SOILS OF HOWARD COUNTY

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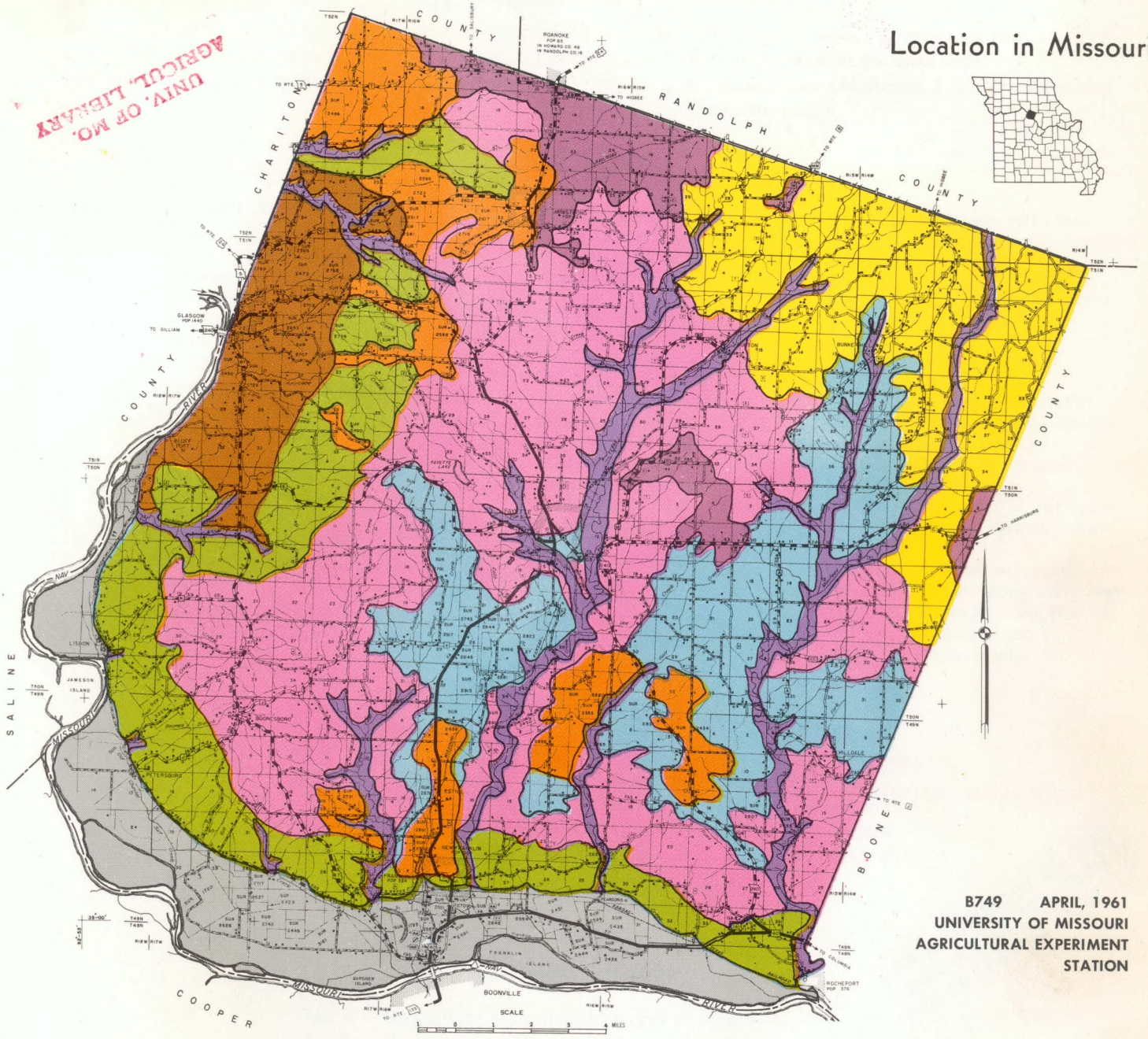


B749 APRIL, 1961
UNIVERSITY OF MISSOURI
AGRICULTURAL EXPERIMENT
STATION

MAJOR SOIL AREAS - SOIL ASSOCIATIONS

Dark Colored Upland Soils

- Knox-Marshall (See page 10)
- Marshall-Sharpsburg-Grundy-Gara (See page 11)
- Grundy-Seymour-Mexico-Gara (See page 12)
- Gara-Ladoga-Pershing (See page 13)

Light Colored Upland Soils

- Menfro-Lindley (See page 14)
- Winfield-Weldon-Lindley-Mandeville (See page 14)
- Lindley-Hatton-Mandeville (See page 16)

Bottomland Soils

- Sarpy-Onawa-Wabash (Missouri River)
- Nodaway-Westerville-Humeston (Creeks)

A Detailed Soils Map—Locate Your Farm—Identify Soil, Slope and Erosion.

(ATTACH PHOTO-MAP HERE)

CONVENTIONAL SIGNS AND SYMBOLS

ROADS
- Paved
- Gravel
- Dirt
- Private

RAILROAD

PIPELINE

STORE

HOUSE

SCHOOL

CHURCH

CEMETERY

STREAMS
- Large Perennial
- Small Perennial
- Large Intermittent
- Small Intermittent

GULLIES
- Large
- Small

SECTION CORNER

POND OR LAKE

MINE OR QUARRY

LEVEE

ROCK OUTCROP

HOW TO READ NUMBER SYMBOLS ON PHOTO MAP

Each mapping unit delineated on the photo-map contains a symbol, consisting of three numbers. The first number indicates the soil type; the second, the average slope; the third, the erosion class or the average depth of the surface soil. The symbol may be in the form of an equation, (Ex. 41-7-2) or it may be in the following form:

41 = Soil type number (Winfield silt loam)
7 = Average slope of the land (7%)
2 = Erosion class (Moderate, 2 to 6 inches surface soil remaining)

Soil Types

SMALL CREEK BOTTOMLANDS

1. . . . .Moniteau silt loam
2. . . . .Westerville silt loam
3, 4 . . .Nodaway silt loam-loam
6. . . . .Wabash silt loam
7. . . . .Chequest silt loam
8,29,27 .Carlow silty clay
9. . . . .Salt spots

MISSOURI RIVER BOTTOMLANDS

10. . . . .Haynie silt loam
11. . . . .Sarpy loamy fine sand
12. . . . .Sarpy sand
13. . . . .Salix clay loam
14. . . . .Onawa clay loam-si. cl.
15. . . . .Onawa silty clay
16. . . . .Wabash silty clay loam
17. . . . .Wabash clay
19. . . . .Riverwash

TERRACES OR HIGH BOTTOMS

20. . . . .Moniteau silt loam
21. . . . .Freeburg silt loam
23. . . . .Chariton silt loam
24. . . . .Blockton silt loam
25. . . . .Napier silt loam

DARK COLORED, LOESS DERIVED UPLANDS

30. . . . .Knox silt loam
31,32 . . .Marshall silt loam
33. . . . .Sharpsburg silt loam
34,71. . .Grundy silt loam
35. . . . .Seymour silt loam
36. . . . .Mexico silt loam
37. . . . .Edina silt loam
38. . . . .Ladoga silt loam
39. . . . .Pershing silt loam

LIGHT COLORED, LOESS DERIVED UPLANDS

40. . . . .Menfro silt loam
41,47 . . .Winfield silt loam
42. . . . .Weldon silt loam
43. . . . .Hatton silt loam
44. . . . .Whitson silt loam
45. . . . .Steinmetz silt loam
46. . . . .Marion silt loam

SOILS FROM GLACIAL TILL, LIMESTONE OR SHALE

50,55 . . .Lindley loam
51. . . . .Sapp silt loam
52. . . . .Gara loam
54. . . . .Lagonda silt loam
56. . . . .Bewleyville - Baxter silt loams
57. . . . .Steep stony land
58. . . . .Unnamed
60,67 . . .Mandeville silt loam
61. . . . .Gosport stony loam
62,63, 66,68 . . .Lacona silt loam
65. . . . .Snead stony silty clay
71. . . . .Grundy - See No. 34
73. . . . .Gullied land
80. . . . .Strip mines

Slope Classes

Ave. Slope	Range	Ave. Slope	Range
1.	0 to 2% slopes	12.	10 to 15% slopes
3.	2 to 5% slopes	20.	15 to 25% slopes
7.	5 to 10% slopes	30.	25 to 35% slopes

50. . . . .Over 35% slopes

FOR A SUMMARY OF SOIL CHARACTERISTICS, TURN TO THE NEXT PAGE

Erosion Classes

Class 0. . .Deposition; More than 10 inches of topsoil
Class 1. . .Slight erosion; Over 6 inches surface remaining
Class 2. . .Moderate erosion; 2 to 6 inches surface remaining
Class 3. . .Severe erosion; Subsoil exposed, small gullies
Class 4. . .Very severe erosion; Badly gullied, cultivation difficult

Section, Township, and Range Numbers

Near the center of each section will be found a large numeral which represents the section number. The range number is found in the top margin of the area on which lines were drawn. An example is R12W which is read as range 12 west. The township number is found in the right hand margin of the area on which lines were drawn. An example is T49N which is read as township 49 north.

IMPORTANT FEATURES OF EACH SOIL

First, determine your soil's number and name from the photo-map

		PHYSICAL			SUBSOIL CHEMICAL FEATURES (15-30 in.)				
Soil Number	Soil Name	Surface Color and Texture	Subsoil Color and Texture	Subsoil Aeration	Available Water Storage (in/3 ft. soil)	Organic Matter (%)	P_2O_5 (lbs/A7")	Exchange Capacity (me/100 g)	Base Saturation (%)
			Soils of the Small Creek Bottomlands						
1	Moniteau	grayish brown silt loam	gray silty clay loam	poor	5	0.7	30	18	70
2	Westerville	brown silt loam	gray silt loam	moderate	7	1.3	50	18	90
3	Nodaway	brown silt loam	brown silt loam	good	7	1.3	200	14	100
4	Nodaway	brown silt loam	brown silt loam	good	7	1.0	200	14	90
6	Wabash	black silt loam	dark gray silty clay	moderate	5	2.8	140	30	90
7	Chequest	dark gray silt loam	dark gray silty clay loam	moderate	5	1.3	17	24	85
8,29,27	Carlow	dark gray silty clay	dark gray clay	poor	4	1.8	50	29	65
9	Saltspots	---	---	---	--	---	---	--	---
			Soils of the Missouri River Bottomlands						
10	Haynie	brown fine sandy loam	brown fine sandy loam	good	7	0.6	360	15	100
11	Sarpy	brown loamy sand	brown loamy sand	good	3	0.5	250	10	100
12	Sarpy	brown sand	brown sand	good	1	0.1	250	5	100
13	Salix	dark brown clay loam	brown clay loam	good	6	1.5	150	20	90
14	Onawa	dark gray clay loam	grayish brown sandy loam	moderate	6	1.5	300	25	100
15	Onawa	dark gray clay	grayish brown sandy loam	poor	4	1.2	350	30	100
16	Wabash	black silty clay loam	dark gray clay	poor	5	1.5	100	35	95
17	Wabash	black clay	dark gray clay	poor	3	1.5	100	35	95
19	Riverwash	---	---	---	---	---	---	---	---
			Soils of the Terraces or High Bottoms						
20	Moniteau	grayish brown silt loam	gray silty clay	poor	5	0.5	10	20	50
21	Freeburg	grayish brown silt loam	yellowish brown clay loam	moderate	6	0.8	10	20	70
23	Chariton	dark gray silt loam	dark gray silty clay	poor	6	1.5	30	30	75
24	Blockton	dark brown silt loam	dark gray silty clay	moderate	6	1.5	50	30	75
25	Napier	dark brown silt loam	dark brown silty clay loam	good	7	2.0	190	21	90
			Dark Colored Loess Derived Upland Soils						
30	Knox	dark brown silt loam	yellowish brown silt	good	7	1.0	200	17	85

			loam						
31,32	Marshall	dark brown silt loam	dark brown silty clay lo.	good	7	1.6	60	19	85
33	Sharpsburg	dark brown silt loam	mottled brown silty clay loam	good	6	1.6	40	25	80
34, 71	Grundy	dark brown silt loam	dark gray silty clay	moderate	6	1.5	30	30	75
35	Seymour	dark gray silt loam	dark gray silty clay	poor	5	1.5	20	33	70
36	Mexico	grayish brown silt loam	grayish brown clay	poor	5	1.3	10	35	65
37	Edina	dark gray silt loam	dark gray clay	poor	5	1.6	10	30	75
38	Ladoga	dark brown silt loam	mottled brown silty clay loam	good	6	1.3	40	24	70
39	Pershing	grayish brown silt loam	gray silty clay	moderate	6	1.2	30	27	65
			Light Colored Loess Derived Upland Soils						
40	Menfro	brown silt loam	brown silty clay loam	good	6	1.0	40	20	70
41,47	Winfield	brown silt loam	mottled brown silty clay loam	good	6	1.0	40	22	60
42	Weldon	gray-brown silt loam	mottled yellow-brown silty clay	moderate	5	1.0	30	24	55
43	Hatton	gray-brown silt loam	mottled yellow-brown silty clay	moderate	5	0.8	10	28	40
44	Whitson	gray-brown silt loam	gray silty clay	poor	6	0.5	30	18	45
45	Steinmetz	gray-brown silt loam	gray silty clay loam	poor	6	0.7	40	20	70
46	Marion	gray-brown silt loam	gray clay	poor	5	0.7	10	28	35
			Upland Soils Derived from Glacial Till, Limestone or Shale						
50,55	Lindley	brown loam	mottled brown sandy clay	moderate	4	0.5	30	25	45
51	Sapp	gray-brown silt loam	gray sandy clay	poor	4	0.7	30	25	45
52	Gara	dark brown loam	yellow-brown sandy clay	moderate	4	1.2	30	25	45
54	Lagonda	dark gray silt loam	dark gray silty clay	poor	4	1.5	220	35	60
56	Bewleyville-Baxter	brown silt loam	yellow-red silty clay	good	6	1.0	40	22	60
57	Stony land	brown stony silt loam	stony	---	3	---	---	--	---
58	Unnamed	dark brown silt loam	dark brown clay loam	good	6	1.0	50	20	70
60, 67	Mandeville	brown silt loam	brown silty clay	moderate	6	1.0	10	22	40
61	Gosport	stony loam	gray shales	---	3	1.0	10	12	30
62,63, 66,68	Lacona	brown silt loam	brown silty clay	moderate	5	1.2	10	25	75
65	Snead	black stony clay loam	stony clay	---	3	---	---	--	---
71	Grundy (See soil number 34)								
73	Gullied land								
80	Strip Mines								

HOW CAN THESE SOIL FEATURES BE INTERPRETED? TURN TO THE NEXT PAGE.

How to Interpret Soil Features Listed on the Preceding Page

For best growth of any plant the soil must furnish

(1) Sufficient soil air—Oxygen is needed for proper root functions and for chemical reactions involving nitrogen, sulfur, iron and manganese.

(2) Sufficient water—for plant growth, transpiration and for chemical reactions.

(3) Sufficient nourishment—in the form of calcium, magnesium, potassium, nitrogen, phosphorus, sulfur and trace elements.

The following paragraphs explain the interpretation of soil features listed in Table I in terms of these three requirements.

PHYSICAL FEATURES

Highly productive soils have both good subsoil aeration and a large available water storage capacity. Deficiency in either will reduce yields or will at least limit the kinds of crops which will produce well.

Subsoil Aeration

Good, moderate, and poor subsoil aeration describe the capacity of the soil to furnish oxygen throughout the year. That capacity is closely related to wetness of a soil because air and water together fill the soil pore space. If water fills all the pores, there is no space for air.

Poorly aerated soils are wet enough to prevent tillage and proper growth of many crops for a part of each growing season. This is especially true during the spring of the year. If possible, wheat, beans, or some other crop having a relatively low need for oxygen and not requiring tillage at this wettest season should be grown. Nitrogen released from organic matter will be only half that released from an equal amount of organic matter in well aerated soils. Extra nitrogen will be needed, perhaps as top dressing if wet periods are long.

Moderately aerated soils are wet for significant periods but are generally very good for corn, wheat, beans or clover. Their restricted aeration is noticeable only on special crops such as tobacco, alfalfa or fruit trees which are deep-rooting crops. Nitrogen release from organic matter will be about three-fourths that released from an equal amount of organic matter in a well aerated soil.

Soils with good aeration may be wet at times but the wetness does not normally interfere with oxygen supplying ability of the soil.

What can be done about aeration? In addition to adjustment of cropping systems, the following practices help improve aeration:

(1) Tillage—Attempt to increase pore space: plow deep, avoid puddling.

(2) Add organic residues—This promotes granulation and pore space.

(3) Surface drainage—Applicable only to nearly level areas.

(4) Diversion channels—Prevent accumulation of excess water from other areas.

Available Water Storage Capacity

This estimate indicates the inches of water which a soil can hold and release to growing plants in the upper 3 feet of soil. It should not be confused with total amount of water held because clays hold sizeable amounts of water so strongly that it is not available to plants.

Rapidly growing summer crops such as corn, beans, alfalfa, or pastures require about 0.2 inch of water per day. The number of days a completely moist soil will support rapidly growing plants without additional water can be calculated. For example, a 6-inch available water storage capacity means a corn crop would exhaust the soil water to a depth of 3 feet in $6 \div 0.2 = 30$ days.

A 6 or 7-inch estimate indicates a soil with little drouth problem most years. A 4 or 5-inch estimate indicates a borderline soil in which plants will suffer from some drouth about half of the seasons. A 3-inch or smaller estimate indicates that summer-growing plants will lack water for some periods nearly all years.

The climate of Howard County is such that all soils are drouthy in the years of lowest rainfall.

The estimate of available water storage capacity should be modified by considerations of position, slope and erosion. Bottomlands and other nearly level soils are able to furnish 10 to 20 percent more water because of more infiltration of summer rainfall. Steep slopes cause excessive runoff; the estimate in these locations should be reduced 10 to 20 percent. Eroded soils should have the estimate reduced by an amount depending upon the subsoil. With a silty surface and a clayey subsoil, a 12-inch loss of surface soil will reduce available water storage capacity 20 percent.

What Can Be Done About Water Supplies?

(1) Supplemental irrigation is most likely to be successfull in bottomland soils, especially sandy or silty ones which have good subsoil aeration.

(2) Adjustment of cropping systems to the moisture supply is an alternative. Wheat is a drouth-avoiding crop which matures before the usual July-August dry period. Sorghums are drouth-tolerant crops which can go long periods without rain.

(3) Planting rates adjusted to the estimated moisture supply increase the chances for success.
(4) Infiltration can be increased on sloping soils by terracing, returning of residues, and other practices which promote granulation of the surface soil.
(5) Prevent erosion. Surface soils retain more plant-available water than do subsoils.

SUBSOIL CHEMICAL FEATURES

Surface soil or "plow layer" chemistry is greatly influenced by management and fertilizer practices; it is assumed that farmers will continue to measure it by soil tests. Subsoil chemistry is changed less by man and is a measure of the natural fertility of the soil. It greatly affects growth of summer growing crops which are deep rooted. The drier the season, the deeper crops root and the greater is the effect of subsoil chemistry. Soils with low subsoil fertility levels must receive more complete surface fertilization than soils with high subsoil fertility levels.

Subsoil Organic Matter. Natural organic matter contents of soils are tremendous compared to organic matter added as residues. One tenth of one percent amounts to one ton of dry, humified organic matter per acre in each 7 inches of soil.

Organic matter promotes granulation, furnishes nitrogen upon decomposition and probably plays a role in making chemical elements more available to plants. The release of subsoil nitrogen alone can be a large factor, especially in well aerated soils or in all soils during dry periods. During such periods the surface is dry, air (oxygen) enters the subsoil and permits the release of subsoil nitrogen. Amounts are difficult to estimate because they depend upon both aeration and base saturation of the subsoil. As a guide it can be estimated that approximately 30 pounds of nitrogen per acre are released for each 1 percent of organic matter in the subsoil. This happens only when the subsoil becomes aerated.

Subsoil Phosphorus (Pounds P_2O_5 per Acre 7″). Amounts of subsoil phosphorus are low in most upland soils and high in some bottomland soils. Where subsoil phosphorus is plentiful, crops respond only to starter phosphorus fertilizer. Where subsoil phosphorus is low in amount, responses are noticed from all forms of phosphates.

Subsoil Phosphorus	*Response*
150 or more pounds	Only to starter phosphates
150 to 50 pounds	Some response to all forms of phosphate
50 pounds or less	Large responses to large amounts of phosphorus

Subsoil phosphorus is most important during dry periods or when perennial, deep rooting crops are grown.

Exchange capacity is a measure of the sum of amounts of four elements held by the soil. Three of those elements, calcium, magnesium, and potassium, are called bases. The fourth is hydrogen; the ions of which cause acidity in soils. The sum of all four is always the same in a single soil but amounts of any two or more of the four can vary. When leaching occurs or growing plants remove one of the bases, hydrogen replaces it.

Base saturation is the percentage of the exchange capacity used in holding bases. It is a measure of the fertility of the soil. The most fertile soils have nearly 100 percent base saturation in the subsoil. Additions of lime or potash to the surface are aimed at increasing the base saturation and decreasing hydrogen. The following interpretations are possible:

Subsoil Base Saturation (15-30 inches)	Interpretation
80% - 100% (High)	No plant growth limitations due to lack of subsoil fertility if the surface is properly fertilized.
60% - 80% (Medium)	Some limitations due to subsoil infertility even if surface is treated according to soil tests. Use deep plowing and fertilization to increase the depth of higher base saturation.
Less than 60% (Low)	Definite limitations if only the surface layer is considered in fertilization. Use deep plowing and frequent top dressing. Large amounts of fertilizer will be required if exchange capacity is high.

Estimated Average Acre Yields on Soils of Howard County

Under (A) Ordinary Management and (B) Good Management*

		UNERODED SOIL						ERODED**	
		Corn Bu.		Wheat Bu.		Alfalfa Tons		Corn Bu.	
No.	SOIL TYPE	A	B	A	B	A	B	A	B
1	Moniteau silt loam	20	50	5	20	1.0	2.7		
2	Westerville silt loam	40	65	15	30	2.5	3.8		
3	Nodaway silt loam - loam	50	80	20	35	3.5	4.5		
4	Nodaway silt loam - loam	45	80	17	35	3.0	4.5		
6	Wabash silt loam	45	70	20	35	3.0	3.7		
7	Chequest silt loam	40	65	15	30	1.8	3.3		
8,29,27	Carlow silty clay	15	45	10	20	1.4	2.3		
10	Haynie silt loam	50	80	20	35	3.5	4.5		
11	Sarpy loamy fine sand	35	55	15	24	2.0	3.2		
12	Sarpy sand	10	20	5	10	1.0	2.3		
13	Salix clay loam	60	85	22	35	3.5	4.3		
14	Onawa clay loam - silty clay	50	70	25	35	3.5	3.9		
15	Onawa silty clay	20	50	17	28	2.3	2.9		
16	Wabash silty clay loam	45	70	20	31	2.9	3.2		
17	Wabash clay	15	45	15	25	2.2	2.6		
20	Moniteau silt loam	20	50	5	20	.3	2.0		
21	Freeburg silt loam	30	60	10	25	.9	3.1		
23	Chariton silt loam	30	60	14	28	1.8	3.0		
24	Blockton silt loam	45	70	17	32	2.2	3.5		
25	Napier silt loam	60	80	25	35	3.9	4.5		
30	Knox silt loam	40	70	12	35	2.6	4.5	25	65
31, 32	Marshall silt loam	50	80	24	35	3.0	4.5	35	70
33	Sharpsburg silt loam	50	80	22	35	2.5	4.0	30	70
34, 71	Grundy silt loam	40	75	18	33	2.0	3.4	25	60
35	Seymour silt loam	35	65	14	30	1.5	2.6	20	50
36	Mexico silt loam	20	60	10	25	1.0	2.5	10	45
37	Edina silt loam	25	60	13	30	1.5	2.6	--	--
38	Ladoga silt loam	45	70	16	33	1.7	3.7	25	60
39	Pershing silt loam	25	60	13	30	1.4	2.8	10	45
40	Menfro silt loam	35	65	12	32	1.4	3.7	25	55
41, 47	Winfield silt loam	30	60	10	30	1.2	3.2	20	50
42	Weldon silt loam	20	55	8	25	.8	2.5	10	45
43	Hatton silt loam	15	40	5	15	.5	2.0	10	40
44	Whitson silt loam	20	50	5	20	.3	2.0	--	--
45	Steinmetz silt loam	20	50	8	20	.8	2.9	10	40
46	Marion silt loam	15	40	5	15	.3	1.6	--	--
50,55	Lindley loam	15	40	5	15	.3	1.9	10	35
51	Sapp silt loam	15	45	5	15	.3	1.5	10	35
52	Gara loam	25	60	7	25	.8	2.0	15	20
54	Lagonda silt loam	20	55	10	20	.8	2.0	15	45
56	Bewleyville-Baxter silt loam	20	50	10	20	1.0	3.0	10	45
58	Unnamed	35	70	13	30	1.5	3.7	20	55
60, 67	Mandeville silt loam	20	55	6	25	.6	2.1	10	40
62, 63, 66, 68	Lacona silt loam	25	60	12	25	1.2	3.1	15	50

*Ordinary management (A) does not provide adequate drainage or soil conserving practices. Lime and fertilizer are used irregularly or in insufficient amounts. Good management (B) includes drainage and soil conserving practices, the return of crop residues and the use of lime and fertilizer where needed.

**Yield estimates on eroded soils are for erosion class 2 in which 6 inches or less of surface soil remains.

The estimates above do not consider the fact that some soil areas slope too steeply to be farmed to the crops listed. Likewise not considered is the fact that good management implies considerably more treatment on some soils than on others. See the discussion of individual soils.

Soils of Small Creek Bottomlands

No. 1—Moniteau silt loam: Light gray, silty, poorly aerated bottomland soil with a low fertility level. This soil is normally wet in the spring but has a little less available water storage capacity than the associated Nodaway and Westerville soils. All fertilizer constituents are required. Grass, soybeans, or wheat can be grown more successfully than corn.

No. 2—Westerville silt loam: Brown, silty bottomland soil which has gray colors below 18 to 24 inches because of restricted aeration there. The soil is slightly acid but response is mainly to phosphorus and nitrogen. Corn grows well but yields are inferior to those on the associated Nodaway soils.

No. 3—Nodaway silt loam: Brown, deep, well aerated, fertile first bottom soil generally needing nitrogen only for high yields of all crops. Overflow from adjacent streams is the main hazard. Continuous corn can be grown without detrimental effects.

No. 4—Nodaway silt loam: Brown, deep, well aerated, fertile soil in the Missouri River bottomland and adjoining small creek bottoms. The erosive, loessial river hills have furnished most of the sediments. All crops grow well with nitrogen as the chief fertilizer material.

No. 6—Wabash silt loam: Dark colored, deep, fertile bottomland soil with restricted subsoil aeration. Corn, wheat, and beans grow very well.

No. 7—Chequest silt loam: Dark gray, moderately fertile bottomland soil with restricted subsoil aeration. Corn, wheat, and soybeans produce very well with additions of nitrogen and phosphorus. Wetness in the spring of the year is the main problem. Thus, surface drainage and diversion of hill water are important.

Nos. 8, 27, 29—Carlow silty clay: Dark gray, poorly drained, acid, clayey soil situated on high bottom position. Lime, phosphorus, and nitrogen are needed, along with provision for surface drainage. Grass, small grains, and soybeans produce better than corn.

Areas shown as No. 27 vary slightly in that a few salt spots are included and the soil is more dispersed and drouthy. No satisfactory method is known to correct the saltiness and dispersion of these high clay soils.

No. 9—Salt spots: These small spots are found where salts, leached out of upland soils, seep out onto bottomland areas. The high salt content prevents growth of most plants. This situation is difficult to correct. Provision of surface drainage is a must. If the soil is silty, tile to the drainage ditch will help remove the saltiness. If the tile work, then pumping salt free water over the surface will remove the excess salt.

Soils of Missouri River Bottomlands

No. 10—Haynie silt loam: Light colored, well aerated, fertile, and productive soil lacking only in organic matter and nitrogen. Continuous corn or similar cropping systems are possible. Supplemental irrigation of special crops is possible since this soil has a rapid intake rate, high available water capacity, and good aeration.

A few spots included in the areas are drouthy because of sand content.

No. 11—Sarpy loamy fine sand: Light colored, well aerated, fertile but slightly drouthy soil lacking only in nitrogen and organic matter. The drouthiness is caused by high sand and low clay content of the soil. Supplemental irrigation is possible but frequent applications will be necessary. Without irrigation, corn will often be damaged by dry weather. Alfalfa produces very well once the stand is established.

No. 12—Sarpy sand: Deep deposits of fresh sand. Fertility levels, except for nitrogen, are high but moisture holding capacity is very low. Much of this land is left idle. Irrigation is difficult because of the frequent need for water.

No. 13—Salix clay loam: Very dark brown, deep, well aerated, fertile, and productive high bottom soil. Overflow occurs only occasionally. This is a good soil in every respect. Nitrogen fertilizers and perhaps irrigation are the main possibilities for increasing yields. This soil has more clay than does the Sarpy fine sandy loam. This characteristic causes it to be a little less desirable than the Sarpy for irrigation.

No. 14—Onawa silty clay loam—silty clay: Dark colored, moderately aerated, fertile soil which has fine textures (clayey) to depths of from 12 to 30 inches. Below that depth, sandy lenses are found. The clayey surface plus the normal position of this soil in slightly depressional areas below sarpy soils make drainage a problem. Corn, wheat, and soybeans grow well. Nitrogen is the only fertilizer which consistently increases yield.

No. 15—Onawa silty clay: Dark gray, poorly aerated and poorly drained but fertile soil. It is similar to soil No. 14 but depth to sandy lenses is greater (24-48 inches) and the clay content of the surface is greater. This soil is often too wet for corn production. Soybeans and wheat produce more consistently.

No. 16—Wabash silty clay loam: Nearly black soil with high fertility levels but poor subsoil aeration and drainage. The surface is a silty clay loam which is well granulated. The subsoil is a dark gray, plastic clay. Corn yields are generally high but are less than on much of the Sarpy and Onawa soils. Wheat and soybeans grow very well.

No. 17—Wabash clay: Dark colored, fertile but poorly aerated and poorly drained soil. It is clay in texture to 4 feet or more. Surface drainage is necessary. Even with surface drainage, corn normally suffers from wetness. During dry periods the soil becomes drouthy much quicker than many of the less clayey soils. Wheat and soybeans grow very well.

No. 19—Riverwash: Missouri River sandbars.

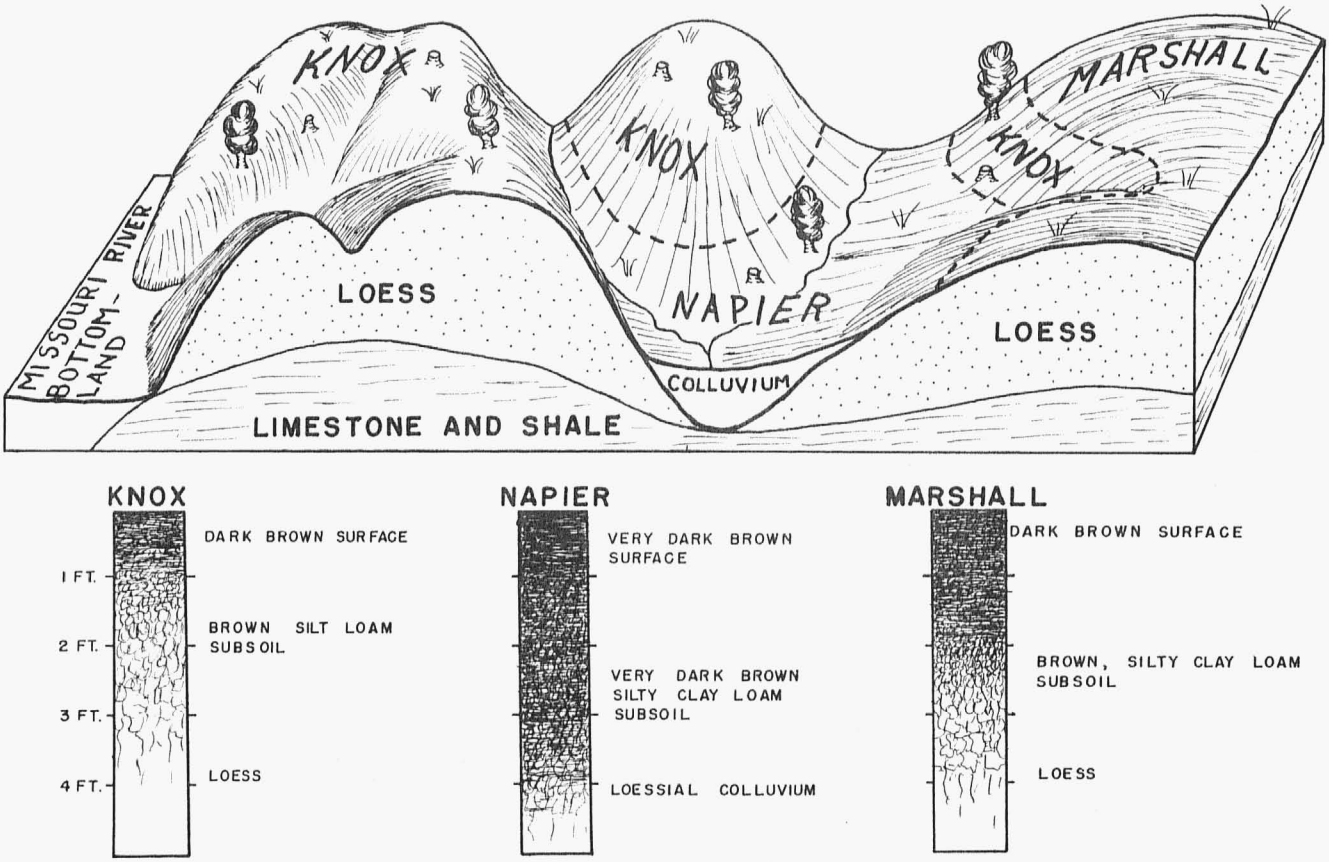
Soils of the Terraces or High Bottoms

No. 20—Racoon silt loam: Light gray, silty, poorly aerated soil with low fertility levels. Lime, phosphorus, potash, nitrogen and organic matter additions are needed. Corn can be grown but grass, wheat, and soybeans are usually more successful.

No. 21—Freeburg silt loam: Grayish brown, silty, moderately aerated soil with low fertility levels. The soil is browner than Racoon in the surface but is gray like the Racoon in the subsoil. Response to fertilizer is good. Lime, phosphorus, potash, and nitrogen are needed.

No. 23—Chariton silt loam: Dark gray, silty, poorly aerated acid soil with a dark gray silty clay subsoil. The nearly level topography causes the soil to be wet at times, thus surface drainage must be provided. Fertility levels are moderate and complete fertilization is needed.

No. 24—Blockton silt loam: Dark brown, moderately aerated soil with a dark gray silty clay subsoil. The soil is better aerated than is Chariton (No. 23) and surface drainage is not as necessary. Fertility levels are moderate and complete fertilization is needed. Corn, wheat, soybeans and clovers produce well.



THE KNOX-MARSHALL-NAPIER SOIL ASSOCIATION

These are the predominant soils of the deep loess area in the Glasgow vicinity. They are all mineralogically rich and little weathered. Nitrogen is the main fertilizer material needed although some lime and phosphorus may be used for Marshall.

The Knox soils are usually steeply sloping with narrow ridgetops. The Napier and Marshall are less sloping therefore easier to farm.

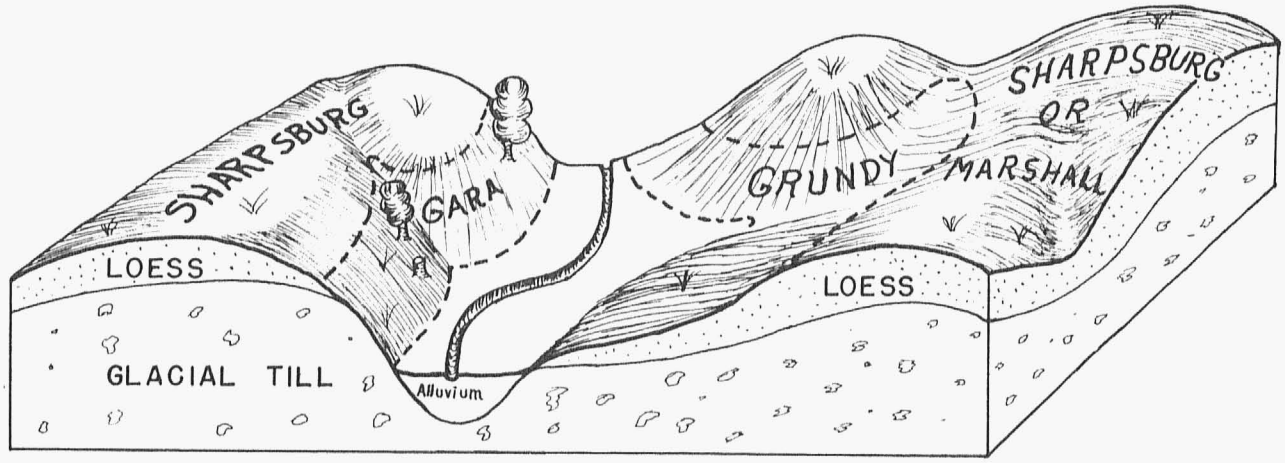
Erosion is a serious problem, especially in Knox which is usually too steeply sloping for terraces. The Napier areas generally need a diversion channel at the base of the Knox slopes. With such protection they can be farmed intensively. Marshall areas are generally well suited to terracing.

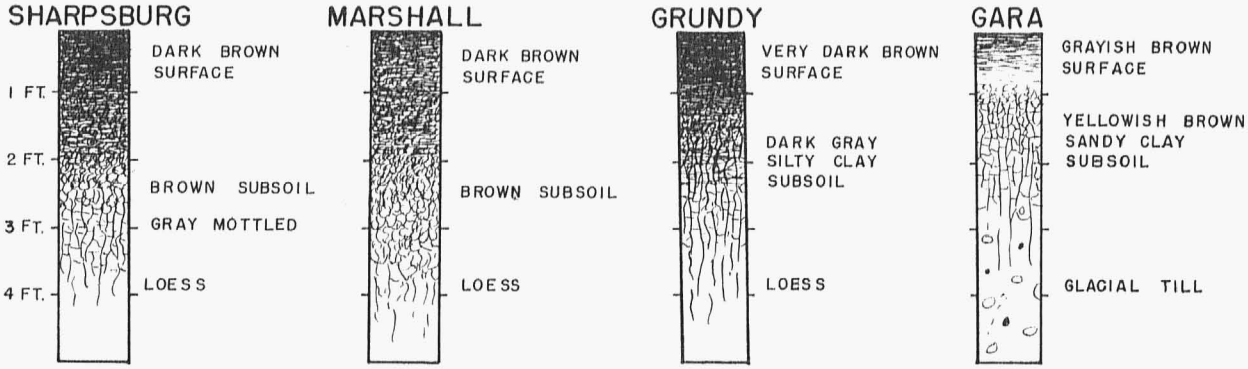
No. 25—Napier silt loam: Dark brown, deep, well aerated, fertile and productive soil which is situated at the base of slopes in the deep loess area near Glasgow. Nitrogen is the main fertilizer needed. Diversion channels at the base of the Knox and above the Napier will help prevent overwash and erosion.

Dark Colored Loess-Derived Upland Soil

No. 30—Knox silt loam: Dark brown, well aerated, fertile, productive, but erosive soil formed from the deep loess deposits in the vicinity of Glasgow. There is a subsoil but it has low clay content and is a silt loam. Organic matter content of the subsoil and lower layers is low but mineralogically and chemically those layers are very fertile. Maintenance of nitrogen and organic matter is the chief fertility problem. The steep topography makes erosion a problem. Terracing is not feasible in most cases because of the steep slopes and the tendency for gullies to form where water is concentrated; in terrace outlets for example. Alfalfa, tobacco, fruit trees, and corn grow well even where erosion has taken place, although production is below that for uneroded soils.

Knox soils have a high available water storage capacity but on eroded steep slopes they are sometimes drouthy because of slow infiltration rates and consequent high runoff. Permanent pastures, especially, show this effect.





THE MARSHALL-SHARPSBURG-GRUNDY-GARA SOIL ASSOCIATION

These are all dark colored soils except Gara which is intermediate between light and dark colored soils. All are very productive. They need from moderate to heavy amounts of fertilizers. The soil association name has the soils listed according to decreasing fertility. Erosion is a problem but most farms in these areas can be terraced since slopes are not steep.

The Grundy is wetter than the Marshall or Sharpsburg and often a line of "seeps" may be found at the line between the soils. Adjustment of cropping systems should be made so that crops sensitive to aeration are grown on the better drained soils. Tiling will help if the tile line is located just upslope from the Sharpsburg-Grundy line. This particular location allows the tile line to intercept water which would seep out to the surface.

The Gara areas are generally steeper in slope and are better suited for pasture than for cultivated crops.

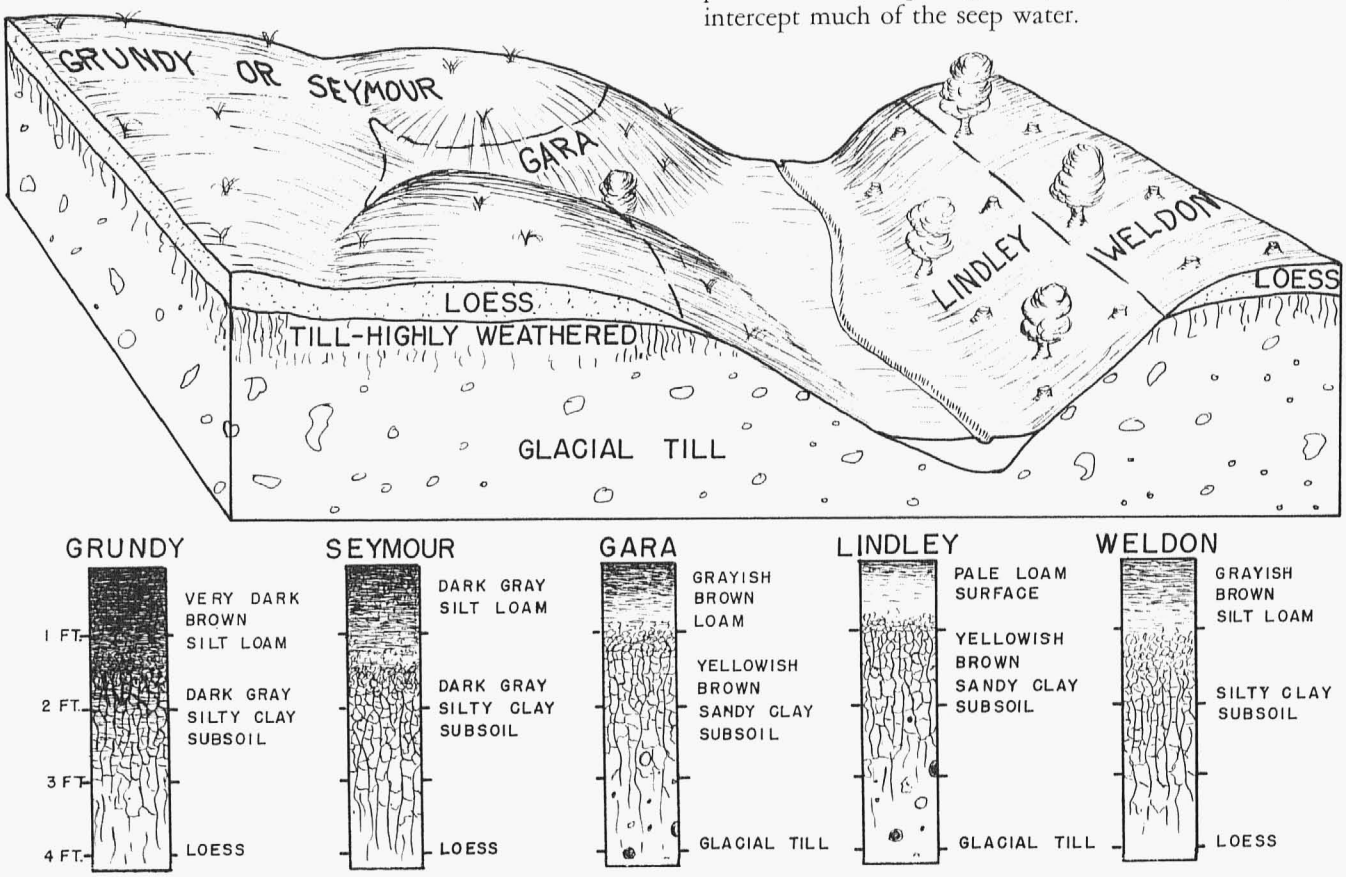
No. 31, 32—Marshall silt loam: Dark brown, deep, well aerated, fertile, and productive soil on some of the more gently sloping topography in the Knox region. This soil has a thicker surface horizon (up to 24″ thick) with more organic matter than has Knox but it is slightly more acid and has less available phosphorus than has Knox. Most crops grow well without fertilization but nitrogen and phosphorus produce good yield increases. Erosion is a problem but the topography is such that terracing works very well.

No. 33—Sharpsburg silt loam: This soil is similar to Marshall silt loam. It has slightly more clay in the surface and subsoil and is a little less well aerated. It is more acid and has slightly less available phosphorus. It is still a very productive soil but needs more nitrogen, phosphorus, and lime than does Marshall.

Slopes are usually such that terracing is possible. This or some other means of erosion control is invaluable in a soil with such a desirable surface soil.

No. 34, 71—Grundy silt loam: Very dark colored, moderately aerated and slightly wet, productive soil with an acid, plastic silty clay subsoil. Complete fertilization is necessary but responses are large, especially if the surface soil remains. This soil has gentle slopes and erosion control measures such as terraces work well in preventing loss of the surface soil. Where erosion has taken place the acid, high exchange capacity subsoil is exposed and large amounts of fertilizers are required. Corn, wheat, soybeans and grasses are well adapted.

Grundy areas with the No. 71 are usually found on slopes below Sharpsburg soils. These areas often have a seep line at the upper part of the Grundy. Tile lines placed in the Sharpsburg area just above the Grundy will intercept much of the seep water.



GRUNDY-SEYMOUR-GARA AND LINDLEY-WELDON SOIL ASSOCIATIONS

Grundy and Seymour are dark colored soils with silty clay subsoils. Lindley and Weldon soils are light colored. The Gara is intermediate.

The Grundy and Seymour soils are by far the most productive in this association. If a choice is possible, these soils should be used for the cultivated crops. Both soils have acid clay subsoils and thus erosion control is very desirable. Slopes on Grundy and Seymour are such that terracing is practical.

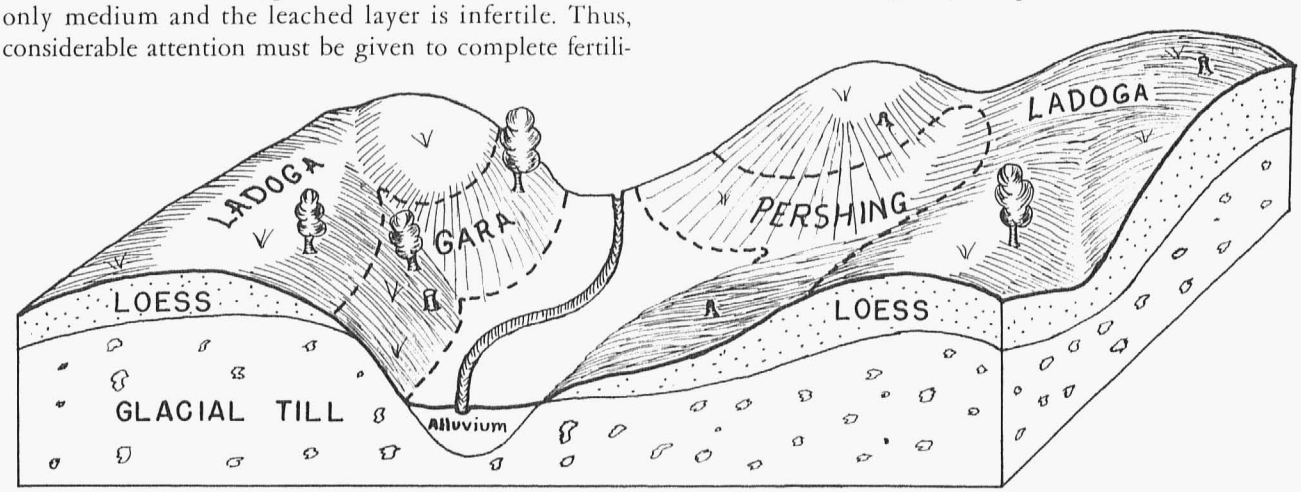
The Gara and Lindley soils should be used for pasture if a choice is possible. Weldon is more gently sloping and can be used for cultivated crops.

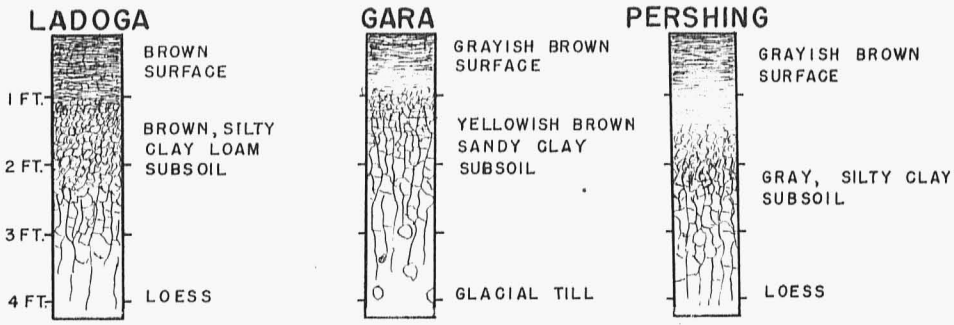
All soils need complete fertilization. Lindley and Gara pastures respond well to lime and phosphates.

No. 35—Seymour silt loam (see Grundy—No. 34): This is a dark grayish brown, poorly aerated soil with an acid, dark gray silty clay or clay subsoil. Management problems are the same as with Grundy. However Seymour has poorer aeration and is less fertile than Grundy. Larger amounts of fertilizers are needed and production is lower. Eroded areas, as well as requiring large amounts of fertilizers, are slightly drouthy.

No. 36—Mexico silt loam: Dark grayish brown, poorly aerated, acid claypan soil. A leached silty layer is situated above the claypan subsoil. Subsoil fertility is only medium and the leached layer is infertile. Thus, considerable attention must be given to complete fertilization. Corn, wheat and soybeans grow well where fertility is corrected. Erosion can be serious on the long gentle slopes. Eroded areas require much larger amounts of fertilizers and are more droughty than the uneroded areas.

No. 37—Edina silt loam: Dark gray, poorly drained and poorly aerated, flat claypan areas associated with the Grundy and Seymour soils. Erosion is not a problem but surface drainage must be provided. Complete fertilization is required. Wheat and soybeans produce very well but corn is often damaged by wet periods.





THE LADOGA-PERSHING-GARA SOIL ASSOCIATION

These are moderately dark, acid, but responsive and productive soils. Ladoga soils are well oxidized and aerated soils on ridgetops. They are suitable for all crops. The Pershing, which often lies in a position below the Ladoga, is slightly wet and poorly aerated. The Gara is situated on steeper slopes (3-10 percent), but is not so steep that it cannot be cultivated. All the soils require complete fertilization for satisfactory yields.

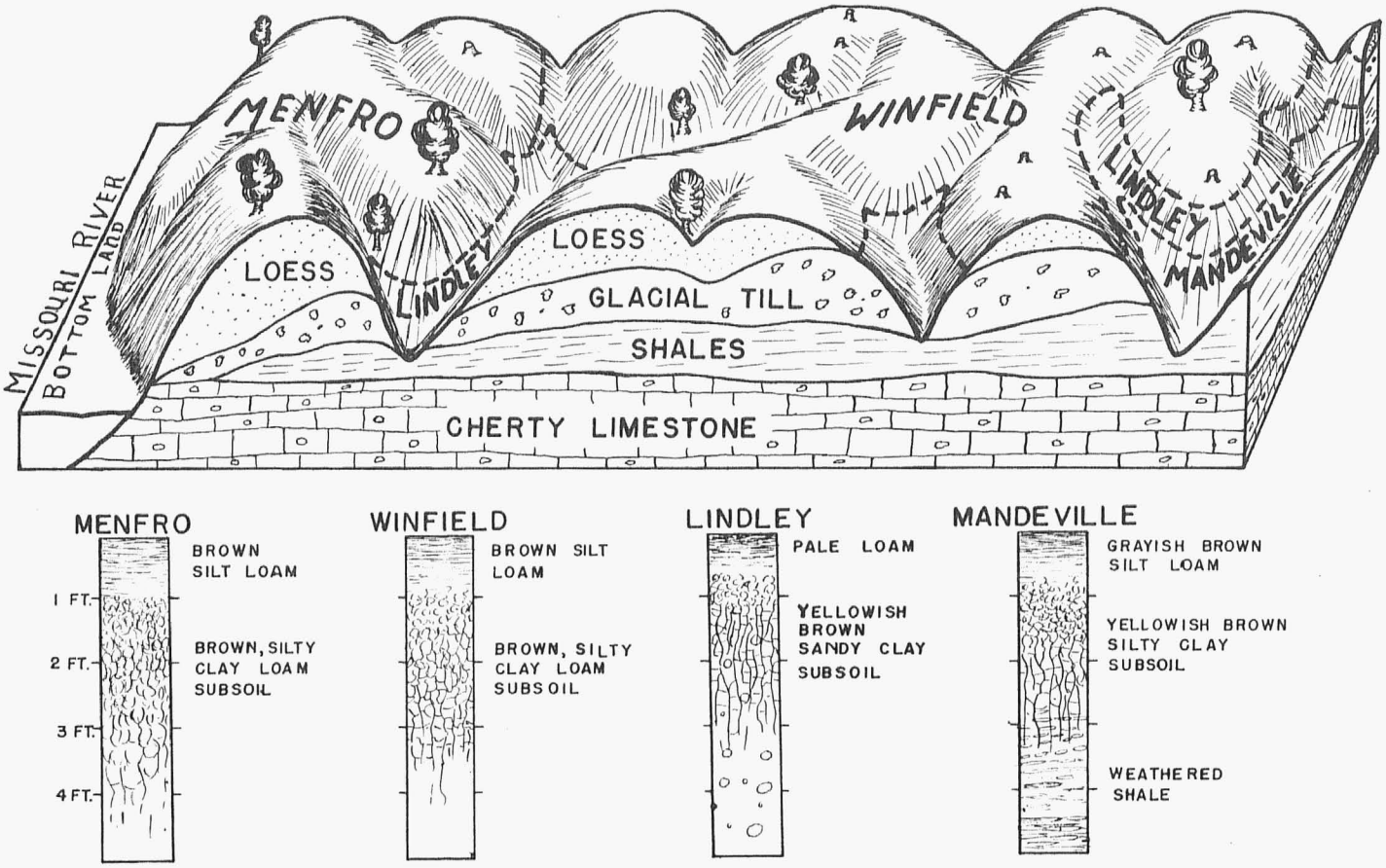
Erosion control is important, and with it, a large percentage of this soil association area can be cultivated. Loss of surface soil is especially critical on Pershing and Gara areas because they have acid, high clay content subsoils.

Seepage spots are often found at the line between Ladoga and Pershing soils. Tile lines placed in the Ladoga just above the Pershing will intercept the seep water and help correct the wetness of the Pershing.

Cropping systems in this association of soils should use the Ladoga for cultivated crops and crops requiring good subsoil aeration, the Pershing for cultivated crops tolerant to poor subsoil aeration, and the Gara for pasture.

No. 38—Ladoga silt loam: Brown, well aerated, productive but acid soil. Lime, nitrogen, and phosphorus are neded. Erosion is generally not severe because the soil is generally on a narrow ridge top. Often Gara or Pershing soils exist on the slopes below the Ladoga. A terrace or diversion around the Ladoga will often prevent much erosion on the Pershing or Gara slopes. All crops produce well if complete fertilization is practiced.

No. 39—Pershing silt loam: Grayish brown, moderately aerated acid soil with a gray, mottled silty clay subsoil. Complete fertilization is necessary but responses are not as great as on the better aerated and associated Ladoga soils. Pershing soils often exist on slopes below Ladoga ridgetops. Thus, erosion is a major problem and terracing is necessary where cultivation is to be practiced.



MENFRO-LINDLEY AND WINFIELD-LINDLEY-MANDEVILLE SOIL ASSOCIATIONS

All of these soils were formed under a forest vegetation and are, therefore, light colored and low in organic matter content. The Menfro and Winfield are more fertile than the Lindley and Mandeville, but all soils need organic matter, nitrogen, lime, and phosphorus.

Farms in these areas usually have narrow ridgetops and steep slopes. The narrow ridgetops constitute most of the cultivatable land. Excellent pastures and legumes can be grown on the Menfro and tobacco produces well. The Winfield has some ridgetops which are wider and more gently sloping than Menfro areas; thus, more cultivation is possible if erosion is controlled. Lindley and Mandeville are restricted to slopes and are best used as pasture or woodland.

Light Colored Loess-Derived Uplands

No. 40—Menfro silt loam: Brown, well-aerated, productive but dissected and erosive river hill soil which was originally forested. It has a silty surface and a brown silty clay loam subsoil which is mildly acid. Crops respond to nitrogen, phosphorus and some lime. Most areas are too steep for corn production and topography makes terracing difficult. Alfalfa grows well and trees, both fruit trees and forest species thrive. Many of the steep hills have potential as hardwood lumber producing areas.

No. 41—Winfield silt loam: See No. 40 Menfro silt loam. Winfield is also brown and well aerated but has some gray mottles in the lower subsoil, indicating some restriction of aeration. Winfield is less fertile than Menfro. Complete fertilization is necessary. Terracing or other forms of erosion control should be employed if the soil is to be cultivated. This can be done on slopes of less than 10 percent gradiant. Heavily eroded areas require much fertilizer for good production but they will respond to treatment.

No. 42—Weldon silt loam: Light colored, moderately aerated soil with a gray silty clay subsoil. The fertility level is low and complete fertilization is needed. Slopes are usually less than 10 percent and thus terracing is possible. This is necessary if the soil is to be used for tilled crops.

No. 43—Hatton silt loam: Light colored, very infertile, but moderately aerated ridgetop soil in northeastern Howard County. The soil is formed from shallow loess caps on the ridges. The slopes are till-derived Lindley (white oak land). Terracing is not feasible on the narrow ridgetops. Cropping systems should emphasize grasses and small grains if possible. Lime and phosphorus and nitrogen are much needed.

No. 44—Whitson silt loam: Grayish brown soil with a thick gray silty layer overlying a gray silty clay subsoil. The soil is situated on nearly level spots in Winfield and Weldon soil regions. It is poorly aerated and has very low fertility levels. Complete fertilization is necessary. Wheat and grass produce well. Corn is often affected by wet periods.

No. 45—Steinmetz silt loam: Gray, silty, poorly aerated soil found on slopes below the well-drained Menfro soils (40). The soil is infertile and is wet in the spring. It is inferior to the Menfro for many crops including trees and alfalfa. It does produce good grass where fertilization is practiced.

No. 46—Marion silt loam: Light colored, poorly aerated, very infertile claypan soil found in small areas in northeastern Howard County. Hay or meadow crops grow very well where ample lime and fertilizers are added. Wheat produces well but corn normally produces moderate to low yields even when fertilized.

Upland Soils Derived From Glacial Till, Limestone or Shale

No. 50 and 55—Lindley loam: Light colored, moderately aerated, very infertile soil with a plastic yellowish brown sandy clay subsoil. Only 7 or 8 inches of surface soil exist in uneroded areas. The soil areas are dissected and sloping. Erosion is often severe and production on these eroded areas is small. Hay or pasture with ample treatments of lime and phosphorus constitute good land use. The soil has a lower available water storage capacity than many of the siltier loess-derived soils. Drouthiness is not uncommon. Many areas remain in the native white oak forest. This may well be the most profitable land use if forest management practices are followed.

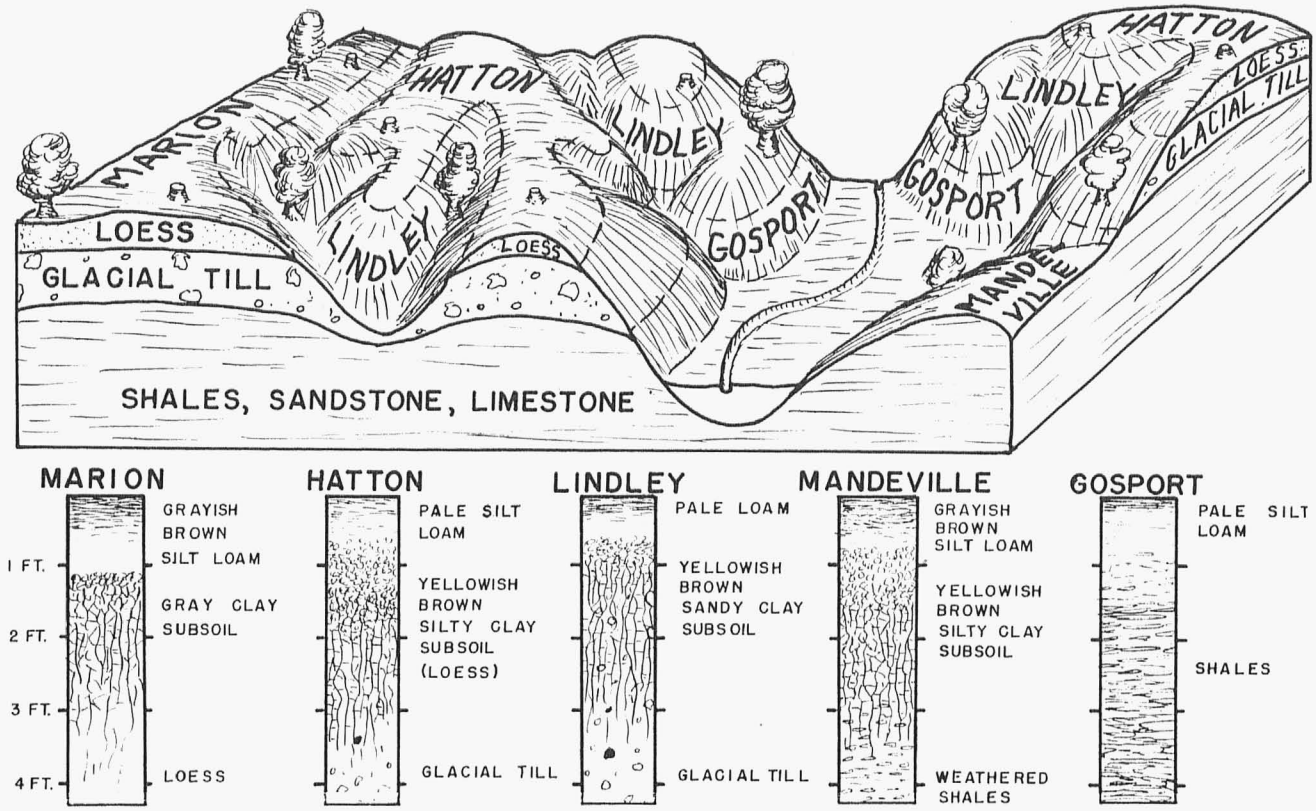
No. 51—Sapp silt loam: Gray, poorly aerated and infertile soil with a sticky and plastic gray sandy clay subsoil. Most of the areas are eroded to the subsoil. Complete fertilization is necessary for any production. Grass or meadow crops are better suited than any cultivated crop.

No. 52—Gara loam: Grayish brown, moderately aerated, acid, glacial-derived soil with a loamy surface and a yellowish brown sandy clay subsoil. Sizeable amounts of fertilizer are required but the soil is very responsive, especially if the loamy surface is not lost. The soil erodes easily and should be protected by terraces if it is to be cultivated. Eroded areas require large amounts of fertilizer and even so do not produce as well as less eroded areas.

No. 54—Lagonda silt loam: Dark gray soil with a dark gray silty clay subsoil underlain by a gray, plastic clay. The soil is very erosive and few areas are without exposures of the gray subsoil. Response to fertilizers is only moderate because of seepiness and poor aeration. Pastures or small grains give the most consistent returns.

No. 56—Bewleyville and Baxter silt loams: Brown, well aerated soil with a yellowish brown or red silty clay subsoil underlain by red cherty clay. The soil is largely on steep slopes and is suited for pasture.

No. 57—Stony land: This type of land has steep slopes and shallow soil. In some places there are ledges of limestone and in others there is a subsoil of red cherty material weathered from the cherty limestone. Forest is the best land use. Good stands of hardwoods can be maintained where there is a mantle of the weathered cherty material and would be profitable over a long period of years.



THE LINDLEY-HATTON-MARION-MANDEVILLE-GOSPORT SOIL ASSOCIATION

All of these soils are light colored, infertile soils of northeastern Howard County, which were originally forested. Lindley is the predominant soil. Hatton and Mandeville represent fairly large areas, but the Marion and Gosport are limited in acreage. All of the soils are very infertile. The Gosport and eroded Lindley or Mandeville also are drouthy.

Hatton, Marion, and some Mandeville represent the cultivatable land, along with some included bottomlands. Ridges are narrow and slopes are generally steep; thus, pastures and forest land are prodominant uses. Large tracts might well be used for a range type pasture system. The areas which have not been cleared have a potential as forest land. White oak is the native tree species and over a long period of time such a forest could yield high acre returns.

No. 58—Unnamed soil: Brown silt loam with a brown sandy clay loam subsoil. The soil is well aerated and moderately fertile. It is responsive to fertilization and with erosion control is suitable for all crops common to the county.

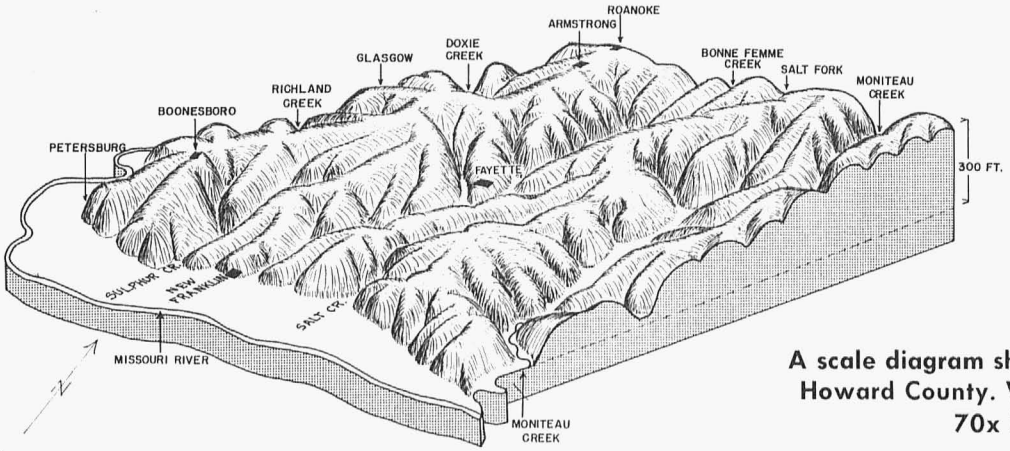
No. 60 and 67—Mandeville silt loam: Brown, moderately aerated soil with a brown silty clay subsoil underlain by shales. The soil is infertile but it is also very responsive because of its aeration. Complete fertilization is needed for medium to good production. Some slopes less than 10 percent in gradient can be terraced and used for cultivated crops. However, if possible, this soil is better used for pasture and meadow crops.

No. 61—Gosport stony silt loam: This is a shallow soil on steep slopes. The stones are largely shales but some limestone and sandstone are present. The soil is drouthy and infertile. It is best used for timber growth where it has not been cleared. White oak grows well. Where cleared, it will have moderate productivity as pasture land.

Nos. 62, 63, 66, 68—Lacona silt loam: Dark brown soil with a brown silty clay subsoil underlain by shales and limestone. The soil is very productive when fertilized and used as pasture. Terracing and other erosion control methods are required where cultivation is to be practiced. All crops common to the county will grow well.

No. 65—Snead stony silty clay: Nearly black, stony soil from limestone and shale. The soil is very fertile but too stony for cultivation. Walnut and other hardwood trees grow well and should be considered as a crop. Where the land is cleared, pastures grow moderately well.

Soils and Relief of Howard County

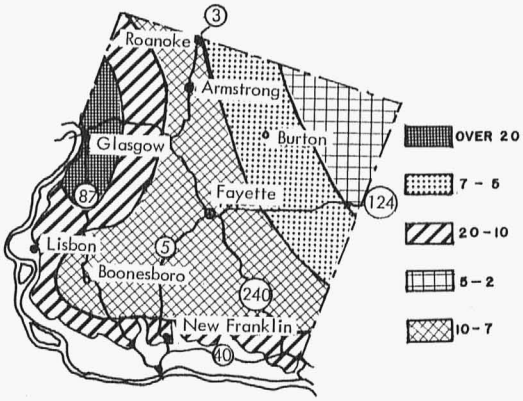


A scale diagram showing relief and drainage of Howard County. Vertical scale is exaggerated 70x horizontal scale.

The relief of Howard County has been produced through ages of geological erosion by water flowing into the Missouri River and its tributary creeks. That erosion has steadily encroached upon an old upland plain which still remains in the Moberly-Centralia area. Materials on the plain were highly leached and weathered and then later covered by loess. Remnants of that plain still remain on the highest ridges in the northeastern part of the county and on a high ridge from Armstrong to Boonesboro. Highly weathered materials (mostly glacial) are exposed at the dissected edges of those remnants and infertile soils are found there.

The diagram above shows the relatively low area from New Franklin to Fayette and southeastward. The weathered plain has been removed completely and materials beneath the loess are much less leached and weathered. Resulting soils are more fertile and productive than those influenced by the weathered materials.

The highly weathered materials have been removed from the area from Richland Creek through Glasgow, Armstrong, and Roanoke.



Maximum Depths of Loessial Deposits in Feet

Distribution of Loess in Howard County

Loess is a silty, windblown deposit which at the time of its deposition was mineralogically rich. Its presence in Howard County accounts for most of the better upland soils.

Thickest deposits are around Glasgow and in a narrow band following the Missouri River bluffs. The loess thins to the east and north but, even so, most ridgetop soils in northeastern Howard County have formed from a thin mantle of loess over glacial till. The loess has been eroded from most slopes in the northeastern part of the county, but is found on increasingly steeper slopes as one approaches the river hills.

Generally speaking, the thicker the loess mantle, the less weathered is the soil and the less clay in the subsoil.

Land Use Capability Grouping--Howard County

(HAROLD E. GROGGER, *State Soil Scientist, Soil Conservation Service,* Columbia)

LAND CAPABILITY CLASS & UNIT e - Major EROSION Problem w - Major excess WATER Problem s - Major SANDY, STONY (Droughty) Problem	KINDS OF SOIL (MAPPING SYMBOLS) GROUPED INTO EACH CAPABILITY UNIT
LAND SUITABLE FOR CULTIVATION AND OTHER USES	
Class I - Very good land that is nearly level, easily worked, and having practically no hazards; soils in this class are suited to a wide range of plants and all types of use.	
Capability Unit I - No major problems.	3, 4, 10 (Nodaway and Haynie soils)
Class II - Good land that can be cultivated safely with carefully applied practices to overcome the relatively moderate problems of erosion or wetness that are present.	
Capability Unit IIe1 - Well drained soils with favorable physical conditions in all layers--occurring on slopes.	25-3-1, 25-7-1, 33-3-1, 31-3-1, 32-7-1, 32-7-2, 31-7-2, 38-3-1, 38-3-2, 32-12-2, 40-3-1, 40-3-2. Napier, Marshall, Sharpsburg, Menfro, Ladoga soils)
Capability Unit IIe6 - Deep soils with silty clay to clay subsoils, occurring on slopes--moderate to slowly permeable.	24-3-1, 34-3-1, 71-3-1, 71-3-2, (Blockton, Grundy soils)
Capability Unit IIw1 - Soils with silty clay to clay subsoils, nearly level, imperfectly to poorly drained.	2,7,13,14,16, (Westerville, Chequest, Salix, Wabash, Onawa soils)
Capability Unit IIw3 - Claypan soils, nearly level, poorly drained.	37-1-1 (Edina soils)
Class III - Moderately good land that can be cultivated safely but usually requires intensive soil management practices applied in accordance with the rather severe hazards of erosion, wetness or droughtiness that occur.	
Capability Unit IIIe1 - Well drained soils on slopes, favorable physical conditions throughout.	30-7-2, 30-12-2, 31-7-2, 32-7-1, 32-7-2, 31-12-2, 32-12-2, 33-7-1, 33-7-2, 40-7-1, 40-7-2, 40-12-2, 38-7-1, 38-7-2. (Knox, Marshall, Sharpsburg, Menfro, Ladoga soils)
Capability Unit IIIe5 - Claypan soils occurring on slopes, very slowly permeable.	36-3-1, 36-3-2, 42-3-1, 42-3-2, 43-3-1, 44-3-1, 75-3-1, 46-3-1, 46-3-2, 51-7-2 (Mexico, Weldon, Whitson, Hatton, Marion, Sapp soils)
Capability Unit IIIe6 - Deep soils with silty clay to clay subsoils, occurring on slopes: a. Slowly permeable, poorly drained	23-3-1, 35-3-1, 35-3-2, 39-3-1, 39-3-2, 71-7-1, 71-7-2, 34-7-2, 54-3-2, 54-7-2, 64-7-2. (Chariton, Seymour, Pershing, Grundy, Lagonda, Snead soils)
b. Moderate to slowly permeable, moderately well to poorly drained.	21-3-1, 41-3-1, 41-3-2, 41-7-1, 41-7-2, 45-3-1, 45-3-2, 45-7-2, 52-7-1, 52-7-2, 60-7-2, 67-7-2, 50-7-2, 55-7-2, 62-7-2, 63-7-2, 66-7-2, 68-7-1, 68-7-2, 66-3-1, 66-3-2 (Winfield, Steinmetz, Gara, Lindley, Mandeville, Freeburg)
Capability Unit IIIw1 - Soils with silty clay to clay subsoils, nearly level, poorly drained.	1, 20-1-1, 20-3-1, 44-1-1, 75-1-1 (Moniteau, Whitson soils)
Capability Unit IIIw14 - Bottomland soils with fine textured surface soils, slow to very slowly drained.	15,17,8, 27-3-1 (Onawa, Wabash, Carlow (Clay) soils)
Capability Unit IIIs4 - Sandy soils lacking in moisture holding capacity	11 (Sarpy (loamy sand) soils)
Class IV - Fairly good land not generally suited to continuous cropping because of severe limitations of erosion or droughtiness which require careful choices of land use, erosion control and soil management.	
Capability Unit IVe1 - Well drained soils on slopes, favorable physical condition in all layers.	30-12-3, 33-7-3, 33-12-2, 40-12-3, 40-12-4 (Knox, Sharpsburg, Menfro soils)
Capability Unit IVe6 - Deep soils with silty clay to clay subsoils, on slopes, usually eroded or steeply rolling.	71-7-3, 41-7-3, 47-12-2, 45-12-2, 45-12-3, 50-12-2, 55-12-2, 52-7-3, 52-12-2, 52-12-3, 60-12-2, 67-12-2, 66-12-2 (Winfield, Steinmetz, Lindley, Gara, Mandeville, Lacona soils)
Capability Unit IVs4 - Sandy soils, droughty in all layers	12 (Sarpy (sand) soils)

LANDS LIMITED IN USE - GENERALLY NOT SUITED TO CULTIVATION	
Class V - Land generally not suited to cultivation due to wetness. Drainage is not generally feasible and management practices applicable to water tolerant grasses or trees are appropriate.	(Do not occur in Howard County in significant amounts)
Class VI - Land that is so steep or eroded that use for regular cultivation is impractical. Pasture management or woodland improvement is needed in accordance with the hazards of slope and erosion which occur.	
Capability Unit VIe - Soils with severe erosion or steep slope to the extent cultivation is not feasible.	30-20-2, 30-30-2, 30-20-3, 40-20-2, 40-30-2, 41-12-3, 47-12-3, 55-7-3, 55-12-3, 50-12-3, 56-12-2. (Knox, Menfro, Winfield, Lindley, Bewleyville-Baxter soils.)
Class VII - Very steeply sloping or very severely eroded areas or areas of stony soils, which present severe hazards requiring very careful land use and very selective timber or grass management.	
Capability Unit VIIe - Very severely eroded or very steep slopes	40-20-3, 40-20-4, 40-20-2, 55-20-2, 50-20-2, 50-12-4, 50-20-3, 55-20-3, 50-20-4, 60-7-3, 60-12-3, 67-12-4 60-12-4, 60-20-2, 60-20-3, 61-12-2, 61-20-2. (Menfro, Winfield, Lindley, Mandeville soils)
Capability Unit VIIs - Shallow stony soils	57-12-2, 57-20-2, 65-20-2 (Stony rolling land, Snead stony silty clay.)
Class VIII - Land that is so stony or gravelly that commercial plant production is not possible. Management practices are needed to maintain such areas for wildlife or recreational use.	19 (Riverwash)

The different kinds of soil in Howard County, including slope and erosion characteristics, can be classified into several management groups. Such groups aid in adopting wise land use and management for protection, improvement, and sustained use of the soil.

The Land Use Capability Grouping

The land use capability grouping is an interpretative soil grouping made for agricultural purposes. It deals with problems involving long time use and management of soils for the production of useful plants. The grouping shows major specific kinds of information:

1. The major kinds of land use (cropping, pasture, woodland, wildlife) to which the soils are best suited.
2. The kind and degree of limitations of the land and the amount or complexity of treatments needed to maintain or improve the soils for different uses. The major problems recognized as *erosion, excess water,* and *root zone limitations* such as drouthiness.
3. Soils that are similar are grouped together. That is, they are sufficiently alike that they respond similartly to the same kinds of soil management.

Capability Classes and Capability Units

There are eight broad Land Use Capability Classes. Class I represents the best land, suited to all kinds of uses and presenting no major problem. Classes II, III, and IV represent land classes suitable for regular cropping and other uses. As the classes increase from II to III or IV the choices in use become fewer, the risks greater and the application of practices more numerous or difficult to apply. Classes V, VI, VII are restricted in their suitability for use. They are primarily suited to permanent vegetation such as grass or trees with hazards and need for corrective practices or treatments increasing as you go from Class VI to Class VII. Class VIII is not suited to any plant crop normally produced for sale. Much of it is valuable only for wildlife food and cover, watershed protection or recreation.

Each broad capability class is divided into sub classes representing kinds of conservation problems and capability units representing groups of soil which are similar.

Capability Grouping of the Soils of Howard County

The table on the following page shows the grouping of all soil mapped in Howard County. The left hand column briefly defines each capability class and unit in terms of major problems and generalized management needs. The right hand column gives the suggested grouping of the map symbols in the soil survey. Numbers are keyed to descriptions on pages 9 through 16.

INDEX FOR LOCATION OF PHOTO-MAP

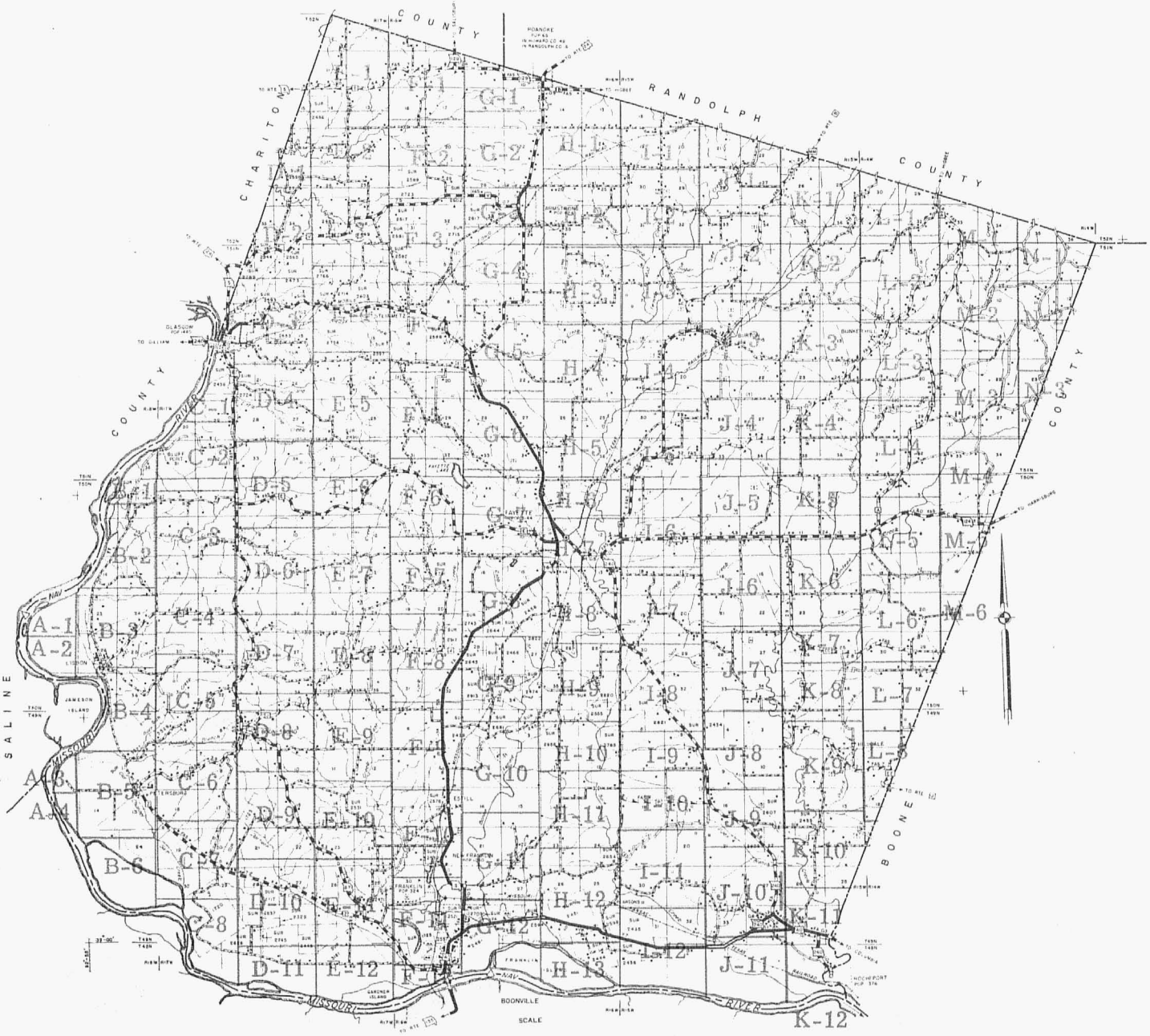


Photo-maps arranged in vertical rows lettered alphabetically from left to right and numerically from top to bottom. The letter number combinations appearing on this map designate the photo-map which covers that area. The photo-map is attached on page 2.

AVAILABLE MISSOURI SOIL SURVEY REPORTS

Reports Similar to the Howard County Report

Boone County—University of Missouri, College of Agriculture, Progress Report 14, 1951

Livingston County—University of Missouri, College of Agriculture, Progress Report 19, 1952

Moniteau County—University of Missouri, College of Agriculture, Bulletin 601, 1953

Other Recent Reports Published in Cooperation with the U.S.D.A. Soil Conservation Service.

St. Charles County 1939

Livingston County 1950

Holt County 1953

Jasper County 1954

Soil maps or reports are available at the University of Missouri Soils Department for 48 of Missouri's 114 Counties.