acidity or alkalinity by Truog quick test), and sometimes estimated organic matter content (23). The type location and the place and date of establishment of the series (15) are known for most of the soils.

INDIVIDUAL SOIL PROFILE DESCRIPTIONS

ABINGTON SERIES (Nos. 4 and 18 on the soil map)

The Abington series includes naturally wet soils on outwash terrace plains or benches, formed from deep silty material overlying stratified calcareous gravel and sand. In Waukesha County, the gravels are largely dolomite. Natural drainage or aeration conditions have been very poor and the original vegetation probably included some hardwood forest and some sedges and grasses. These soils are classified in the Humic-Gley great soil group. The subsoil (B_g or G horizon) begins at a depth of about 18 inches, and continues downward about 30 inches, with a maximum clay content of about 42 percent. Above the B_g horizon are silt loam to silty clay loam layers (A horizons) containing 15 to 30 percent clay. Slopes are less than 2 percent. Associated soils are Ockley, Fox, and Homer soils. There are silt loam and silty clay loam types. It is estimated that most of Abington soil areas have been drained artificially. A profile description is as follows:

0–16″ A_1
Very dark gray to black (10YR 3/1–2/1, moist) silt loam; medium granular structure, well developed; friable; pH 6.8; about 15% organic matter.

16–36″ B_g
Olive gray mottled with light yellowish brown (5Y 5/2, 10YR 6/4, moist) silty clay loam; coarse angular blocky, with some medium prismatic structure, well developed when dry; plastic; pH 7.5; about 0.7% organic matter.

Figure 20. Alluvial soils, undifferentiated, wet, are used largely for pasture.

36–42″ B_g–D
Mottled olive gray and light yellowish brown (5Y 5/2, 10YR 4/4, moist) gravelly silty clay loam to sandy clay loam; coarse angular blocky structure; plastic; pH 8.0; about 0.4% organic matter.

42–48″ D
Yellowish brown, mottled brownish yellow (10YR 6/4, 6/8, moist) gravel and coarse sand; friable; single grain; stratified; highly dolomitic; about 0.1% organic matter.

Type location: Wayne County, Indiana. Series established: Wayne County, Indiana. Source of name: Village in Wayne County, Indiana.

ALLUVIUM, UNDIFFERENTIATED, WET (No. 24 on the soil map)

Alluvial soils, undifferentiated, wet, (see Figure 20) is a miscellaneous land unit, which includes many kinds of alluvial soils on the poorly drained bottomlands. The term "undifferentiated" means that the surveyors did not map the individual soil series and types, chiefly because floods change the surface textures and patterns of deposits from year to year. These soils are not considered productive enough to warrant expenditure of time and money to map them in detail. This unit includes silty clay loams, silt loams, loams, sandy loams, and sands, somewhat poorly drained. Alluvial soils are not extensive in Waukesha County because the streams are small, for the most part, and have relatively gentle gradients. There is an ever-increasing area of colluvial or "local alluvial" soils, which are overwash materials from adjacent slopes.

ASHKUM SERIES (Nos. 3 and 17 on the soil map)

The Ashkum series includes soils developed from dolomitic gray silty clay glacial till of Cary (Middle Wisconsin) age in poorly drained depressions, in association with Blount soils. Original vegetation ranged from prairie to hardwood forest. These soils are classified in the Humic-Gley great soil group. The subsoil (B_g or G) horizon begins at a depth of about 16 inches and continues downward 10 to 30 inches, with a maximum clay content of about 38 percent. The surface soil has a clay content of about 27 to 30 percent and the C horizon, about 38 perent. Slopes are usually less

than 2 percent. There are two types, the silt loam and the silty clay loam. Permeability of these soils is slow, but they can be successfully drained with tile under good management. It is estimated that nearly 90 percent of the Ashkum soil bodies in Waukesha County have been artificially drained. The Ashkum soils have a higher clay content than the Drummer soils of Illinois, but a lower clay content than the Bryce soils (37). Ashkum soils are the dark colored, very poorly drained (very poorly aerated) associates of the Beecher, Blount, Morely and Elliott soils.

A soil profile description of Ashkum silt loam is as follows:

0–8" A_1
Very dark gray to black (10YR 3/1–2/1, moist) friable heavy silt loam, with fine granular structure; pH 8.0; about 15% organic matter.

8–13" A_3–B_{g1}
Dark gray, mottled with dark grayish brown and light olive brown (2.5Y 4/0, 4/2, 5/4, moist) silty clay loam; weakly developed fine blocky structure; pH 8.0; about 2% organic matter.

13–21" B_{g2}
Grayish-brown mottled with yellowish brown (2.5Y 5/2, 10YR 5/6, moist) clay loam, somewhat stony in lower part; medium blocky structure; pH 7.5; about 0.6% organic matter.

21–28" B_{g3}
Gray mottled with yellowish brown (5Y 5/1, 10YR 5/8, moist) firm clay loam; weakly developed medium blocky structure; pH 7.8; about 0.3% organic matter.

28–36" C_g
Gray mottled with yellowish brown (5Y 6/1–5/1, 10YR 5/8, moist), and containing white (10YR 8/1, moist) dolomitic grains, silty clay loam; massive; dolomitic; about 0.1% organic matter.

Type location: Iroquois County, Illinois. Series established: Iroquois County, Illinois, 1940. Source of name: Village in Iroquois County, Illinois.

BADOURA SERIES (Nos. 5 and 23 on the soil map)

The term peat is a general one for organic soils more than about one foot thick which contains recognizable plant fragments. There are numerous soil series included in peat, but in this report and map, the peats are undifferentiated. The organic matter content of a peat is usually very high, ranging from about 70 percent to nearly 100 percent. As is stated under the heading of Carlisle muck, further decomposition, which is hastened by drainage and cultivation, transforms peat into muck. A peaty loam is a soil with about 15–30 percent of "raw" organic matter in the A_1 horizon.

Mucky peats, such as Badoura, in Waukesha County are somewhat decomposed peats, consisting (20) of several inches of undecomposed sedges and grasses over several inches of black (10YR 2/1, moist) weak, granular, neutral mucky peat, over weakly matted, neutral, black mucky peat, resting on gray (5Y 6/1, moist) fine sand or silt at a depth of 2 to 6 feet. Peats may be separated on the basis of depth to mineral deposits into three groups: 10–30"; 30–40"; and more than 40 inches deep.

BEECHER SERIES (No. 13 on the soil map)

The Beecher series includes soils developed from gray dolomitic silty clay loam glacial till of middle Wisconsin (Cary) age, under moderate drainage and prairie border conditions. Vegetation was apparently prairie with invasion by oak. These soils are classified in the Gray-Brown Podzolic great soil group, but transitional from Brunizem (prairie), from which they differ by the presence of a distinct A_2 horizon which is lighter in color than the A_1. The subsoil (B horizon) begins at a depth of about 15 to 18 inches and continues downward one or two feet with a maximum clay content of about 42 percent. The surface horizon has a clay content of about 27

to 30 percent, and the C horizon, about 38 percent. Slopes are usually between 2 and 12 percent. There are silt loams and silty clay loams. These soils are transitional between the light colored Morley and Blount soils and the darker Elliott soils. Ashkum soils are the very poorly drained associates found in depressions and small drainage ways. The following description of a Beecher silty clay loam was made in the NE ¼ SW ¼ Sec. 13, T. 5 N., R. 20 E., Waukesha County, Wis.

0–11″ A_1
Very dark gray (10YR 3/1, moist) silty clay loam; friable; medium to coarse granular structure; pH 6.5; about 6% organic matter.

11–14″ A_2
Brown (10YR 5/3, moist) silty clay loam containing very dark gray (10YR 3/1, moist) earthworm casts, brought down from the A_1; friable to firm; coarse medium platy to fine subangular blocky structure; pH 6.7; about 2% organic matter.

14–27″ B
Brown (10YR 4/3, moist) silty clay to clay, with mottles of dark brown and strong brown (7.5YR 4/4, 5/6, moist); medium to fine subangular blocky structure; peds are coated with a dark brown (7.5YR 4/2, moist) material; about 1% organic matter.

27–36″ C
Light brownish gray, mottled with brown and yellowish brown (2.5Y 6/2; 10YR 5/3, 5/8, moist) gritty silty clay; medium prismatic and medium to fine angular blocky structure; grayish brown (10YR 5/2, moist) coatings on the peds; dolomitic; about 5% stones by volume; about 0.6% organic matter.

Type location: Will County, Illinois. Series established: Will County, Illinois, 1948. Source of name: Village in Will County, Illinois.

BLOUNT SERIES (Nos. 12 and 13 on the soil map)

The Blount series includes soils developed from gray to pinkish dolomitic silty clay loam till, under forest vegetation, and somewhat poor drainage conditions. These soils are classified in the Gray-Brown Podzolic great soil group. The subsoil begins at a depth of about one foot and continues downward 8 to 16 inches, with a maximum

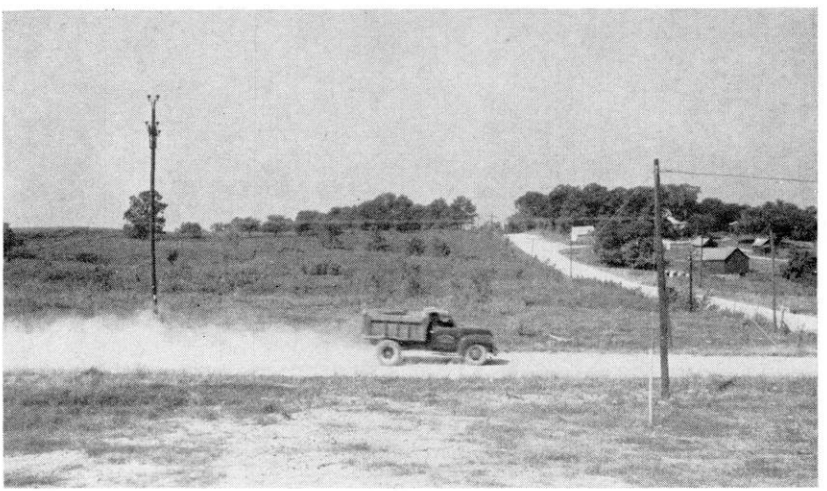


Figure 21. Lime dust is stirred up on gravel roads by vehicles. Winds carry the fine lime considerable distances from the roads into fields and woods, thereby raising the reaction (pH) of the surface soil.

clay content of about 42 percent. The surface soil (A horizons) has a clay content of about 27 percent, and the C horizon, about 38 percent. These soils are associated with the better drained Morley and the very poorly drained Ashkum. In many fields, particularly close to roads, the reaction (pH) of the soil has been raised by liming to 7.5 to 8.0 (see Figure 21). This was the case at the site from which the following description was taken, but pH figures considered typical of an unlimed profile have been substituted on the basis of field observations. The following description of a Blount silt loam was made in the NE ¼ SE ¼ SE ¼ Sec. 26, T. 6 N., R. 20 E., Waukesha Co., Wis.

0–5″ A_1
Very dark grayish brown to dark grayish brown (10YR 3/2–4/2, moist) heavy silt loam; friable; very weak fine granular structure; pH 6.0; about 6% organic matter.

5–11″ A_2
Brown to pale brown (10YR 5/3–6/3, moist) silt loam; friable; weak fine granular to platy structure; pH 5.8; about 2.5% organic matter.

11–24″ B
Dark brown (7.5YR 4/3, moist) mottled with yellowish brown (10YR 5/6, moist) silty clay; plastic; very fine to fine strongly developed subangular blocky structure; peds are coated with dark brown (7.5YR 4/2, moist) material; pH 6.5; slightly stony; about 1% organic matter.

24–30″ C
Grayish-brown (10YR 5/2, moist) silty clay loam, mottled with brown and dark brown (7.5YR 5/2, 4/2, 5/4, moist); 5% stones by volume; very fine subangular blocky structure, strongly developed; dolomitic; about 0.1% organic matter.

Type location: Vermilion County, Illinois. Series established: Vermilion County, Illinois. Source of name: Township in Vermilion County, Illinois.

CALAMUS SERIES (No. 9 on the soil map)

(Tentative series name)

The Calamus series includes soils developed from deep silts overlying dolomitic glacial till of middle Wisconsin (Cary) age, under moderately good drainage conditions, and deciduous forest cover. These soils are classified in the Gray-Brown Podzolic great soil group. The subsoil (B horizon) begins at a depth of about one foot and continues downward about two feet, with a maximum clay content of about 32 percent. Above and below the B horizon are silt loam horizons, the upper one of which (A horizons) has a clay content of about 15 percent and the lower one (C horizon), about 25 percent. Slopes are usually between 2 and 12 percent. This is usually mapped as a monotype series. The Calamus soils occur in association with Dane, Miami, Dodge, Clyman, and Elba soils, both in ground moraine and in drumlin landscapes. The following description is largely based on field notes by Dr. G. B. Lee.

¾″–0 A_{00} and A_0
Loose hardwood leaves and partially decomposed organic matter.

0–3″ A_1
Very dark gray (10YR 3/1, moist) silt loam; friable; fine granular structure; earthworm casts abundant; pH 6.8; abrupt lower boundary; about 6% organic matter.

3–6″ A_2
Pale brown (10YR 5/3, moist) silt loam; friable; well developed fine to medium platy structure; pH 5.2; clear lower boundary; about 3% organic matter.

6–8″ A_3
Brown (10YR 5/3, moist) silt loam; friable; well developed medium platy structure; pH 4.7; clear lower boundary; about 2.5% organic matter.

8–12″ B_1
Brown (10YR 4/3, moist) silt loam; slightly firm; moderately well developed medium subangular blocky structure; pH 4.8; gradual lower boundary; about 2% organic matter.

12–28″ B_{2g}
Dark brown above, to dark yellowish brown below (10YR 4/3 to 4/4, moist) silty clay loam, slightly mottled below the 16-inch depth with browns (10YR 6/3; 7.5YR 5/8, moist); firm; moderately to well developed medium, above, to coarse, below, subangular blocky structure; lower peds are stained dark grayish brown (10YR 3/2, moist); pH 4.8 above to 6.0 below; about 1% organic matter.

28–36″ B_{3g}
Brown and dark yellowish brown (10YR 5/3, 4/4, moist) light silty clay loam, mottled as in the above horizon; firm; massive; pH 6.5; about 0.8% organic matter.

36–48″ C_{1g}
Yellowish brown (10YR 5/4, moist) silt loam, mottled with small rusty spots; somewhat firm; massive; pH 7.0 (dolomitic at 50″); about 0.1% organic matter.

Type locality: Dodge County, Wisconsin. Series proposed: Dodge County, Wisconsin, 1951. Source of name: Civil town in Dodge County, Wisconsin.

CARLISLE SERIES (Nos. 5 and 23 on the soil map)

Muck is a general name for a group of soil series consisting of organic matter more than about one foot deep, accumulated under very poor drainage or aeration conditions, and sufficiently decomposed as to make original plant parts unrecognizable. Usually a muck has mineral matter (30 to 60 percent) in larger proportion than does a peat, but some mucks are nearly free of mineral particles. The adjective, "mucky", as used in such a phrase as "mucky silt loam", usually indicates an organic matter content of 15 to 30 percent, which is less than in a true muck. When peats are drained and cultivated, they soon become mucks, because the shreds and fragments of plant material become broken beyond recognition under cultivation. Mucks are low in fertility, but in Waukesha County usually have a pH of 6.5 to 7.5.

In the Carlisle muck several inches of black (10YR 2/1, moist) granular muck overlies very dark brown (10YR 2/1–2/2, moist) coarse granular and fibrous mucky and peaty material. At about two feet is encountered yellowish-brown (10YR 5/8–4/4, moist) muck or peat. Gray (5YR 6/1) sand or silt lies at a depth of 2½ to 6 feet. Layers of sand or marl may occur within the lower profile of the muck, as shown in Figure 27.

CASCO SERIES (Nos. 8, 21 and 22 on the soil map)

The Casco series includes soils developed from stratified calcareous or dolomitic outwash gravel and sand, with or without a thin (10–24″) covering of silty material. These soils are well drained and formed under oak-hickory forest vegetation. They are classified in the Gray-Brown Podzolic great soil group. The subsoil (B horizon) begins at a depth of about one foot and continues downward 8 or 10 inches, with a maximum clay content of about 30 percent. The surface soil (A horizons) contains about 10 percent clay. These soils are associated with the deeper Fox and the shallower Rodman. Slopes range from 1 percent to 25 percent. There are silt loam, loam, and sandy loam types, the last two mentioned being the most extensive in Waukesha County. The Casco series may be regarded as the Gray-Brown Podzolic equivalent of the Brunizem Lorenzo series. The Oshtemo is deeper to sand and gravel and has a lighter textured B horizon. A description of a Casco silt loam is as follows:

0–4″ A_1
Very dark grayish brown (10YR 3/2, moist) silt loam; friable; weak fine granular structure; pH 6.5; abrupt lower boundary; about 6% organic matter.

4–10″ A_2
Yellowish brown (10YR 5/4, moist) silt loam; friable; weak fine platy structure; pH 6.3; abrupt lower boundary; about 3% organic matter.

10–14″ B_1
Dark yellowish brown (10YR 4/4, moist) light silty clay loam; friable; weak fine subangular blocky structure; pH 6.5; abrupt lower boundary; about 2% organic matter.

14–20″ B_2–D_1
Dark brown (7.5YR 4/2–4/4, moist) gravelly, sandy clay loam; 60% stones by volume, both dolomitic and crystalline; plastic; moderately well developed fine subangular blocky structure; pH 7.5; abrupt, irregular lower boundary; about 0.7% organic matter.

20–25″ + D_2
Yellowish brown (10YR 5/6, moist) loose gravel and coarse sand; stratified; dolomitic; about 0.1% organic matter.

Type location: Lapeer County, Michigan. Series proposed: Kewaunee County, Wisconsin. Source of name: Village in Kewaunee County, Wisconsin.

CLYMAN SERIES (Nos. 4 and 18 on the soil map)

(Tentative series name)

The Clyman series includes soils developed from moderately deep (32″+) silty materials (loess) overlying dolomitic glacial till of middle Wisconsin (Cary) age, under somewhat poor drainage conditions (see Figure 11), under hardwood forest vegetation. These soils are classified in the Gray-Brown Podzolic great soil group. The subsoil (B horizon) begins at a depth of about 13 inches and continues downward about 20 inches with a maximum clay content of about 37 percent. Above and below the B horizon are silt loam layers, including surface soil (A horizons) containing about 15 percent clay, and the C horizon, with about 20 percent clay. Slopes range from 1 percent to 7 percent. This is a monotype series. The Clyman soils are associated with the better drained Calamus, Dane, Dodge and Miami soils, and the very poorly drained Elba soils. A description of the Clyman silt loam is as follows:

½″–0 A_0
Decomposed leaf litter.

0–4″ A_1
Very dark gray (10YR 3/1, moist) friable silt loam; fine to medium granular structure; pH 6.3; abrupt lower boundary; about 8% organic matter.

4–12″ A_{2g}
Light gray mottled with yellowish brown (10YR 7/2, 5/4, moist) silt loam; friable; moderately well developed medium to coarse platy structure; pH 5.3; lower boundary abrupt; about 2% organic matter.

12–17″ B_{1g}
Dark grayish brown mottled with yellowish brown (2.5Y 4/2; 10YR 5/4, moist) silt loam; friable; moderately developed fine to medium subangular blocky structure; pH. 5.3; lower boundary clear; about 1% organic matter.

17–34″ B_{2g}
Grayish brown and yellowish brown mottled (10YR 5/2, 5/4, moist) silty clay loam; moderately developed medium to coarse subangular blocky structure; slightly firm; pH 5.5 above to 6.6 below; lower boundary gradual; about 0.7% organic matter.

34–40″ C_{1g}
Grayish brown mottled with brown (10YR 5/2; 7.5YR 5/6; 5YR 4/8) silt loam; slightly firm; massive; pH 7.0; lower boundary abrupt; about 0.2% organic matter.

40–48″ D
Brown (10YR 4/3, 8.5YR 5/6, moist) loam till; friable; massive; dolomitic; about 0.1% organic matter.

Type location: NW ¼ NE ¼ Sec. 7, T. 12 N., R. 14 E., Dodge Co., Wisconsin. Series proposed: Dodge County, Wisconsin, 1951. Source of name: Village in Dodge County, Wisconsin.

DODGE SERIES (Nos. 9 and 11 on the soil map)

(Tentative series name)

The Dodge series includes soils formed from 24 to 36 inches of silty material (loess) overlying highly dolomitic loam till of middle Wisconsin (Cary) age, under conditions of good drainage, with oak-hickory or maple forest cover. These soils are classified in the Gray-Brown Podzolic great soil group. The subsoil (B horizon) begins at a depth of about one foot and continues downward 20 to 30 inches, with a maximum clay content of about 34 percent. The surface soil (A horizons) is a silt loam with a maximum clay content of about 15 percent. Beneath the B horizon lies the dolomitic till, with about 15 percent clay. Slopes range from 2 to 12 percent. This is a monotype series. These soils are associated with the shallower Miami and the deeper Dane. The Dane soil is formed from 42 inches or more of loess over glacial till, and can be observed on an 8 percent slope in the SW ¼ of the SW ¼ of Section 20, T. 6 N., R. 20 E., Waukesha County, Wisconsin. A profile description of Dodge silt loam is as follows:

½–0″ A_0
Decomposing leaf litter.

0–3″ A_1
Very dark gray (10YR 3/1, moist) silt loam; friable; weak very fine granular structure; pH 6.5; lower boundary abrupt; about 6% organic matter.

3–11″ A_2
Brown (10YR 5/3, moist) silt loam; friable; weak medium platy structure; vesicular; pH 5.0; lower boundary abrupt; about 2% organic matter.

11–16″ B_1
Yellowish brown (10YR 5/4, moist) heavy silt loam; friable; weak fine subangular blocky structure; pH 5.3; lower boundary gradual; about 1% organic matter.

16–33″ B_2
Dark brown (10YR 4/3, moist) silty clay loam; somewhat plastic; moderately developed fine to medium subangular blocky structure; peds coated with dark grayish brown (10YR 4/2, moist) material; pH 5.5; lower boundary gradual; about 0.7% organic matter.

33–39″ B_3–D_1
Pale and dark yellowish brown (10YR 7/6, 5/6, 5/8, 8/3; 7.5YR 4/3, moist) stony sandy clay loam to clay loam; somewhat plastic; moderately developed medium subangular blocky structure; pH 6.0; lower boundary abrupt; about 0.3% organic matter.

39–45″ D_2
Yellowish brown (10YR 5/6, 6/3, moist) loam till; friable to slightly plastic; massive; dolomitic; about 0.1% organic matter.

Type location: Dodge County, Wisconsin. Series proposed: Dodge County, Wisconsin. Source of name: County name, Dodge County, Wisconsin.

ELBA SERIES (Nos. 4 and 18 on the soil map)

(Tentative series name)

The Elba series (see Figure 3) includes soils formed from deep silty deposits in lowlands or depressions in morainic or drumlin landscapes of middle Wisconsin (Cary) till country. Drainage has been very poor, and vegetation was probably sedges and grasses. These soils are classified in the Humic-Gley great soil group. The subsoil (B_g or G horizon) begins at a depth of about 14 inches and continues downward about 30 inches, with a maximum clay content of about 40 percent. The surface soil (A horizon) is a silt loam to light silty clay loam with maximum clay contents of 20 to 30 percent. The layers below the B_g horizon may be silt loam, silty clay, or gravelly loam glacial till. A thin layer of peat may occur on these soils. Slopes range

between 0 and 4 percent. There are silt loams, and silty clay loams. A bouldery phase occurs where ice shove or wash concentrated large rock fragments. In places the entire profile is calcareous and may contain fragments of shells. The catena includes the well drained Saylesville, the imperfectly drained Hahns and the very poorly drained Elba. The following description is based largely on field notes of Drs. G. B. Lee and S. S. Pollack (26).

0–9″ A_1
Black (2.5Y 2/0, moist) silty clay loam; friable to slightly firm; moderately well developed medium to coarse granular structure above to blocky structure below; pH 6.7; clear lower boundary; about 15% organic matter.

9–14″ A_{2g}
Very dark gray (2.5Y 3/1, moist) to dark gray (5YR 4/1, moist) silty clay loam; slightly firm; well developed medium blocky structure; pH 7.0; clear lower boundary; about 3% organic matter.

14–46″ B_g
Olive gray, mottled below with light yellowish brown (5Y 5/2; 10YR 6/4, moist) heavy silty clay loam to silty clay; firm; coarse prismatic structure which breaks to medium blocky aggregates; pH 7.2; about 0.8% organic matter.

46–50″ D_1
Yellowish brown, mottled brownish-yellow (10YR 6/4, 6/8, moist) gravelly loam till; massive; dolomitic; about 0.1% organic matter.

Type locality: NW ¼ SE ¼ Sec. 14, T. 10 N., R. 14 E., Dodge County, Wisconsin. Series proposed: Dodge County, Wisconsin, 1951. Source of name: Civil town in Dodge County, Wisconsin.

FOX SERIES (Nos. 2, 7, 15, 21 and 22 on the soil map)

The Fox series (see Figure 22) includes soils formed from 24 to 42 inches of silty or loamy material overlying dolomitic stratified coarse sand and gravel outwash. Drainage conditions are good (to excessive). The natural vegetation was hardwood forest, ranging from oak-hickory to maple. These soils are classified in the Gray-Brown Podzolic great soil group. The subsoil (or B horizon) begins at a depth of about 10 inches and continues downward 14 to 26 inches, with a maximum clay con-

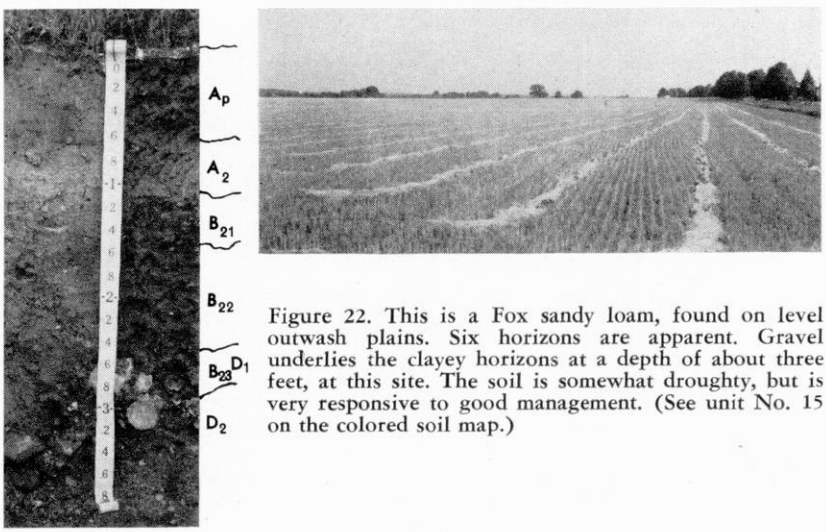


Figure 22. This is a Fox sandy loam, found on level outwash plains. Six horizons are apparent. Gravel underlies the clayey horizons at a depth of about three feet, at this site. The soil is somewhat droughty, but is very responsive to good management. (See unit No. 15 on the colored soil map.)

tent of about 47 percent (in the B_2 horizon). The surface soil is a silt loam, with a maximum clay content of about 15 percent. These soils are associated on level plains and terraces with Ockley, Bronson, Homer, and Abington soils of the light colored catena, and Wea, Warsaw, and Eagle soils of the dark catena. On hilly, highly pitted outwash, Rodman and Casco are common associates. There are several types: silt loams, loams and sandy loams. Slope and erosion phases are mapped. Near roads, the pH has been raised by road dust to above pH 8 (see Figure 21). The pH figures given below are substituted from an unlimed profile. The following profile description was made in the NW 1/4 Sec. 5, T. 8 N., R. 19 E., Waukesha Co., Wis.

0–4″ A_1
Very dark grayish brown (10YR 3/2, moist) silt loam; friable; weak fine granular structure; pH 6.0; about 5% organic matter.

4–10″ A_2
Yellowish brown (10YR 5/4, moist) silt loam; friable; weak fine platy structure; pH 5.4; about 2% organic matter.

10–14″ B_1
Dark yellowish brown (10YR 4/4, moist) light silty clay loam; friable; weak fine subangular blocky structure; pH 5.5; about 1% organic matter.

14–18″ B_{21}
Dark brown (10YR 4/3, moist) light fine sandy clay loam; slightly plastic; moderately developed fine subangular blocky structure; about 10% of stones by volume; pH 5.5; about 0.4% organic matter.

18–27″ B_{22}
Dark brown above to dark reddish brown below (7.5YR 4/3; 5YR 3/4, moist) sandy clay above grading into sandy clay loam below; plastic; well developed medium to fine subangular blocky structure; 25% stones above to 50% stones below, by volume; pH 5.2; about 1% organic matter.

27–30″ B_{23}–D_1
Dark brown (7.5YR 4/3, moist) sandy clay; plastic; moderately developed fine subangular blocky structure; peds coated dark brown (7.5YR 3/2, moist); 60% stones by volume, including both dolomitic and crystalline stones; pH 8.5; about 0.6% organic matter.

30–36″ D_2
Yellowish brown (10–7.5YR 5/6, moist) coarse sand and gravel; loose; stratified; dolomitic; about 0.1% organic matter.

Type location: Hillsdale County, Michigan. Series established: Columbia County, Wisconsin, 1911. Source of name: Fox River in Columbia County, Wisconsin.

The following description of a Fox fine sandy loam was made in the NE corner, Sec. 1, T. 6 N., R. 17 E., Waukesha County, Wisconsin, by R. R. track.

0–8″ A_p
Very dark grayish brown (10YR 3/2, moist) fine sandy loam to loam; friable; weak fine platy and granular structures; 1% stones by volume; pH 6.7; abrupt boundary; about 4% organic matter.

8–14″ A_2
Dark yellowish brown (10YR 4/4, moist) loam; friable; weak fine platy structure; 5% stones by volume; pH 6.2; clear boundary; about 2% organic matter.

14–20″ B_{21}
Brown (8.5YR 5/4, moist) heavy loam; slightly plastic; weak fine subangular blocky structure; 15% stones by volume; pH 6.0; clear boundary; about 0.4% organic matter.

20–34″ B_{22}
Dark brown (7.5YR 4/4, moist) sandy clay loam; moderately plastic; weak fine subangular blocky structure; 20% stones by volume; pH 6.0; clear boundary; about 0.8% organic matter.

34–36″ B_{23}
Strong brown (7.5YR 4/4–5/6, moist) sandy gravelly clay loam; coatings of dark brown (7.5YR 4/2, moist); moderately plastic; weak medium angular blocky structure; 30% stones by volume; pH 5.7; abrupt boundary; about 0.3% organic matter.

36–42″+ D
Strong brown (8.5YR 5/6, moist) coarse sand and gravel; loose; stratified; 99% stones; dolomitic; about 0.1% organic matter.

Type location, etc. as for Fox silt loam.

HACKETT SERIES (No. 19 on the soil map)

(Tentative series name)

The Hackett series includes soils developed from slightly calcareous sandy outwash under conditions of excessive aeration or drainage, and hardwood forest (oak-hickory) cover. These soils are classified in the Gray-Brown Podzolic great soil group. The subsoil (B horizon) begins at about 11 inches and continues downward about 10 inches, with a maximum clay content of about 22 percent. Above and below the B horizon are sandy layers, the upper of which (A horizons) contains a maximum of about 10 percent clay, and the lower (C horizon) about 5 percent. Slopes range from 0 to 12 percent in gradient. There are loamy find sand and fine sand types. These soils are associated with the more sandy and more acid Plainfield and Gotham, and the more clayey Casco soils. The following description is based on field notes of Messrs. T. C. Bass and William DeYoung, State Soil Scientists of the Soil Conservation Service.

0–7″ A_1
Very dark grayish brown to dark brown (10YR 3/2, 7.5YR 4/4, moist) loamy fine sand; friable to loose; weak fine granular structure to single grain; pH 7.8; about 1% organic matter.

7–11″ A_2
Brown (7.5YR 4/2, moist) fine sand; loose; single grain; pH 7.8; about 0.4% organic matter.

11–16″ B_1
Dark brown (7.5YR 4/4–4/6, moist) loamy fine sand; very friable; very weak medium subangular blocky structure; pH 7.8; about 0.3% organic matter.

16–20″ B_2
Reddish brown (5YR 4/4–4/6, moist) sandy clay loam or loam; firm to slightly plastic; weak to moderate medium angular blocky structure; pH 7.8; about 0.2% organic matter.

20–40″ C_1
Brown (10YR 5/3–6/4, moist) fine sands and gravels; loose; single grain; stratified; dolomitic; about 0.1% organic matter.

Type location: SW ¼ SE ¼ NW ¼ Sec. 22, T. 22 N., R. 20 E., Washington County, Wisconsin. Series proposed: Washington County, Wisconsin, 1944. Source of name: Hacketts Grove on Big Cedar Lake, Washington County, Wisconsin.

HOMER SERIES (Nos. 4 and 18 on the soil map)

The Homer series includes soils developed from very deep (42–60″) silty material overlying stratified calcareous or dolomitic coarse sand and gravel outwash. The soils formed under somewhat poor natural drainage or aeration conditions, and under a hardwood forest cover. They are somewhat poorly aerated Gray-Brown Podzolic soils. The subsoil (B horizon) begins at a depth of about 10 inches and continues downward 24 to 36 inches, with a maximum clay content (in the B_3) of about 34 percent. The surface soil (A horizons) is a silt loam with a maximum clay content of about

15 percent. Slopes range from 0 to 3 percent. This is a monotype series. These soils are associated with the better drained Ockley and Bronson, and the more poorly drained Abington soils. This catena of soils is deeper to gravel than is the Fox catena, which consists of the well drained Fox, moderately well drained Ionia, imperfectly drained Matherton, and poorly to very poorly drained Sebewa. The following description is of a Homer silt loam:

½–0" A_0
Decomposed leaf litter.

0–3" A_1
Very dark gray (10YR 3/1, moist) silt loam; friable fine to medium granular structure; pH 6.3; about 8% organic matter.

3–11" A_{2g}
Light gray mottled with yellowish brown (10YR 7/2, 5/4, moist) silt loam; friable; moderately well developed medium to coarse platy structure; pH 5.3; about 2% organic matter.

11–15" B_{1g}
Dark grayish brown mottled with yellowish brown (2.5Y 4/2; 10YR 5/4, moist) silt loam; friable; moderately developed fine to medium subangular blocky structure; pH 5.3; about 1% organic matter.

15–34" B_{2g}
Grayish brown and yellowish brown, mottled (10YR 5/2, 5/4, moist) silty clay loam; somewhat firm; moderately developed medium subangular blocky structure; pH 6.6; about 0.5% organic matter.

34–44" B_3
Dark brown (7.5YR 4/2, moist), slightly mottled, gravelly clay loam; somewhat plastic; coarse angular blocky structure; pH 7.5; about 0.7% organic matter.

44–50" D_1
Yellowish brown (10YR–7.5YR 5/6, moist) coarse sand and gravel; loose; stratified; dolomitic; about 0.1% organic matter.

Type location: Rush County, Indiana. Series established: Marion County, Ohio, 1916. Source of name: City of Homer, Calhoun County, Michigan.

KEOWNS SERIES (Nos. 4 and 18 on the soil map)

(Tentative series name)

The Keowns series includes soils developed from dolomitic deep silts and fine sands of glacio-lacustrine origin, under conditions of poor drainage, under forest vegetation. These soils are classified in the Low Humic-Gley and Humic-Gley great soil groups. The subsoil (B_g or G horizon) begins at a depth of about 13 inches and continues downward about 8 inches, with a maximum clay content of about 20 percent. The surface soil ranges in texture from silt loam to loam to sandy loam, with a maximum clay content of about 16 percent. Slopes are 0–2 percent. There are silt loams and sandy loam types. These soils are associated with the better drained Tuscola, the imperfectly drained Shiocton and the very poorly drained Elba. As this bulletin goes to press, it is suggested that Keowns signify AC profiles, and Colwood ABC profiles. The following description is based largely on field notes by Dr. G. B. Lee of the University Soil Survey.

0–9" A_1
Very dark gray (10YR 3/1, moist) very fine sandy loam; very friable; weak fine granular structure; pH 7.8; about 10% organic matter.

9–13" A_{2g}
Light yellowish brown to pale yellow (2.5Y 6/4–7/4, moist) mottled with yellowish brown (10YR 5/8, moist) very fine sandy loam; friable; weak fine platy structure; vesicular; pH 8.0; about 3% organic matter.

13–18″ B_{1g}
Light olive brown mottled with yellowish brown and gray (2.5Y 5/5; 10YR 5/8, 5/1, 6/1, moist) very fine sandy loam; friable; weak fine platy structure and weak coarse prismatic structure; pH 8.0; about 0.8% organic matter.

18–27″ C_{1g}
Light yellowish brown mottled with yellowish brown (2.5Y 6/4; 10YR 5/8, moist) silt loam; friable; laminated with weak coarse prismatic structure; dolomitic; about 0.1% organic matter.

Type location: SW ¼ SW ¼ Sec. 34, T. 9 N., R. 14 E., Dodge County, Wisconsin. Series proposed: Washington County, Wisconsin, 1944. Source of name: Small village in Washington County, Wisconsin.

KETTLES

Kettles are pits (see Figure 23), depressions, or basins in glacial drift, which range in width from one hundred feet to a mile or so. These pits are often called "potholes", but are correctly termed "kettles". The Kettle Moraine contains an abundance of them, but kettles are also numerous in nearly level outwash plains. It is believed that each kettle marks the site of burial in the drift of a block of glacial ice, which ultimately melted and caused the glacial drift to collapse. About 1200 kettles are indicated on the soil map. No attempt was made to show individual kettles in areas of complex topography, so the total number of them in the county is much greater. Kettles resemble superficially the "sinks" of unglaciated limestone country.

KOKOMO SERIES (Nos. 4 and 18 on the soil map)

The Kokomo series includes soils developed over dolomitic or calcareous glacial till of Wisconsin (Cary or Tazewell) age. In Wisconsin, there is a shallow to moderately deep (20–36″) mantle of silty material over the till. Drainage conditions have been very poor and vegetation was sedges, reeds, swamp grasses. These soils are classified in the Humic-Gley great soil group. The subsoil (B_g or G horizon) begins at a depth of about 15 inches, and continues downward 20 to 36 inches, with a maxi-

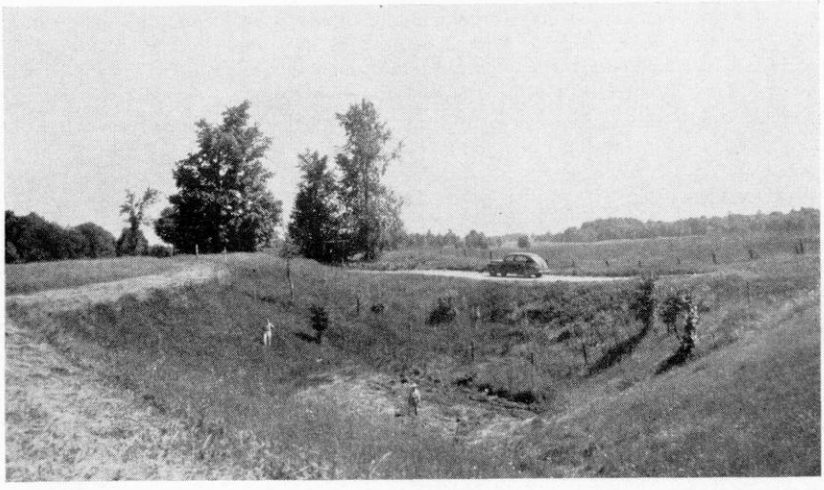


Figure 23. This "kettle" is a pit in a glacial outwash plain. Geologists tell us that pits like this one mark the locations of large blocks of glacial ice, which melted, leaving deep depressions.

mum clay content of about 40 percent. The surface soil is a silt loam or silty clay loam and ranges in clay content from 15 to 38 percent. Slopes are 0–2 percent. The till is a light loam to loam with a clay content of 15 to 20 percent. These soils are associated with the Miami, Dodge, Calamus and Clyman series. A description of a Kokomo silt loam is as follows:

0–10" A_1

Black (10YR 2/1, moist) silt loam; friable; moderately well developed medium to coarse granular above to medium to coarse subangular blocky structure below; pH 7.0; about 15% organic matter.

10–15" A_{3g}

Very dark gray (2.5Y 3/1, moist) silty clay loam; somewhat firm; well developed medium blocky structure; pH 7.0; about 3% organic matter.

15–40" B_g

Olive gray mottled with light yellowish brown (5Y 5/2; 10YR 6/4, moist) silty clay loam to silty clay; plastic; well developed coarse angular blocky and prismatic structures; pH 7.2; about 0.4% organic matter.

40–42"+ C_{1g}

Yellowish brown and brownish yellow mottled (10YR 6/4, 6/8, moist) gravelly loam till; friable; massive; dolomitic; about 0.1% organic matter.

Type location: Adams County, Indiana. Series proposed: Cass County, Indiana, 1951. Source of name: County seat of Howard County, Indiana.

LANNON SERIES (No. 8 on the soil map)

(Tentative series name)

The Lannon series includes soils formed from shallow to moderately deep (12–36") silty material overlying a silty clay layer and Niagara dolomite (see Figure 24). Drainage has been good, and the vegetation was hardwood forest, largely maple. These soils are classified in the Gray-Brown Podzolic great soil group. The subsoil or B horizon begins at a depth of about one foot and continues downward one to three feet, with a maximum clay content in the B_2 of about 40 per cent. The surface soil (A horizons) is a silt loam with a maximum clay content of about 15 percent. Slopes are 1 to 7 percent. These soils are found on nearly level plains associated with Casco and Tuscola soils. The following description of Lannon silt loam was made in the NW 1/4 NE 1/4 SE 1/4 Sec. 35, T. 8 N., R. 19 E., Waukesha Co., Wis.

Figure 24. This is a view of a stone quarry near Lannon. In the background is a cut through the Lannon soil which overlies the bedrock in the surrounding area. (See unit No. 8 on the soil map.)

½–0″ A_0
Decomposing leaf litter.

0–4″ A_1
Very dark grayish brown (10YR 3/2, moist) silt loam; friable; moderately developed fine to medium granular structure; pH 6.4; about 6% organic matter.

4–12″ A_2
Grayish brown (10YR 4/2, moist) silt loam; friable; moderately developed medium platy structure; pH 6.0; about 2% organic matter.

12–17″ B_1
Brown (10YR 4/3, moist) heavy silt loam; friable; weak medium to fine subangular blocky structure; peds are coated with dark grayish brown material (10YR 4/2, moist) pH 7.0; about 1% organic matter.

17–25″ B_{21}
Colors as in the B_1; light silty clay loam; firm; moderately developed medium subangular blocky structure; pH 7.5; about 0.8% organic matter.

25–33″ B_{22}
Dark brown (7.5YR 4/2–3/2, moist) silty clay; plastic; well developed fine angular blocky structure; 25% by volume of weathered stones, of which about one-third are dolomitic; pH 8.5; about 1% organic matter.

33–36″ D_1
Bedrock dolomite.

Type location: At Lannon, Waukesha County, Wisconsin. Series proposed: Waukesha County, Wisconsin, 1955. Source of name: Village in Waukesha County, Wisconsin.

LAPEER SERIES (Nos. 16, 20 and 21 on the soil map)

The Lapeer series includes soils developed from calcareous or dolomitic sandy loam glacial till of Wisconsin (Cary) age. These soils are leached to a depth of 20 to 42 inches. Drainage or aeration is good to somewhat excessive and the native vegetation was oak-hickory forest. These soils are classified in the Gray-Brown Podzolic great soil group. The subsoil (B horizon) begins at a depth of about one foot and continues downward about 2 feet with a maximum clay content (in the B_2) of about 30 percent. The surface soil (A horizons) is a loam or sandy loam or gravelly loam, with a maximum clay content of about 10 percent. Slopes are 2 to 25 percent. It is probable that the Lapeer in Michigan is underlain by a till lower in content of carbonates than it is in Wisconsin.

These soils are associated with the Miami, which is underlain by a more highly dolomitic loam till, and has less stones in the solum (A and B horizons). Another associated series is the McHenry, formed from 12 to 24 inches of silty material (loess) overlying sandy loam dolomitic glacial till of Wisconsin age. At the N.W. corner of Sec. 27, T. 5 N., R. 18 E. is found a prairie equivalent (Ringwood series) of the McHenry, a loam soil with sandy clay loam and heavy sandy loam B over dolomitic gravelly sandy loam till at 42 inches. The following description of a Lapeer fine sandy loam was made in the SE ¼ SW ¼ Sec. 10, T. 5 N., R. 18 E., Waukesha Co., Wis.

0–5″ A_1
Very dark gray (10YR 3/1, moist) fine sandy loam; friable; weak fine granular structure; about 2% stones by volume; pH about 6.5; about 5% organic matter.

5–10″ A_2
Dark grayish brown (10YR 4/2, moist) fine sandy loam; friable; weak medium platy structure; about 5% stones by volume; pH about 6.5; about 2% organic matter.

10–13″ B_{21}
Brown (7.5YR 5/4, moist) light very fine sandy clay loam; friable; weak fine blocky structure; 25% stones by volume; pH about 5.5; about 1% organic matter.

13–18″ B_{22}

Brown (7.5YR 5/4–4/4, moist) gravelly light sandy clay loam; friable; moderately developed fine blocky structure; about 30% by volume of stones; pH about 5.5; about 0.5% organic matter.

18–38″ B_{23}

Reddish brown above to brown below (5YR and 7.5YR 4/4, moist) gravelly sandy clay loam above and gravelly sandy clay below; slightly plastic; moderate to weak medium subangular blocky structure; about 30–40% stones by volume; pH 7.5 above to 8.5 below; about 0.8% organic matter.

38–42″ C_1

Yellowish brown (10YR 5/4, moist) gravelly heavy sandy loam; friable; massive; 40% stones by volume; dolomitic; about 0.1% organic matter.

Type location: Lapeer County, Michigan. Series proposed: Lapeer County, Michigan, 1954. Source of name: County name, Lapeer County, Michigan.

LORENZO SERIES (No. 14 on the soil map)

The Lorenzo series includes soils developed from stratified calcareous or dolomitic outwash gravel and sand, with or without a thin (10–24″) covering of silty material. These soils are well to excessively drained or aerated, and formed under prairie vegetation. They are classified in the Brunizem (prairie) great soil group. The subsoil (B horizon) begins at a depth of 6 to 12 inches and continues downward about 10 inches, with a maximum clay content of about 30 percent. The surface soil (A horizon) contains about 10 percent clay. Slopes are 0–12 percent. The Lorenzo is the best drained member of the Lorenzo-Will catena. These soils are associated with the Wea (Brunizem), Longlois (transitional), Ockley (Gray-Brown Podzolic), Warsaw, Fox, and Casco soils. The Casco differs from the Lorenzo only in the A horizon, as effected by the native vegetation. The following description of the Lorenzo loam was made in the SE ¼ NE ¼ Sec. 4, T. 7 N., R. 18 E., Waukesha County, Wisconsin.

0–5″ A_1

Black (10YR 2/1, moist) loam; friable; weak fine granular structure; pH 7.0; about 6% organic matter.

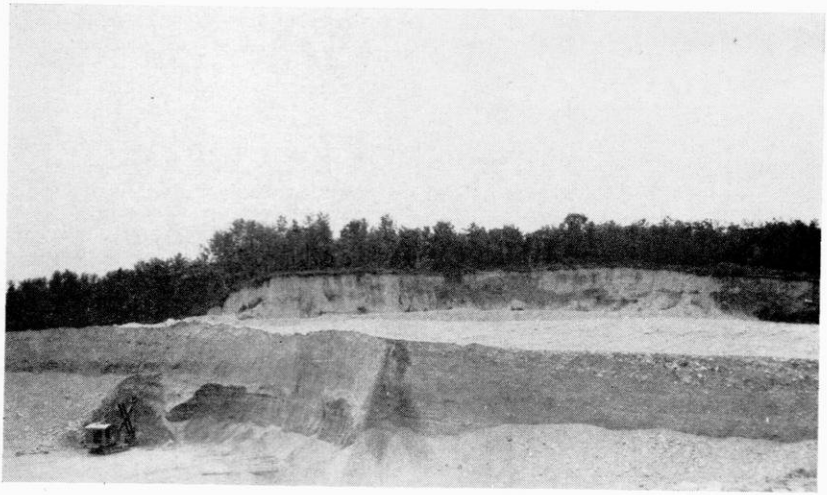


Figure 25. At this gravel pit in eastern Waukesha County, a large body of gravel has been uncovered beneath about 20 feet of glacial till, which in turn is capped with about two feet of silty material. Miami and Dodge soils are mapped in the forest beyond the pit.

5–14″ B

Dark brown (7.5YR 3/2, moist) sandy clay loam above to clay loam below; plastic; moderately developed fine subangular blocky structure; 50% by volume of stones in the lower part; pH 7.5 above to 8.5 below; about 3% organic matter.

14–20″ C

Yellowish brown (10YR 5/6, moist) coarse sand and gravel; loose; stratified; dolomitic; about 0.1% organic matter.

Type location: Will County, Illinois. Series proposed: Will County, Illinois, 1951. Source of name: Town in Will County, Illinois.

MADE LAND

Made land is a term used for areas disturbed by man's activities, either in removing or depositing soil and rock debris. Some 80 gravel pits (see Figure 25) and quarries are shown on the soil map, which is indicative of the activity in the county in removing soil and underlying materials. There are corresponding over-burdens being laid down over soils in and near cities. In some places, large earth-moving machinery is used to carry on land forming operations which greatly alter the arrangement of soil materials. Subdivision of land into lots for residences is proceeding at a rapid pace.

MAUMEE SERIES (No. 25 on the soil map)

The Maumee series includes soils developed from calcareous or dolomitic sands on glacio-fluvial and glacio-lacustrine plains. Drainage has been very poor and vegetation was apparently both hardwood trees and sedges and grasses. These soils are classified in the Humic-Gley great soil group. The subsoil (B_g or G horizon) begins at 10 to 20 inches and continues downward about 20 more inches, with a maximum clay content of about 8 percent. The surface soil ranges in texture from a loamy fine sand to a sandy loam, with a maximum clay content of about 12 percent. Calcareous or dolomitic material lies at a depth of 36 to 50 inches. Slopes are 0 to 2 percent in gradient. These soils are associated with Plainfield, Oshtemo and Hackett soils. The Dillon is a strongly to very strongly acid soil, which otherwise resembles Maumee. A profile description of the Maumee fine sandy loam is as follows:

0–10″ A_1

Black (10YR 2/1, moist) fine sandy loam; very friable; weak fine granular structure; pH 7.0; about 8% organic matter.

10–30″ B_g

Very dark gray and olive gray, slightly mottled with pale yellow (5Y 3/1, 5/2, 7/3, moist) fine sand; loose; single grain; pH 7.5; about 0.8% organic matter.

30–40″ C_{1g}

Gray mottled with light olive brown (5Y 5/1, 5/4, moist) fine sand; loose; single grain; dolomitic; about 0.1% organic matter.

Type location: SW 1/4 NW 1/4 Sec. 13, T. 29 N., R. 10 W., Newton County, Indiana. Series established: Porter County, Indiana, 1916. Source of name: Name of river in Lucas County, Ohio.

MATHERTON SERIES (Nos. 4 and 18 on the soil map)

As this bulletin goes to press, the series name Matherton, established in 1954 in Lapeer County, Michigan, is added. See the description for the deeper Homer. Matherton soils are underlain at 24 to 42 inches by calcareous or dolomitic gravel. The Matherton is the imperfectly drained member of the Fox catena. The type location is in Section 26, Almont Township, Lapeer County, Michigan. The name comes from a village in Ionia County, Michigan.

METEA SERIES (No. 20 on the soil map)

The Metea series includes soils developed from moderately deep (24–40 inches) sandy glacial drift over loam to sandy loam till. Drainage has been somewhat excessive, and vegetation was oak-hickory forest. These soils are classified in the Gray-Brown Podzolic great soil group. The subsoil (B horizon) begins at a depth of about 10 inches and continues downward one to three feet, with a maximum clay content of about 40 percent. The surface soil (A horizons) is a loamy sand to sandy loam, with a maximum clay content of about 12 percent. The till ranges from a sandy loam to a heavy loam with a maximum clay content of about 25 percent. Slopes range from 2 to 15 percent. These soils are associated with the Lapeer and Miami soils. An example of the Metea soil is found in the S. E. corner of Section 34, T. 6 N., R. 17 E., Waukesha County, Wisconsin.

$\frac{1}{2}$–0″ A_0
Decomposing leaf litter.

0–3″ A_1
Very dark gray (10YR 3/1, moist) loamy fine sand; friable to loose; very weak fine granular to single grain; pH 6.0; about 2% organic matter.

3–10″ A_2
Yellowish brown (10YR 5/4, moist) loamy fine sand; loose; single grain; pH 5.5; about 4.0% organic matter.

10–24″ B_1
Brownish yellow (YR 6/6, moist) loamy fine sand; loose; single grain; pH 5.8; about 0.2% organic matter.

24–41″ B_2–D_1
Yellowish brown (10YR 5/4, moist) sandy clay loam; somewhat plastic; moderately well developed medium to coarse subangular blocky structure; some weathered stones are present; pH 6.5; about 0.2% organic matter.

41–50″ C_1–D_2
Yellowish brown (10YR 5/4, moist) stony loam; friable; massive; dolomitic.

Type location: Fulton County, Indiana. Series established: Fulton County, Indiana, 1941. Source of name: Village in north central Cass County, Indiana.

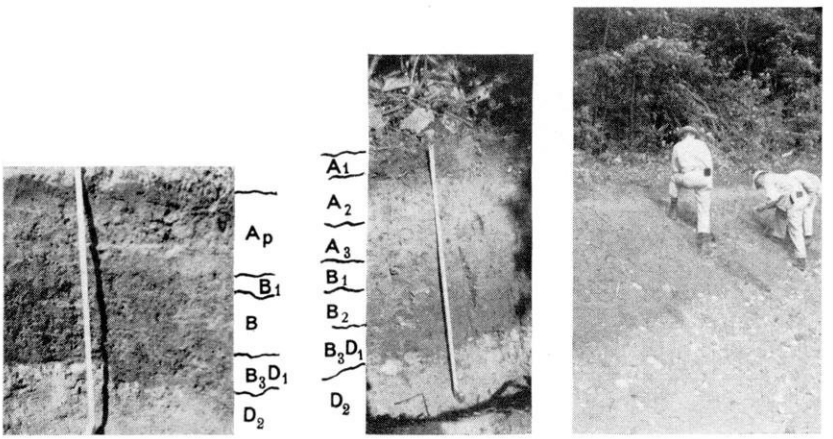


Figure 26. These views of Miami silt loam show: on the left, a profile in a cultivated field with a slope of 10 percent; in the center, a profile in a woods 125 feet from the cultivated profile; right, a road cut through a deciduous forest, showing the same silty soil resting at a depth of about two feet on stony dolomitic glacial till. Actual measurements indicated that the cultivated field has lost the A_1 and A_2 horizons (soil layers), and that the plow layer (A_p) is a mixture of the original A_3 and upper B_1. (Pictures by L. H. Gile, Jr. and F. D. Hole.)

MIAMI SERIES (Nos. 9, 11 and 16 on the soil map)

The Miami series includes soils developed on highly calcareous or dolomitic yellowish or grayish brown loam Wisconsin (Cary) glacial till of mixed lithology, with or without 18 inches (plus or minus 6 inches) or less of silty covering (loess). Drainage has been good (see Figures 10 and 26) and the natural vegetation was forest, either oak-hickory or maple. Soils with colors redder than 7.5YR are excluded. The Miami soils are classified in the Gray-Brown Podzolic great soil group. The dark A_1 of some soil bodies called Miami in Wisconsin indicates a transition toward the Prairie or Brunizem great soil group. The subsoil (B horizon) begins at a depth of about one foot and continues downward another 20 to 24 inches, with a maximum clay content (in the B_3) of about 37 percent. The surface soil (A horizons) is a silt loam or loam with a maximum clay content of about 15 percent. Slopes range from 2 to 25 percent. The C horizon, glacial till, is a loam in Waukesha County, with a maximum clay content of about 12 percent. Associated soils are the deeper Dodge and Dane, Calamus and Clyman, Elba, and the moderately deep Celina, Crosby, Kokomo. The following description is based on field notes by Dr. G. B. Lee and Mr. L. H. Gile, Jr., of the University of Wisconsin Soil Survey.

2–¼″ A_{00}
Layer of loose deciduous leaves, twigs, and bark.

¼–0″ A_0
Decomposed leaf litter.

0–3″ A_1
Very dark gray (10YR 3/1, moist) silt loam; friable; well developed fine granular structure; pH 6.4; about 8% organic matter.

3–9″ A_2
Brown (10YR 4/3, moist) silt loam; friable; moderately developed fine platy structure; pH 6.9; about 2% organic matter.

9–14″ A_3
Yellowish brown (10YR 5/4, moist) light silty clay loam; friable; moderately developed coarse platy to fine subangular blocky structure; pH 5.9; about 0.6% organic matter.

14–18″ B_1
Dark yellowish brown (10YR 4/4, moist) light silty clay loam; slightly firm; moderately developed fine to medium subangular blocky structure; pH 6.1; about 1% organic matter.

18–22″ B_{21}
Dark yellowish brown (10YR 4/4, moist) silty clay loam; firm; well developed medium to coarse blocky structure; in upper part, peds are slightly coated with gray; pH 5.9; about 0.4% organic matter.

22–30″ B_{22}–D_1
Dark brown (7.5YR 3/2–4/4, moist) heavy gritty clay loam; firm; well developed coarse angular blocky structure; some stones present; pH 5.7; about 0.3% organic matter.

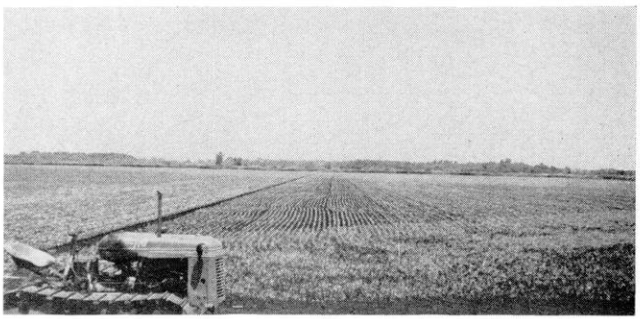
30–34″ B_3–D_2
Dark yellowish brown (10YR 3/4–4/4, moist) stony loam; friable; massive; contains some dolomitic fragments; pH 7.7; about 0.2% organic matter.

34–42″ D_3
Dark yellowish brown (10YR 4/4, moist) stony loam; friable; massive; dolomitic (36 to 45% $CaCO_3$-equivalent); about 0.1% organic matter.

Type location: SW ¼ Sec. 8, T. 15 N., R. 14 E. (Lewis Woods), Wayne County, Indiana. Series established: Montgomery County, Ohio, 1900. Source of name: Name of Miami River in western Ohio.

MORLEY SERIES (Nos. 12 and 13 on the soil map)

The Morley series (see Figure 4) includes soils developed from highly calcareous or dolomitic silty clay loam to clay loam glacial till of Wisconsin (Cary or Tazewell) age, with or without a silty covering (loess) 12 inches or less in thickness. Drainage or aeration has been moderately good and the vegetation was hardwood forest, oak-hickory or maple. These soils are classified in the Gray-Brown Podzolic great soil group. The subsoil (B horizon) begins at a depth of about 9 inches and continues downward 12 to 20 inches, with a maximum clay content of about 55 percent. The surface soil (A horizons) is usually a silt loam or silty clay loam, and the C horizon is a silty clay loam or clay loam. Both the A and C horizons have a maximum clay tent of about 30 percent. The dolomitic parent material is usually found at 24–27" in Waukesha County. Blocky structure continues down from the B into the C, which is not the case in the Miami soils. Slopes are 5 to 15 percent. A pink till phase (7.5YR 5/4, mottled with 4/4, 6/4, 6/2, 7/0, moist) of the Morley is present in



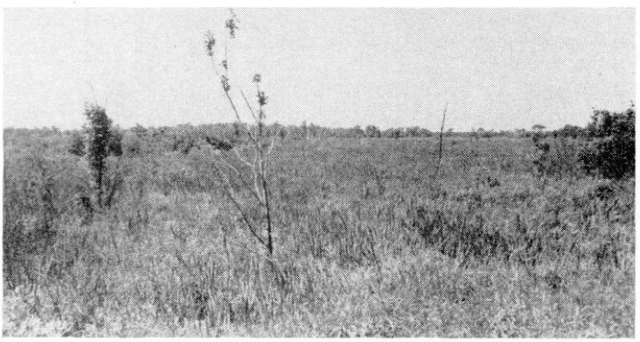


Figure 27. This is a Carlisle muck, with a one-inch marly sedimentary layer at a depth of about 3 feet, and a sandy substratum at 3½ feet. The lower view is of an undrained mucky peat, and the upper view is of a cultivated muck. Cultivation breaks up the organic fragments and transforms the peat into a finely divided muck. (See units Nos. 5 and 23 on the colored soil map.)

Waukesha County, as in the NE ¼ SW ¼ Sec. 13, T. 6 N., R. 20 E. There the B horizon is a reddish brown (5YR 4/3). Morley soils are associated with the Blount, Ashkum, and Elliott soils. In Illinois, the Varna soils are also associated.

A profile description of a Morley silt loam is as follows:

½–0″ A_{00} and A_0
Leaf litter and decomposing residue.

0–3″ A_1
Dark gray (10YR 4/1, moist) silt loam; friable; moderately developed medium granular structure; pH about 6.0; about 6% organic matter.

3–8″ A_2
Yellowish-brown (10YR 5/4, moist) silt loam; friable; weak fine to medium platy structure; pH about 5.8; about 2% organic matter.

8–10″ A_3
Brown (10YR 5/3, moist) heavy silt loam; slightly firm; weak coarse platy to fine subangular blocky structure; pH about 5.6; about 1% organic matter.

10–13″ B_1
Dark yellowish brown (10YR 4/4, moist) silty clay loam; firm; moderate fine subangular blocky structure; pH 5.5; about 0.8% organic matter.

13–20″ B_2
Yellowish brown, mottled (10YR 4/4, 5/6, moist) silty clay; plastic; well developed fine to medium subangular blocky structure; peds coated with dark grayish brown material (10YR 4/2, moist); pH 6.0.

20–26″ C_1
Grayish brown mottled with yellowish brown (10YR–2.5Y 5/2; 10YR 5/6, moist) silty clay loam; plastic; well developed fine angular blocky; peds coated with light brownish gray (10YR 6/2, moist) material; dolomitic (about 40% $CaCO_3$ equivalent); about 0.1% organic matter.

Type location: Will County, Illinois. Series established: Will County, Illinois, 1952. Source of name: Village in Will County, Illinois.

MUCK (Nos. 5 and 23 on the soil map)

See Carlisle series.

OCKLEY SERIES (No. 2 on the soil map)

The Ockley series includes soils formed from a silty covering 42 to 60 inches deep over calcareous or dolomitic stratified outwash of coarse sand and gravel. In Waukesha County, the deep covering material is silty, similar to that from which the Fox silt loam formed, but deeper. Drainage conditions have been good, and the native vegetation was hardwood forest, oak-hickory or maple. The subsoil (B horizon) begins at a depth of about 10 inches and continues downward 36 to 50 inches, with a maximum clay content of about 38 percent. The surface soil (A horizons) is a silt loam, with a maximum clay content of about 15 percent, and there may be present, below the B and above the D (gravel), a silt loam C horizon with about 28 percent of clay. Other members of the catena are the moderately well drained Bronson, the imperfectly drained Homer, and the very poorly drained Abington. Slopes are between 0 and 4 percent in grade. These soils are associated with the Brunizem Wea soils and the transitional Longlois. Ockley soils are also associated with the shallower Fox soils. A profile description of an Ockley silt loam is as follows:

0–3″ A_1
Very dark grayish brown (10YR 3/2, moist) silt loam; friable; weak medium to fine granular structure; pH 6.0; about 6% organic matter.

3–10″ A_2
Yellowish brown ((10YR 5/4, moist) silt loam; friable; weak fine platy structure; pH 5.8; about 2% organic matter.

10–15″ B_1
Dark yellowish-brown (10YR 4/4, moist) light silty clay loam; friable; weak fine subangular blocky structure; pH 5.8; about 1% organic matter.

15–36″ B_{21}
Dark brown (10YR 4/3, moist) silty clay loam; somewhat plastic; moderately developed fine subangular blocky structure; pH 5.5; about 0.6% organic matter.

36–48″ B_{22}
Dark brown (10YR 4/3, moist) silty clay loam; somewhat plastic or firm; moderately developed medium to coarse subangular blocky structure; pH 5.5; about 0.4% organic matter.

48–50″ B_{23}–D_1
Dark brown (7.5YR 4/2, moist) sandy clay loam; plastic; moderately developed medium subangular blocky structure; 50% by volume of stones; pH 7.5; about 0.8% organic matter.

50–56″ D_2
Yellowish brown (10YR–7.5YR 5/6, moist) coarse sand and gravel; loose; stratified; dolomitic; about 0.1% organic matter.

Type location: Tippecanoe County, Indiana. Series proposed: Tippecanoe County, Indiana, 1954. Source of name: Village in Carroll County, Indiana.

OSHTEMO SERIES (No. 19 on the soil map)

The Oshtemo series includes soils developed from calcareous or dolomitic stratified sand and gravel outwash, under excessive drainage or aeration conditions, and oak-hickory forest. These soils are classified in the Gray-Brown Podzolic great soil group. The subsoil (B horizon) begins at a depth of about one foot and continues downward 15 or 20 inches, with a maximum clay content of about 24 percent in the B_2, which is less than 10 inches thick, resting at 42 inches or more on calcareous sand and gravel. The surface soil (A horizons) ranges in texture from loamy sand to sandy loam, with a maximum clay content of about 12 percent. Slopes are between 0 and 12 percent in grade. These soils are associated with the Fox soils, which have more clayey B horizons, and the Plainfield and Hackett soils, which have little or no textural B horizons. The Boyer series is shallower, with calcareous sand and gravel at 24 to 42 inches. An Oshtemo sandy loam profile is described as follows:

1–0″ A_{00}, A_0
Leaf litter and decomposing residue.

0–3″ A_1
Very dark grayish brown (10YR 3/2, moist) sandy loam; very friable; weak fine granular structure to single grain; pH about 6.0; about 3% organic matter.

3–11″ A_2
Dark yellowish brown (10YR 4/4, moist) sandy loam; loose; single grain; pH 6.2; about 1% organic matter.

11–36″ B_1
Dark brown (7.5YR 4/4, moist) sandy loam; loose; very weak fine subangular blocky; pH 6.0; about 0.5% organic matter.

36–44″ B_2
Dark brown (7.5YR 4/4, moist) heavy sandy loam to light sandy clay loam; somewhat firm; weak fine subangular blocky structure; pH 6.5; about 0.3% organic matter.

44–50″ C
Brown (10YR 5/3–6/4, moist) fine sands and gravels; loose; single grain; stratified; dolomitic; about 0.1% organic matter.

Type location: Kalamazoo County, Michigan. Series established: Kalamazoo County, Michigan, 1922. Source of name: Village in Kalamazoo County, Michigan.

PARR SERIES (No. 10 on the soil map)

The Parr series includes soils developed from 24 to 36 inches of silty material (loess) overlying highly calcareous or dolomitic loam glacial till of Wisconsin (Cary) age. Drainage has been good and the original vegetative cover was prairie. These soils are classified in the Brunizem (prairie) great soil group. The subsoil (B horizon) begins at a depth of about 15 inches and continues downward 14 to 20 inches with a maximum clay content of about 40 percent. The surface soil (A horizons) have a clay content of about 15 percent. Slopes range from 5 to 15 percent in grade. These soils are associated with the deeper Waupun and the moderately well drained Corwin and somewhat poorly drained Bristol soils. A Parr silt loam profile is described as follows:

0–13″ A_1
Black (10YR 2/1, moist) silt loam; friable; well developed medium granular structure; pH 5.4; about 7% organic matter.

13–18″ A_3–B_1
Very dark gray (10YR 3/1, moist) heavy silt loam; well developed fine to medium platy structure above to medium subangular blocky structure below; pH 5.4; about 3% organic matter.

18–23″ B_{21}
Dark brown (10YR 3/3–4/3, moist) silty clay loam; firm; moderately developed fine subangular prismatic structure breaking into fine subangular blocks; peds are coated with dark brown (10YR 3/3, moist); pH 5.7; about 1% organic matter.

23–30″ B_{22}
Dark brown (10YR 4/3, moist) silty clay loam; firm; moderately developed fine prismatic structure, breaking down to medium subangular blocks; peds coated with dark brown (10YR 3/3, moist) material; about 5% by volume of stones in the lower portion; pH 5.5 above to 6.2 below; about 0.5% organic matter.

30–32″ B_3–D_1
Dark brown (7.5YR 4/2–4/4, moist) heavy sandy clay loam; sticky; weakly developed fine subangular blocky structure; 60% by volume of coarse fragments; pH 8.0; about 0.7% organic matter.

32–36″ D_2
Dark brown (10YR 4/3, moist) light stony loam; slightly hard; massive; 80% by volume of gravel, cobbles, stones, of which 95% are dolomitic stones; about 0.1% organic matter.

Type location: Green Lake County, Wisconsin. Series established: Green Lake County, Wisconsin, 1923. Source of name: Probably from the name of a village northwest of Rensselaer in Jasper County, Indiana.

PEAT (Nos. 5 and 23 on the soil map)

See Badoura peat.

PLAINFIELD SERIES (No. 19 on the soil map)

The Plainfield series includes soils formed from deep acid glacial outwash sands, under forest vegetation and excessive aeration or drainage conditions. These soils are classified variously in the Gray-Brown Podzolic and Regosol great soil groups. The entire soil profile consists of sand with a maximum clay content of about 3 percent. Slopes range from 1 to 3 percent in grade. These soils are associated with the slightly heavier and darker Gotham, the more alkaline Hackett, and the much darker Sparta, the wetter Nekoosa (moderately well drained), Morocco (somewhat poorly drained) and Newton (poorly drained). It is possible that detailed study of sandy soils on outwash plains of Waukesha County will show that Plainfield is quite limited in extent, and soils (Spinks) with calcareous C horizons are more typical of the area. The Coloma soil differs from the Plainfield in having a textural B horizon in the form of distinct bands ¼ to 8 inches thick of brown, somewhat coherent sand

at a depth of four to seven feet, with a maximum clay content of about 8 percent. The description of a Plainfield fine sand is as follows:

1–0″ A_0
Leaf litter, partially decomposed below.

0–2″ A_1
Very dark gray (10YR 3/1, moist) fine sand; loose; single grain; pH 6.0; about 1% organic matter.

2–46″ A_2
Grayish brown above to brownish yellow below (10YR 5/2, 6/6, moist) fine sand; loose; single grain; pH 5.8; about 0.4% organic matter.

46–72″ B
Yellowish brown (10YR 5/6, moist) loose fine sand; pH 5.7; about 0.2% organic matter.

72–80″ C
Brownish yellow (10YR 6/6, moist) fine sand; loose; single grain; pH 5.7; about 0.1% organic matter.

Type location: Muskegon County, Michigan. Series established: Waushara County, Wisconsin, 1909. Source of name: Village in Waushara County, Wisconsin.

RODMAN SERIES (No. 22 on the soil map)

The Rodman series (see Figure 2) includes soils developed from cross-bedded and irregularly sorted coarse calcareous or dolomitic outwash gravels of eskers, kames, and escarpments of outwash terraces. Native vegetation ranged from prairie to oak-hickory forest. Drainage or aeration has been excessive. These soils are variously classified in the Brown Forest, Rendzina, and Regosol great soil groups. In many Rodman soil profiles, no B horizon is present. Where present, the B is distinguished by little or no increase in clay content over that of the surface soil (A horizon), which ranges from 8 to 14 percent, but by a greater coherence and a slight increase in chroma, hue or both. Slopes range from 5 to 70 percent in grade. These soils are associated with the Casco and Fox soils. In the SE ¼ NE ¼ Sec. 5, T. 8 N., R. 20 E., this surveyor found on a hill crest a shallow regosol with a much finer textured surface soil than is characteristic of the Rodman: 9 inches of granular fine sandy clay loam (10YR 3/2, moist) containing 10 percent by volume of dolomitic gravel, underlain by 1 inch of granular to blocky medium sandy clay loam (7.5 YR 5/4, moist) containing 15 percent by volume of dolomitic stones, underlain by stony loam (10YR 5/4–6/4, moist) stony loam, containing 40 percent by volume of dolomitic stones. The following description of the Rodman gravelly sandy loam was made in the SW ¼ Sec. 26, T. 5 N., R. 17 E., Waukesha County, Wisconsin.

0–3″ A_{11}
Dark reddish brown (5YR 2/2, moist) gravelly sandy loam; very friable; weak fine granular structure; 40% by volume of stones; pH 7.5; about 4% organic matter.

3–6″ A_{12}
Dark reddish brown (5YR 3/2, moist) gravelly coarse sandy loam; very friable; very weak fine granular structure; 50% by volume of stones; pH 7.5; about 2% organic matter.

6–10″ B
Dark reddish brown (5YR 3/3–7.5YR 4/2, moist) gravelly coarse sandy loam; slightly cemented; loose; 60–70% by volume of stones; pH 8.0; about 0.1% organic matter.

10–15″ C
Brown (10YR 4/2–4/3, moist) gravel and sand; loose; 85% by volume of stones; highly dolomitic; about 0.1% organic matter.

Type location: Sheboygan County, Wisconsin. Series established: Jefferson County, New York, 1911. Source of name: Probably from the name of a village in Jefferson County, New York.

TUSCOLA SERIES (No. 8 on the soil map)

The Tuscola series includes soils developed from moderately dolomitic or calcareous glacio-lacustrine silts and very fine sands and pink clays, under forest (oak-hickory or maple) vegetation and conditions of good to moderately good drainage or aeration. These soils are classified in the Gray-Brown Podzolic great soil group. The subsoil (B horizon) begins at a depth of about one foot and continues downward another foot or two, with a maximum clay content of about 35 percent. It seems probable that much of the textural increase in the B is inherited from the parent material. The surface soil is usually a silt loam, with a clay content of about 15 percent. Slopes range between 0 and 3 percent. Beneath the B horizon are stratified materials ranging from about 7 to 30 percent in content of clay. Tuscola soils are associated with Shiocton (somewhat poorly drained) and the Keowns (poorly drained). As this bulletin goes to press, the Sisson series is proposed for well drained profiles and the Tuscola is restricted to moderately well drained profiles. The description below is of a Sisson, and was found in the SW ¼ NW ¼ NW ¼ Sec. 1, T. 7 N., R. 19 E., Waukesha Co., Wis.

1–0″ A_0
Decomposing forest litter.

0–3″ A_1
Very dark gray (10YR 3/1, moist) silt loam; friable; moderately developed medium granular structure; pH 6.5; about 6% organic matter.

3–12″ A_2
Brown (10YR 5/2–5/3, moist) silt loam; friable; moderately developed fine platy structure; pH 6.0; about 2% organic matter.

12–15″ B_1
Brown (10YR 5/3–4/3, moist) heavy silt loam; friable; weakly developed medium subangular blocky structure; pH 6.5; about 1% organic matter.

15–34″ B_2
Dark yellowish brown above to brown below (10YR 3/4, 5/3, moist) silty clay loam; firm; moderately developed medium to coarse subangular blocky structure; peds coated with dark grayish brown (10YR 4/2, moist); pH 6.5 to 5.5; about 0.4% organic matter.

34–53″ C_1
Brown (10YR 5/3, moist) stratified silt loam and fine sandy loam layers; friable; coarse subangular blocky structure to massive; pH 6.0 above to 8.0 below; about 0.2% organic matter.

53–60″ C_2
Yellowish brown (10YR 5/4, moist) stony fine sandy loam; friable; massive; dolomitic; about 0.1% organic matter.

Type location: Tuscola County, Michigan. Series proposed: Tuscola County, Michigan, 1926. Source of name: Tuscola County, Michigan.

WARSAW SERIES (Nos. 1, 6 and 14 on the soil map)

The Warsaw series includes soils formed from medium textured materials (silt loam, loam) 24 to 42 inches deep over calcareous or dolomitic coarse sands and gravels. Drainage or aeration has been somewhat excessive, and the native vegetation was prairie. These soils are classified in the Brunizem great soil group. The subsoil (B horizon) begins at a depth of about one foot and continues downward another 18 to 24 inches, with a maximum clay content of about 38 percent. The surface soil is a sandy loam, loam or silt loam, with a maximum clay content of about 15 percent. Slopes range between 1 and 3 percent in grade. Warsaw soils are considered as the prairie equivalents of the Fox soils. Warsaw soils are associated with the moderately well drained soil tentatively named Eagle. A profile description of a Warsaw loam is as follows:

0–8″ A_p
Black (10YR 2/1, moist) silt loam; friable; moderately developed fine granular structure; pH 6.5; about 5% organic matter.

8–12″ A_{12}
Very dark grayish brown (10YR 2/2, moist) silt loam; friable; moderately developed fine to medium granular structure; pH 6.0; about 3% organic matter.

12–15″ B_1
Dark grayish brown (10YR 4/2, moist) heavy silt loam; slightly firm; moderately developed fine to medium subangular blocky structure; pH 5.8; about 1% organic matter.

15–28″ B_{21}
Dark yellowish brown (10YR–7.5YR 3/4, moist) gravelly clay loam; firm; well developed medium, above, to coarse, below, angular blocky structure; weak to moderate fine prismatic structure, also; pH 5.8 above to 7.0 below; about 0.4% organic matter.

28–32″ B_{22}
Dark brown (7.5YR–10YR 3/4–3/2, moist) gravelly clay loam; firm; massive to weak coarse angular blocky structure; tongues penetrate downward into the substratum; pH 7.0–7.5; about 0.8% organic matter.

32–42″ C
Brown (10YR 5/3, moist) coarse sand and gravel; loose; stratified; dolomitic; about 0.1% organic matter.

Type location: Kosciusko County, Indiana. Series established: Kosciusko County, Indiana, 1922. Source of name: County seat of Kosciusko County, Indiana.

WEA SERIES (No. 1 on the soil map)

The Wea series includes soils developed from moderately deep (24–36″) silty material on leached clay loam to sandy or gravelly clay loam, resting at 42 to 66 inches on calcareous or dolomitic coarse sand and gravel glacial outwash of Wisconsin (Cary) age. Drainage or aeration conditions have been good, and the native vegetation was prairie. These soils are classified in the Brunizem (Prairie) great soil group. The subsoil (B horizon) begins at a depth of about one foot, and continues downward two to four and a half feet, with a maximum clay content of about 35 percent. The surface soil (A horizons) is a silt loam, with a clay content of about 15 percent. Slopes range from 0 to 2% in grade. These soils are associated with the light colored Ockley soils (Gray-Brown Podzolic), the transitional Longlois series, and the shallower less acid Watsaw soils. The Waukegan solum is thinner over leached sands at 27″ which in turn overlie calcareous gravels. The following profile description was made in the SW ¼ NW ¼ Sec. 15, T. 7 N., R. 17 E., Waukesha Co., Wis.

0–8″ A_p
Black (10YR 2/1–3/1, moist) silt loam, with light colored sand grains visible; friable; moderately developed coarse subangular blocky structure; pH 7.0; about 5% organic matter.

8–16″ A_3
Very dark brown (10YR 2/2–3/2, moist) silt loam; friable; medium to coarse blocky structure; pH 6.5; about 3% organic matter.

16–23″ B_1
Dark brown (10YR 3/3, moist) light silty clay loam; friable; weak fine medium subangular blocky structure; pH 6.0; about 1% organic matter.

23–39″ B_{21}
Dark yellowish brown (10YR 3/4, moist) clay loam; hard when dry, slightly plastic when wet; weak medium subangular blocky structure; pH 5.4; about 0.4% organic matter.

39–42″ B_{22}
Dark brown (7.5YR 3/4, moist) gravelly clay loam; hard; weak medium subangular blocky structure; dolomitic; about 0.6% organic matter.

42–60" D
Brown (10YR 4/3–5/3, moist) sand and gravel; loose; stratified; single grain; dolomitic; about 0.1% organic matter.

Type location: Sec. 5, T. 22 N., R. 5 W., Tippecanoe County, Ind. Series established: Tippecanoe County, Indiana, 1955. Source of name: Township in Tippecanoe County, Indiana.

VII. "SOIL COMMUNITY" DESCRIPTIONS

On the preceding pages, some major soils of Waukesha County have been described in considerable detail. However, on the introductory soil map, "soil communities" (soil associations) are shown, rather than individual soil bodies. Soil bodies are shown only on the field sheets of the Soil Conservation Service (see Figure 5). A soil community consists of soil bodies representing usually less than a dozen soil types. These soil bodies occur in a typical repeating pattern within the landscape. For example, soil community number 11 on the soil map is one of "rolling light brown silt loams, shallow to moderately deep", with the Miami and Dodge soils dominant. Other soils in the landscape are the deeper Dane and the moderately well drained or aerated Calamus. The shallower soils (Miami) usually occur on narrow ridge crests or on steeper slopes of broad-topped hills. Dodge and Dane are found on less steep areas. The Calamus soils lie on foot slopes, or on nearly level hill tops. These same soils are found both on ground moraine and drumlin land forms. The drumlin land form is the more easily strip-cropped and contour farmed, because the soil bodies are larger, longer, and are oriented in parallel arrangement. Some depressional soil communities of the county have been subdivided on the introductory soil map on the basis of improved management and unimproved management, as estimated by stereoscopic inspection of the aerial photographs. For example, soil community number 3 includes the drained phases of the Ashkum series, while soil community number 17 includes undrained phases. These two subdivisions are in many instances situated side by side. The Ashkum community includes other soil conditions, such as the wetter Peotone, and overwash phases of the Ashkum.

Some outwash terrace landscapes are subdivided on the basis of texture or color of surface soil. In this way, soil communities 14 and 15 may occur side by side, the former being composed of dark colored prairie soils, and the latter of light colored soils which were formerly timbered. Soil communities 15 and 19 may be adjacent, differing in proportion of sand in the soil profiles.

Soil communities numbered 3, 6, 7, 10, 15, 17, and 25 are labeled with one soil series name, only, although other soils are included to a limited extent.

The legend of the introductory soil map is set up on the basis of estimated general agricultural productivity ratings for each soil community. Because of this soil productivity bias, the artificially drained and undrained soils are separated in the legend, as are different types of the same series. Within each general soil productivity class, the soil communities are arranged on the basis of physiography and parent materials.

The following table lists the soil communities in the order of decreasing proportionate extents.

TABLE VI. PROPORTIONATE EXTENTS OF SOIL MAP UNITS, WAUKESHA COUNTY, WISCONSIN, 1956

Map Number	Soil Map Unit	Approximate Proportionate Extent	
		In Acres	Percent of Land Area
16	Hilly loams (Lapeer, Miami)	44,314	12.4
12	Gently rolling light brown silt loams over pinkish silty clay (Blount, Morley)	41,204	11.6
22	Hilly gravelly loams (Rodman, Casco, Fox)	40,466	11.4
4	Level dark silt loams (Abington, Elba, Clyman, Homer, Matherton, Keowns, Kokomo, drained phases)	34,161	9.6
11	Rolling light brown silt loams, shallow to moderately deep (Miami, Dodge)	26,669	7.5
2	Level light brown silt loams (Fox, Ockley)	24,197	6.8
18	Level dark silt loams, wet (Abington, Elba, Clyman, Homer, Matherton, Keowns, Kokomo, undrained)	21,350	6.0
9	Rolling light brown silt loams, moderately deep (Dodge, Miami, Calamus)	18,148	5.1
23	Level dark brown organic soils, wet (Peats and mucks, undrained)	17,792	5.0
7	Level light brown loam over gravel (Fox)	15,301	4.3
6	Level dark loam over gravel (Warsaw)	13,166	3.7
3	Level black silty clay loams (Ashkum drained phase)	11,387	3.2
5	Level dark brown organic soils (Peats and mucks, drained phases)	9,964	2.8
21	Rolling gravelly loams (Lapeer, Casco, Fox)	7,473	2.1
8	Level light brown loams over limestone (Lannon, Casco, Tuscola)	7,117	2.0
19	Level light brown sands and loamy sands (Plainfield, Hackett, Oshtemo)	5,693	1.6
15	Level light brown sandy loams (Fox)	3,203	0.9
13	Gently rolling dark silty clay loams and silt loams over gray silty clay (Beecher, Morley, Blount)	2,847	0.8
25	Wet black sands (Maumee)	2,491	0.7
24	Wet alluvium (Alluvial soils, undifferentiated, undrained)	2,491	0.7
20	Rolling loamy sands and sandy loams (Lapeer, Metea)	2,135	0.6
14	Level dark sandy and gravelly loams (Warsaw, Lorenzo)	1,423	0.4
1	Level dark silt loams (Warsaw, Wea)	1,068	0.3
10	Rolling dark silt loams, moderately deep (Parr)	712	0.2
17	Level black silty clay loams, wet (Ashkum, undrained)	712	0.2
		355,484	99.9
	Gravel pits and quarries	356	0.1
	(Water 12,380 acres, 3.4%)	355,840 a.	100.0

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The first soil survey of Waukesha County, Wisconsin, was made in 1910 and published in 1912 by the U. S. Bureau of Soils (10), and in 1914 by the Soil Survey Division of the Wisconsin Geological and Natural History Survey (38). The map was in color and was at a scale of 1 inch equals 1 mile. The supply of copies of the 1912 and 1914 editions has been exhausted for several years. The Soil Survey Division at the University undertook production of a new map and report in 1954, and the County Board contributed financially to the drafting and printing of the map. The U. S. Agricultural Stabilization and Conservation Office at Madison, Wisconsin, made available aerial photographs of the county. Soil maps of scattered farms, prepared by Mssrs. Joseph Steingraeber and Bruce Watson, Soil Scientists of the U. S. Soil Conservation Service, were generalized and incorporated into the map. Field work by F. D. Hole, of the University Soil Survey Division, was carried on in the summers of 1954 and 1955 in Waukesha County. Mr. William DeYoung, State Soil Scientist of the S. C. S., reviewed the mapping in the field in 1955. Mr. Randall D. Sale, University Cartographer with the Soil Survey Division, made field checks on the road network in 1955, and prepared the map, using the scriving method, in consultation with Mr. Kenneth Crook, Cartographer of the U. S. Soil Conservation Service in Beltsville, Maryland. Mssrs. Andrew F. Burghardt and Clifford M. Stamper, Cartographers with the University Soil Survey Division, also worked on the map and on the illustrations for the report. The manuscript was written by F. D. Hole and reviewed by G. B. Lee of the University Soil Survey Division, State Geologist George F. Hanson, Chairman O. J. Attoe of the Soils Department of the College of Agriculture, Assistant Director R. J. Muckenhirn of the Agricultural Experiment Station, Mssrs. J. K. Ableiter and A. H. Paschall, Regional Correlators, and Mssrs. William DeYoung and A. J. Klingelhoets, State Soil Scientists, and Mssrs. J. Steingraeber and Bruce Watson, of the Soil Conservation Service, and Mr. George Dehnert, County Agricultural Agent, Waukesha County. Professor W. M. Haas of Michigan College of Mining and Technology contributed to the chapter on soil ratings for engineering uses. W. H. Negley, University Editor, checked the manuscript for transmittal to the printer. It can thus be seen that the present introductory soil map and report are the products of the cooperative effort of a number of agencies and individuals. This is a reconnaissance or introductory soil survey, according to current standards, with a map scale of one inch equals one mile.

INTRODUCTORY SOIL MAP OF WAUKESHA COUNTY, WISCONSIN

THE SOIL SURVEY DIVISION, WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY. UNIVERSITY OF WISCONSIN

G. F. HANSON, STATE GEOLOGIST

LEGEND

FIRST CLASS SOILS *GOOD FARM LAND*

FLATS *(Drainage good)*

1 Level dark silt loams *(WARSAW and WEA)*

2 Level light brown silt loams *(FOX, OCKLEY)*

LOWLANDS *(Now artificially drained)*

3 Level black silty clay loams *(ASHKUM, drained phase)*

4 Level dark silt loams *(ABINGTON, ELBA, CLYMAN, HOMER, KEOWNS, KOKOMO, drained phases)*

5 Level dark brown organic soils *(Peats and mucks, drained phases, CARLISLE, BADOURA)*

SECOND CLASS SOILS *GOOD to FAIR FARM LAND*

FLATS *(Drainage good)*

6 Level dark loam over gravel *(WARSAW)*

7 Level light brown loam over gravel *(FOX)*

8 Level light brown loams over limestone *(LANNON, CASCO, TUSCOLA)*

UPLANDS *(Drainage good to fair)*

9 Rolling light brown silt loams, moderately deep *(DODGE, MIAMI, CALAMUS)*

10 Rolling dark silt loams, moderately deep *(PARR)*

11 Rolling light brown silt loams, shallow to moderately deep *(MIAMI, DODGE)*

12 Gently rolling light brown silt loams over pink silty clay *(BLOUNT, MORLEY)*

13 Gently rolling dark silty clay loams and silt loams over gray silty clay *(BEECHER, MORLEY, BLOUNT)*

THIRD CLASS SOILS *FAIR FARM LAND*

FLATS *(Drainage good)*

14 Level dark sandy and gravelly loams *(WARSAW, LORENZO)*

15 Level light brown sandy loams *(FOX)*

UPLANDS *(Drainage good)*

16 Hilly loams *(LAPEER, MIAMI)*

FOURTH CLASS SOILS *POOR FARM LAND*

LOWLANDS *(Drainage poor)*

17 Level black silty clay loams, wet *(ASHKUM, undrained)*

18 Level dark silt loams, wet *(ABINGTON, ELBA, CLYMAN, HOMER, KEOWNS, KOKOMO, undrained)*

FLATS *(Drainage good)*

19 Level light brown sands and loamy sands *(PLAINFIELD, HACKETT, OSHTEMO)*

UPLANDS *(Drainage good)*

20 Rolling loamy sands and sandy loams *(LAPEER, METEA)*

21 Rolling gravelly loams *(LAPEER, CASCO, FOX)*

22 Hilly gravelly loams *(RODMAN, CASCO, FOX)*

FIFTH CLASS SOILS *PASTURE or FOREST*

LOWLANDS *(Drainage poor)*

23 Level dark brown organic soils, wet *(Peats and mucks, undrained)*

24 Wet alluvium *(Alluvial soils, undifferentiated, undrained)*

25 Wet black sands *(MAUMEE)*

MAP SIGNS

County boundary

Town line

Section line

Railroad

Gravel pit or quarry

Permanent stream

Lake

Soil boundary

Steep slopes

Natural pit ("kettle")

Roads and Highways

U.S. highway

State highway

County highway

City road

SCALE IN MILES

0 1 2 3 4 5

RECONNAISSANCE SOIL SURVEY 1954-55 BY THE SOIL SURVEY DIVISION, WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY. BODIES OF WATER AND ROAD NETWORK DELINEATED FROM AERIAL PHOTOGRAPHS FROM THE A.S.C. OF THE U.S.D.A. SOILS DATA SUPPLIED ALSO BY J. STEINGRABER, SOIL SCIENTIST, AND OTHERS OF THE S.C.S., U.S.D.A. SOME DATA ADAPTED FROM SOIL MAP, 1910, OF A. R. WHITSON AND W. J. GEIB, SOIL SURVEY DIVISION, UNIVERSITY OF WISCONSIN. RECONNAISSANCE SOIL SURVEY INSPECTED, 1954, BY WILLIAM DE YOUNG, U.S. SOIL CONSERVATION SERVICE. PUBLICATION BY THE SOIL SURVEY DIVISION, WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY, AND IN PART SUPPORTED BY THE WAUKESHA COUNTY AGRICULTURAL BOARD. SURVEY IN COOPERATION WITH THE SOILS DEPARTMENT, COLLEGE OF AGRICULTURE, UNIVERSITY OF WISCONSIN.

Map compilation by A. A. Peckham and F. D. Hole, 1954. Cartography by R. D. Sale, A. F. Burghardt, and C. M. Stamper.

LITHOGRAPHED BY METZEL BROTHERS MILWAUKEE

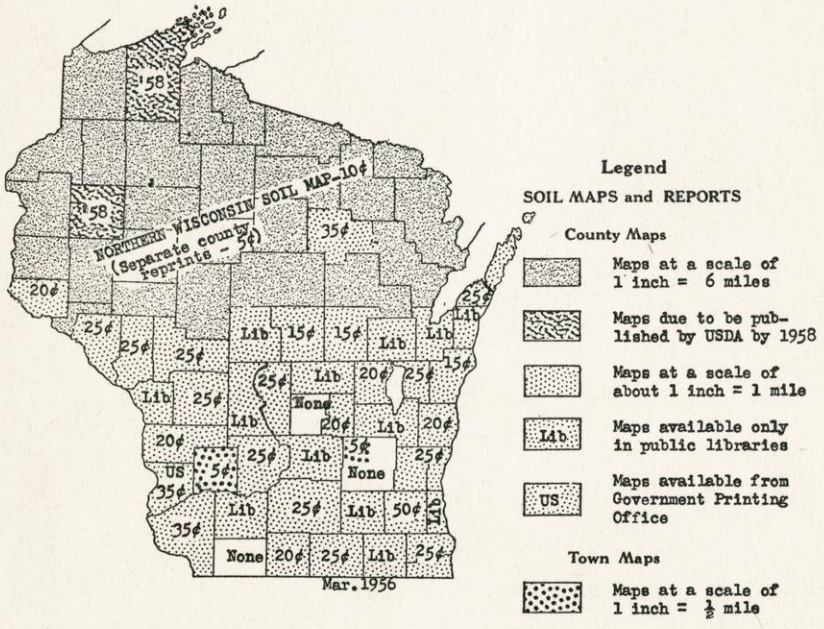
WISCONSIN SOIL MAPS AND REPORTS

------Leaflet colored soil map (state)----------Free

------Technical bulletin on "Preliminary Study of the Profiles of the Principal Soil Types of Wisconsin" 25¢

------Introduction to the soils of Wisconsin -------- 10¢

------What's in that soil map? ---------- 5¢



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