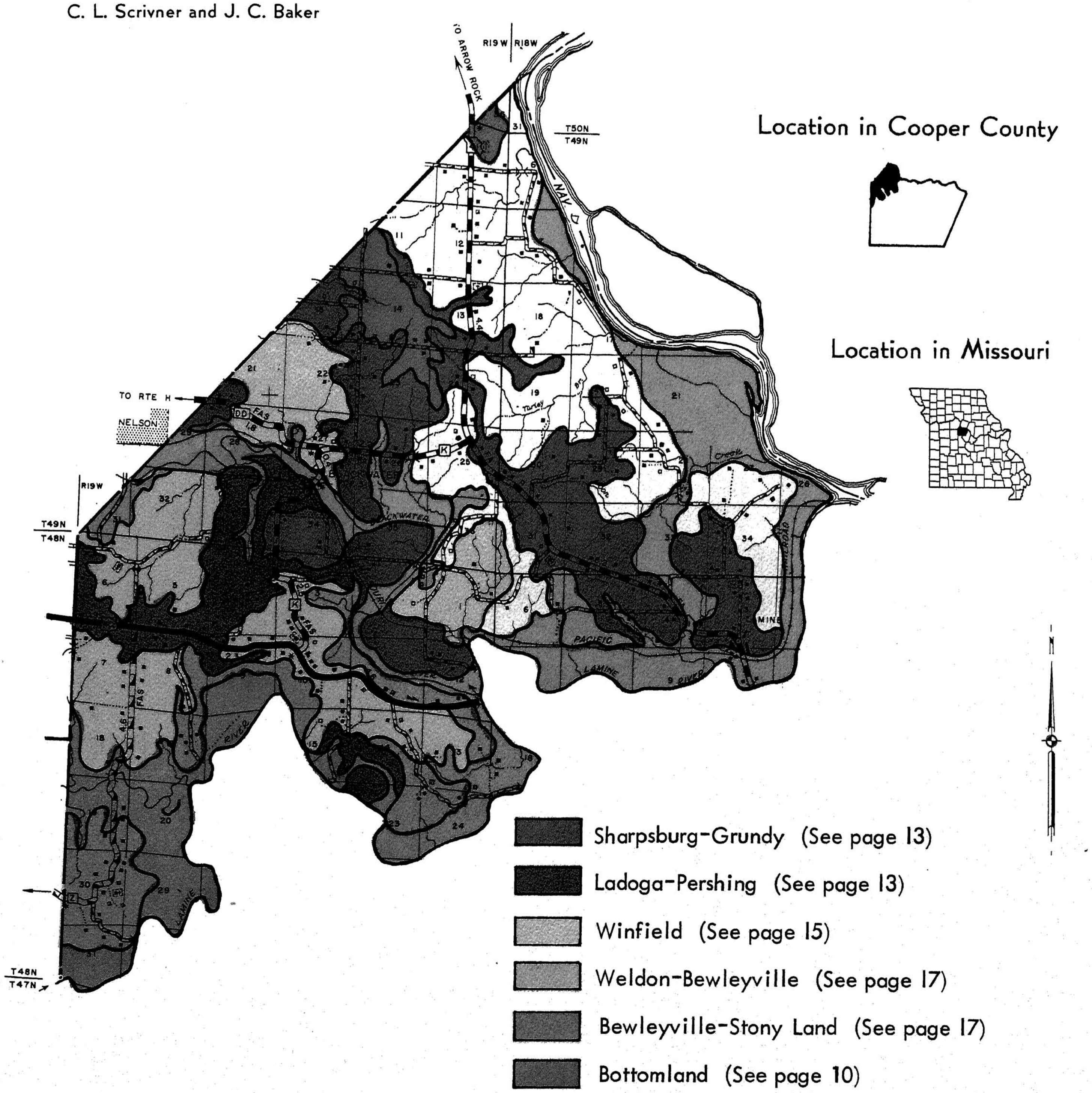
SOILS OF BLACKWATER AND LAMINE TOWNSHIPS

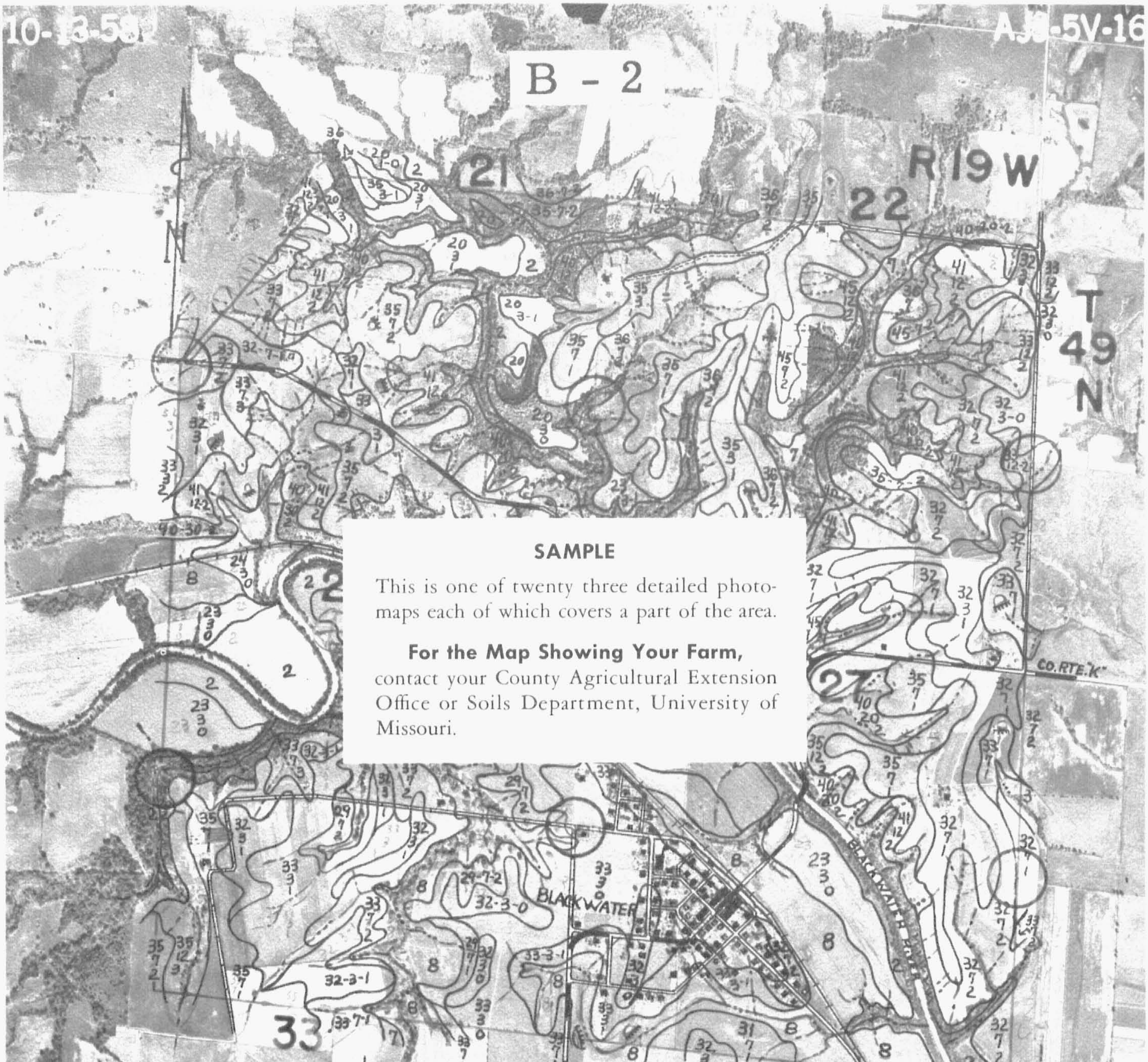
Cooper County

C. L. Scrivner and J. C. Baker



B772, AUGUST, 1961, UNIVERSITY OF MISSOURI AGRICULTURAL EXPERIMENT STATION

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



SAMPLE

This is one of twenty three detailed photo-maps each of which covers a part of the area.

For the Map Showing Your Farm, contact your County Agricultural Extension Office or Soils Department, University of Missouri.

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. 35-7-2) or it may be in the following form:

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

Areas of bottomland soils are indicated by a soil type number only.

Soil Types

SOILS OF THE SMALL CREEK BOTTOMLANDS
2---Westerville silt loam
3---Nodaway silt loam
7---Chequest silt loam
8---Carlow silty clay loam

SOILS OF THE MISSOURI RIVER BOTTOMLANDS
10---Haynie fine sandy loam
11---Sarpy loamy sand
12---Sarpy sand
13---Onawa clay loamn
14---Onawa clay

SOILS ON TERRACES OR HIGH BOTTOMS
20---Moniteau silt loam
21---Winfield silt loam, terrace phase (See pp. 35)
23---Chariton silt loam
24---Blockton silt loam
29---Sandy terrace

DARK COLORED, LOESS-DERIVED UPLANDS
30---Sharpsburg silt loam
31---Grundy silt loam
32---Ladoga silt loam
33---Pershing silt loam

LIGHT COLORED, LOESS-DERIVED UPLANDS
34---Menfro silt loam
35---Winfield silt loam
36---Weldon silt loam
37---Steinmetz silt loam

SOILS FROM LIMESTONE OR GLACIAL TILL
40---Stony land
41---Bewleyville and Baxter silt loams
45---Gara silt loam

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 R19W which is read as range 19 west. The township number is found in the right hand margin of the area on which lines were drawn. An example is T48N which is read as township 48 north.

IMPORTANT FEATURES OF EACH SOIL

Soil Number	Soil Name	PHYSICAL			SUBSOIL CHEMICAL FEATURES (15-30 in.)				
		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						
2	Westerville	brown silt loam	grayish brown silt loam	Moderate	7	1.2	100	18	65
3	Nodaway	brown silt loam	brown silt loam	Good	7	2.1	230	18	85
7	Chequest	black silt loam	very dark gray silty clay loam	Moderate	6	2.2	20	23	75
8	Carlow	dark gray silty clay loam	dark gray clay	Poor	4	1.4	40	27	75
			Soils of the Missouri River Bottomlands						
10	Haynie	brown fine sandy loam	brown fine sandy loam	Good	7	.6	360	15	100
11	Sarpy	brown loamy sand	brown loamy sand	Good	3	.5	250	10	100
12	Sarpy	brown sand	brown sand	Good	1	.1	250	5	100
13	Onawa	dark gray clay loam	grayish brown sandy loam	Moderate	6	1.5	300	25	100
14	Onawa	dark gray clay	dark gray clay	Poor	4	1.2	350	30	100
			Soils of the Terraces or High Bottoms						
20	Moniteau	grayish brown silt loam	gray silty clay loam	Poor	5	.6	70	20	65
23	Chariton	dark brown silt loam	dark gray silty clay	Poor	6	1.2	50	30	80
24	Blockton	dark brown silt loam	very dark gray silty clay	Moderate	6	1.7	30	30	80
29	Sandy Terrace	dark brown silt loam	dark brown clay loam	Good	6	1.0	50	20	70

			Dark Colored Loess-Derived Upland Soils						
30	Sharpsburg	very dark brown silt loam	mottled brown silty clay loam	Good	6	1.6	40	25	80
31	Grundy	very dark brown silt loam	dark gray silty clay	Moderate	6	1.3	30	30	80
32	Ladoga	dark brown silt loam	dark brown silty clay loam	Good	6	1.5	40	22	75
33	Pershing	grayish brown silt loam	gray silty clay	Moderate	6	.8	30	25	70
			Light Colored Loess-Derived Upland Soils						
34	Menfro	brown silt loam	brown silty clay loam	Good	6	1.0	170	20	75
21 & 35	Winfield	brown silt loam	mottled brown silty clay loam	Good	6	.8	90	22	70
36	Weldon	gray-brown silt loam	yellowish brown silty clay	Moderate	5	.6	70	25	60
37	Steinmetz	gray-brown silt loam	gray silty clay loam	Poor	6	.6	85	20	70
			Upland Soils Derived From Limestone or Glacial Till						
40	Stony Land	brown stony silt loam	red cherty silty clay	Moderate	3	.9	15	30	80
41	Bewleyville Baxter	brown silt loam	reddish brown silty clay loam	Good	6	.7	45	25	70
45	Gara	dark brown silt loam	gray mottled clay	Poor	4	.8	60	25	60

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 the area is such that all soils are drouthy in the most severely low rainfall years.

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 to Be Expected Over a Period of Years

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

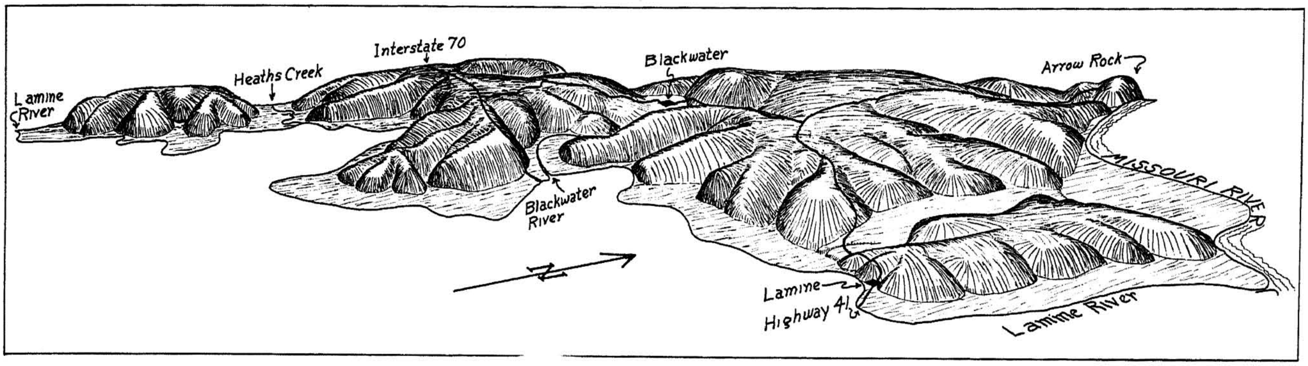
Soil No.	SOIL NAME	Uneroded Soil						Eroded Soil**	
		Corn bu./A.		Wheat bu./A.		Alfalfa Tons/A.		Corn bu./A.	
		A	B	A	B	A	B	A	B
2	Westerville Silt Loam	40	65	18	30	2.5	3.8	No significant problems from erosion	
3	Nodaway Silt Loam	50	75	25	35	3.7	4.5		
7	Chequest Silt Loam	35	60	15	30	1.9	4.0		
8	Carlow Silty Clay Loam	30	55	13	25	1.5	2.6		
10	Haynie Fine Sandy Loam	60	80	20	35	3.5	4.5		
11	Sarpy Loamy Sand	35	55	15	24	2.0	3.2		
12	Sarpy Sand	10	20	5	10	1.0	2.3		
13	Onawa Clay Loam	50	70	25	35	3.5	3.9		
14	Onawa Clay	20	50	17	28	2.3	2.9		
20	Moniteau Silt Loam	20	50	7	21	0.5	2.2		
23	Chariton Silt Loam	30	60	12	28	1.7	3.2		
24	Blockton Silt Loam	40	70	16	32	2.0	3.4		
29	Sandy Terrace	35	70	13	30	1.5	3.7		
30	Sharpsburg Silt Loam	50	80	21	35	2.2	4.0	30	70
31	Grundy Silt Loam	45	75	17	33	1.9	3.5	30	60
32	Ladoga Silt Loam	45	75	18	33	2.0	3.8	25	60
33	Pershing Silt Loam	25	60	13	30	1.4	3.0	15	40
34	Menfro Silt Loam	35	65	10	30	2.0	3.8	25	55
21,35	Winfield Silt Loam	30	60	10	30	1.8	3.5	20	50
36	Weldon Silt Loam	25	55	7	25	.9	2.9	10	45
37	Steinmetz Silt Loam	20	50	9	20	.9	3.0	10	35
40	Stony Land	--	--	--	--	--	--	--	--
41	Bewleyville-Baxter Silt Loams	20	55	9	25	1.0	2.5	10	45
45	Gara Silt Loam	25	60	8	25	.8	2.0	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.

Relief and Soils of the Area



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

The above diagram emphasizes the main streams, the dissection, and the relief of the area. Major soil variations are related to variations in relief because of two factors. First, slope and position of an area affect water run-off, accumulation and infiltration, which in turn, affect the development of soil characteristics. Rarely are soils on level areas the same as those on sloping ones. Second, the natural or geologic erosion which has formed the valleys and drainageways has exposed differing underlying materials for soil formation.

Most of the gently sloping areas are covered by several feet of loess, a silty, mineral-rich, windblown deposit believed to have originated in the Missouri River flood plain. The deposits of loess are 10 to 20 feet thick at the Missouri River bluffs and they diminish in thickness with increasing distance from the bluffs.

On slopes, underlying glacial till or cherty limestones are often exposed and the resultant soils vary. Such non-loessial materials are most common in the southwestern part of the area where the loessial mantle is thinnest and dissection is greatest. The area traversed by Highway 41 is, in general, a gently rolling area having a thick mantle of loess. The soils are the dark colored Sharpsburg, Grundy, Ladoga, or Pershing or the light colored Menfro and Winfield. The general elevation of ridgetops in this area is approximately 150 feet higher than that of the Missouri River flood plain.

The area south of Blackwater River is hilly and dissected. Cherty limestone constitutes the soil-forming material in many places. Interstate Highway 70 traverses one gently sloping loess-mantled ridgetop area on which the Pershing and Ladoga soils are situated. General ridgetop elevations are 200 feet higher than the floodplains of the adjacent Blackwater and Lamine Rivers.

Soils of alluvial origin are extensive. They vary in clay contents, natural drainage, and productivity. Stream terraces situated above overflow are common along Blackwater and Lamine Rivers. One such terrace appears to have been the former channel of the Lamine River. It is shown in Figure 1 just west of Lamine and extending northward to the Missouri River bottomlands.

BOTTOMLAND ALONG HEATH'S CREEK. Similar lands are extensive along other creeks and along Lamine and Blackwater Rivers. They have favorable topography and generally produce high yields of cultivated crops. Stream overflow is a hazard. The four creek bottomland soils discussed on this page vary in fertility levels, clay contents, drainage and aeration.

Soils of Small Creek Bottomlands

No. 2—Westerville silt loam: Brown bottomland soil which has gray colors below 18 to 24 inches because of restricted aeration in this region. The soil is slightly acid, but lime is generally not necessary and crops respond mainly to phosphorus and nitrogen. Corn grows well, but yields are inferior to those on the associated, better drained Nodaway soils.

No. 3—Nodaway silt loam: A deep, brown, 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. 7—Chequest silt loam: A very dark gray, imperfectly drained, small creek bottomland with a moderately high fertility level. Due to the imperfect drainage, this soil is wet and subsoil aeration is restricted.

Corn and soybeans produce well with applications of nitrogen and phosphorus. Wetness is the main problem, therefore surface drainage and diversion of surface water from the upland must be considered for most efficient land use.

No. 8—Carlow silty clay loam: This is a dark colored bottomland soil of moderately high fertility. The surface is a very dark gray silty clay loam, grading into a dark gray silty clay to clay subsoil at depths of 10 to 20 inches. The subsoil is acid and very plastic and the soil has slow internal drainage. The Carlow silty clay loam is subject to occasional overflow and surface drainage is usually slow. This soil has a tendency to crack and be difficult to till during prolonged dry periods. It is used for corn, soybeans, and small grains.

BOTTOMLAND ALONG THE MISSOURI RIVER. Five soils of this bottomland are discussed on this page. The soils are very fertile but they vary in contents of sand and clay and also in aeration, drainage and available moisture storage capacity.

CHARITON SILT LOAM. This soil is situated on stream terraces. Soils of the stream terraces have level to gently sloping topography and are above stream overflow levels. They are generally less fertile than bottomland soils but this varies among the four terrace soils discussed on this page.

Soils of Missouri River Bottomlands

No. 10—Haynie fine sandy 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 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 of water application.

No. 13—Onawa clay loam: Dark colored, moderately aerated, fertile soil which has fine textures (clayey) to depths of 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. 14—Onawa clay: Dark gray, poorly aerated, and poorly drained but fertile soil. It is similar to soil No. 13 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.

Soils of the Terraces or High Bottoms

No. 20—Moniteau silt loam: Light gray, silty, poorly aerated soil with low fertility levels. Lime, phosphorus, potash, nitrogen and organic matter additions are necessary for good results. Corn can be grown but grasses, wheat, or soybeans are usually more successful.

No. 23—Chariton silt loam: A 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, therefore surface drainage should be provided.

Fertility is moderate and complete fertilization is required. Corn, soybeans, and clovers produce well but this soil is best adapted for small grains and grasses.

No. 24—Blockton silt loam: Dark brown, moderately aerated soil with a very dark gray silty clay subsoil. The soil has better aeration than the Chariton and surface drainage is not as necessary. This soil has moderate fertility and complete fertilization is necessary for high yields. Corn, wheat, soybeans, and clovers produce well.

No. 29—Sandy terrace: A brown, well aerated, sandy clay loam soil occupying the edges of high terraces. This soil should be managed the same as soils in association with it since areas of this are small.

LADOGA SILT LOAM. This area has been terraced and used for pasture. All four of the dark colored soils discussed on this page have slopes which are gentle enough that terracing or other erosion control methods are feasible. When so protected, the soils are suitable for intensive use for crops such as corn, wheat or soybeans. Fertility levels, aeration, drainage, and adapted crops vary among the four soils.

Dark Colored Loess-Derived Upland Soil

No. 30—Sharpsburg silt loam: A dark brown, deep, moderately well aerated, fertile, and productive soil. This soil is found in association with the Grundy, but has less clay in the subsoil, has better aeration, a higher water storage capacity and in general is a more fertile soil.

Most crops produce well on this soil but applications of nitrogen, phosphorus, and lime produce good yield increases. 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. 31—Grundy silt loam: A 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. The soil is situated on wide gently sloping ridge tops. Terracing works well as an erosion control measure.

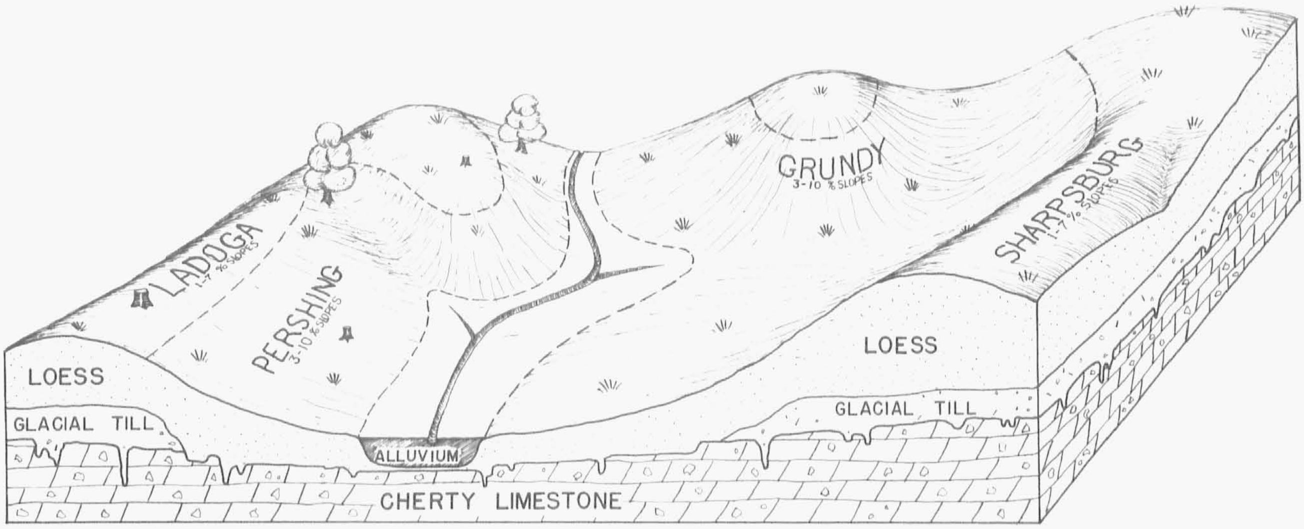
Where erosion has exposed the acid, high exchange capacity subsoil, large amounts of fertilizers are required. Corn, wheat, soybeans, and grasses are well adapted.

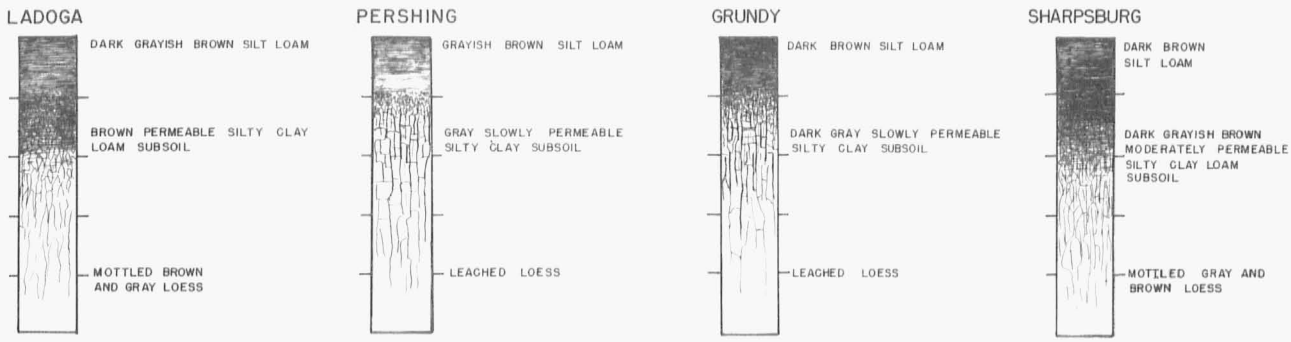
No. 32—Ladoga silt loam: A brown, well aerated, productive soil. The surface is a dark brown silt loam grading into a brown silty clay loam subsoil. Erosion is not too great a problem on many Ladoga areas because of their ridgetop positions. However, the soil is entirely suitable for terracing where erosion control measures are necessary.

Although this soil has moderately high fertility levels, applications of nitrogen, phosphorus and lime are necessary for high yields. With good management and fertilization, all crops produce well.

No. 33—Pershing silt loam: A grayish brown soil developed from loess on gently sloping topography. The surface soil is 8 to 10 inches thick on uneroded areas. The subsoil is a gray silty clay which is slowly permeable to air and water.

The Pershing is commonly situated on slopes below Ladoga ridgetops, making erosion a problem. The soil when uneroded is of moderate fertility and with good management and complete fertilization good yields of corn, small grains, and pastures can be obtained.





SHARPSBURG-GRUNDY AND LADOGA-PERSHING SOIL ASSOCIATIONS

All of these soils are dark colored or moderately dark colored. They have moderately high fertility levels but require complete fertilization for best yields.

The Sharpsburg and Ladoga are well drained soils. Grundy and Pershing have some restriction in subsoil drainage and are less well aerated. Where all soils exist on one farm, best results will be obtained by using Sharpsburg and Ladoga for crops requiring good drainage and subsoil aeration and by using the Grundy and Pershing for crops such as pastures, corn, wheat, or soybeans which are more tolerant to imperfect soil drainage.

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

Grundy and Pershing generally need some means of erosion control and slopes are usually such that terracing is feasible.

UNERODED GRUNDY SILT LOAM EXPOSED IN A ROADCUT. The deep, dark colored, well granulated silt loam surface soil is very desirable for plant rooting. Its loss by erosion should be prevented when cultivation is practiced.

THE BLACKWATER AREA. The town is surrounded by trees in the background. The soils are mainly Grundy and Pershing on gentle slopes. The area is very productive.

A ROADCUT THROUGH THE MENFRO SOIL. The soil has a light colored surface, a well aggregated subsoil and is underlain by loess, a silty, mineral-rich wind-blown deposit. This soil is very similar to Winfield soils. They are excellent soils but steepness of slopes is a limiting factor in land use in many areas. The four light colored, loess-derived soils discussed on this page vary in natural fertility, aeration and drainage.

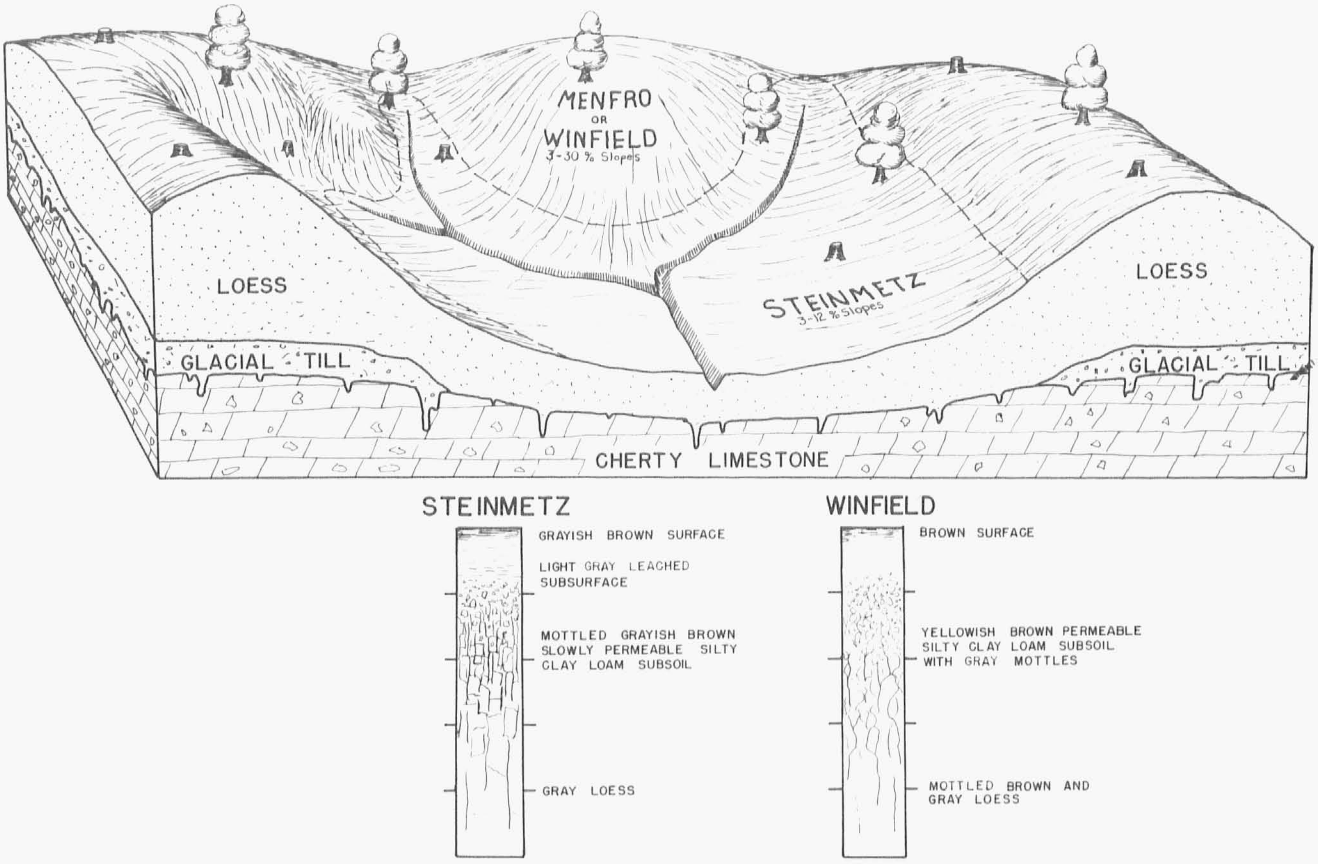
Light Colored Loess-Derived Uplands

No. 34—Menfro silt loam: A brown, deep, well drained, fertile soil situated on moderate to steep slopes in the river hills adjacent to the Missouri River bottom. The uniform brown color and the medium textures of the subsoil are very desirable and are indicators of this soil's high quality. Steep topography and erosion are the main limitations for the use of this land for cultivation. Most of it is used for pasture. Alfalfa will thrive without soil treatment. Where topography permits this is an excellent soil for orchards.

No. 35—Winfield silt loam: A brown, well drained soil of the river hills similar to the Menfro but with gray mottles in the lower subsoil indicating some restriction to internal drainage. Winfield is also less fertile than the Menfro. Complete fertilization is necessary. Erosion is one of the main problems and terracing is advisable if this soil is to be cultivated. This can be done on slopes of less than 10 percent gradient. Severely eroded areas require heavy applications of fertilizer but they will respond to such treatment.

No. 36—Weldon silt loam: A grayish brown, moderately aerated soil of the river hills with a gray silty clay subsoil. The fertility level is low and complete fertilization is required. Slopes are generally less than 10 percent making terracing possible. This is required if the soil is to be used for cultivation. The predominent uses for this soil are pastures and small grains.

No. 37—Steinmetz silt loam: A gray silty, poorly aerated soil of low fertility situated on slopes below the Winfield and Menfro and in the heads of draws. The soil is very acid and is wet in the spring. It is inferior to the Menfro and Winfield soils for most crops. It does produce good grass where fertilization is practiced.



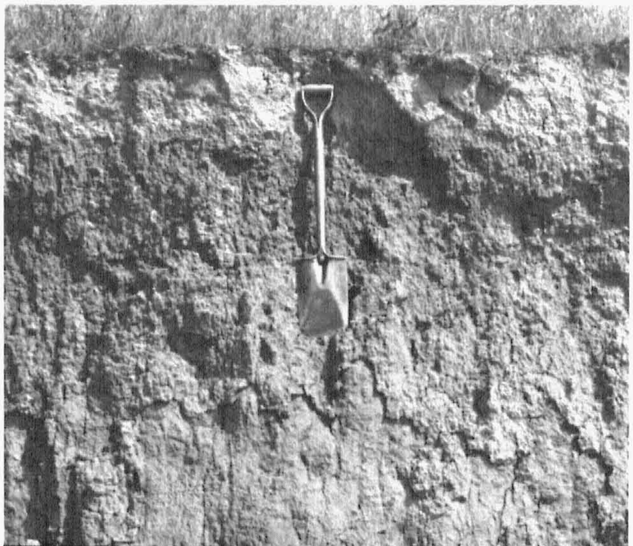
MENFRO-WINFIELD-STEINMETZ SOIL ASSOCIATION

These river hill soils were formed from loess under forest vegetation. They are light colored and low in organic matter. The fertility levels of the Menfro and Winfield are moderate to high while that of the Steinmetz is moderate.

The Menfro and Winfield are situated on the steeper slopes while the Steinmetz is situated in the heads of draws and on gently sloping areas below the Menfro and Winfield soils. The position of the Steinmetz causes it to be poorly drained.

All the soils are well adapted to grasses, hay, and small grains. On slopes where terracing is feasible, intertilled crops may be grown successfully with applications of nitrogen, phosphorus, and lime. The Steinmetz is acid and wet much of the time, making intertilled crops and legumes less adapted than on the better drained Menfro and Winfield soils.

MENFRO SILT LOAM EXPOSED IN A ROADCUT. The light colored surface indicates low organic matter content. The well aggregated subsoil is easily penetrated by roots. The underlying loess (below spade) is chemically very rich. Winfield soils are similar to this soil.



PLOWED FIELD OF WINFIELD AND STEINMETZ SOILS. The brown Winfield soils occupy the well drained, rounded ridgetops and the poorly drained Steinmetz is situated below the Winfield. They gray colors indicate the poor drainage of the Steinmetz. Diversion of water runoff from the Winfield areas will help correct the wetness of the Steinmetz soils.

CHERTY LIMESTONE ALONG HIGHWAY 40 WEST OF LAMINE RIVER. Limestone underlies the entire area but is covered by loess and glacial till in most places. Only on steep slopes in the southern part of the area does the limestone comprise an important part of the soil-forming materials.

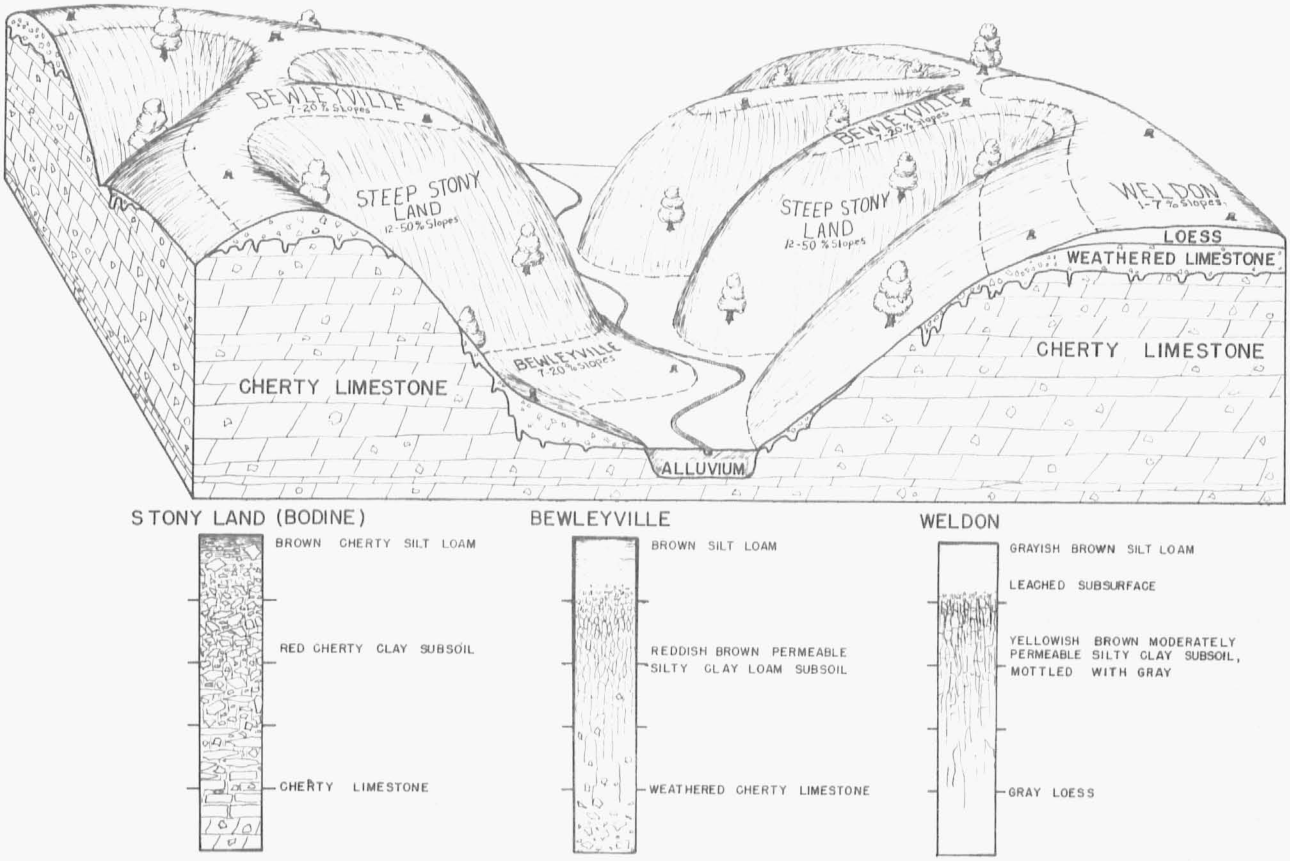
Upland Soils Derived From Limestone or Glacial Till,

No. 40—Stony land: This type of land has steep slopes, a shallow soil and has many rock outcroppings. In some places there are ledges of limestone and in others there is a subsoil of red cherty clay. Forest is the best land use. Good stands of hard wood can be maintained where there is a mantle of the weathered cherty material.

No. 41—Bewleyville and Baxter silt loams: A brown well aerated soil with a yellowish brown or red silty clay subsoil underlain by red cherty clay. The depths to chert fragments are 28 to 36 inches. The soil is largely found on steep slopes at the base of a hill or on very narrow ridgetops. It is used mainly for pasture.

No. 45—Gara silt loam: A dark gray, poorly aerated soil developed from glacial till. For the most part the subsoil is a mottled, gray clay but in some instances the sand content is high enough to be a sandy clay. The soil is located largely at the heads of draws where glacial deposits are exposed.

Generally this soil is eroded and therefore best suited to pastures and small grains. Where surface soil remains, terracing works well as an erosion control measure.



WELDON-BEWLEYVILLE-STONY LAND SOIL ASSOCIATION

This association represents the major portion of upland soils south of the Blackwater River. These soils are all light colored and were originally forested. Fertility levels are moderate to low.

The steep, stony land makes up the major portion of this association but the Weldon and Bewleyville are the most important for agricultural uses. The Weldon is situated on the gently sloping, loess-capped ridgetops. The Bewleyville and stony land are situated on narrow ridgetops and steep slopes.

The Weldon, Bewleyville, and stony lands are best suited for pastures and forest land. The Weldon and some gently sloping areas of the Bewleyville may be used for hay and small grains. The slopes are generally such that intertilled crops are not well adapted to these soils.

WELDON AND STONY LAND. Weldon soils are formed from loessial deposits on gently sloping ridgetops. The stony land is formed from cherty (flinty) limestone on steep slopes. Weldon soils are infertile and require complete fertilization. They are best suited for pasture and hay crops but can be cultivated. The stony land is best suited for pasture and woodlots.

STONY LAND IN A ROADCUT. The limestone has been removed by leaching during long periods of soil formation. Only an acid, cherty (flinty) clay material remains for soil formation. The chert content reduces the volume of soil which can hold available water and chemcial elements necessary for plant growth. Some areas of stony land have outcropping limestone ledges. These soils are shallow but they are more fertile than the cherty areas. Pastures or forests of oak and walnut are main uses for the soil.

Land Use Summary

Maximum use intensities which are desirable*

	Intensive Cultivation Row Crops 1/2 or More of Time	Moderate Cultivation Row Crops 1/2 to 1/4 of the Time	Small Grain, Pasture and Meadow Row Crops Less Than 1/4 of the Time	Pasture and Woodlots
				
Soils needing no major erosion or drainage control for each use intensity	Nodaway Haynie Sarpy Westerville Chequest Blockton		On 2 to 10% Slopes Sharpsburg Grundy Ladoga Pershing Menfro Winfield On 2 to 5% Slopes Weldon Bewleyville	Slope over 10% Menfro Winfield Slope over 5% Weldon Bewleyville Gara Stony land
Soils needing terracing for each use intensity	On 2 to 5% slopes Sharpsburg Grundy Ladoga Pershing Menfro Winfield	On 5 to 10% Slopes Sharpsburg Grundy Ladoga Pershing Menfro Winfield On 2 to 5% Slopes Weldon Bewleyville	10 to 15% Slopes Menfro Winfield On 5 to 10% Slopes Weldon Bewleyville Gara	
Soils needing drainage or protection from surface water	Chariton Carlow Onawa		Steinmetz Moniteau	

*The actual intensity of use for any tract of land is dependent upon many factors in addition to soils. All soils listed for intense use can be used less intensively. Likewise, with special care, some soils can be used more intensively than shown.

Fertilization and contouring are considered to be standard practices in the above grouping.

Acreage Summary of Blackwater and Lamine Townships

Total Area - 40,149 Acres

		Acres	Percent of the area
SOILS OF THE SMALL CREEK BOTTOMLANDS			
2--Westerville silt loam		3,670	9.1
3--Nodaway silt loam		629	1.6
7--Chequest silt loam		1,100	2.7
8--Carlow silty clay loam		2,000	5.0
	Total	7,399	18.4
SOILS OF THE MISSOURI RIVER BOTTOMLANDS			
10--Haynie fine sandy loam		768	1.9
11--Sarpy loamy sand		346	0.9
12--Sarpy sand		77	0.2
13--Onawa clay loam		694	1.7
14--Onawa clay		229	0.6
19--Riverwash		42	0.1
	Total	2,156	5.4
SOILS ON TERRACES OR BENCHES			
20--Moniteau silt loam		768	1.9
23--Chariton silt loam		1,864	4.6
24--Blockton silt loam		556	1.4
29--Sandy terrace		197	0.5
	Total	3,589	8.9
DARK COLORED, LOESS-DERIVED UPLAND SOILS			
30--Sharpsburg silt loam		254	0.6
31--Grundy silt loam		1,150	2.9
32--Ladoga silt loam		3,367	8.4
33--Pershing silt loam		3,288	8.1
	Total	8,059	20.0
LIGHT COLORED, LOESS-DERIVED UPLAND SOILS			
34--Menfro silt loam		1,080	2.7
35--Winfield Silt loam		7,469	18.7
36--Weldon silt loam		1,524	3.8
37--Steinmetz silt loam		1,627	4.1
	Total	11,700	29.3
UPLAND SOILS DERIVED FROM LIMESTONE OR GLACIAL TILL			
40--Stony land		3,703	9.2
41--Bewleyville and Baxter silt loams		2,930	7.3
45--Gara silt loam		613	1.5
	Total	7,246	18.0

Twenty-six percent of the area is nearly level and can be farmed intensively without special erosion control practices. Another twenty-two percent of the area has slopes of 2 to 5 percent gradient and most of it can be farmed intensively if erosion control methods are employed. Seventy-five percent of the total area has slopes less than 10 percent in gradient.

Fifty-three percent of the area has slight or no erosion (over 6 inches of surface soil remain). Forty-seven percent of the area has moderate to severe erosion (6 inches or less of surface soil remain).

INDEX FOR LOCATION OF PHOTO-MAP

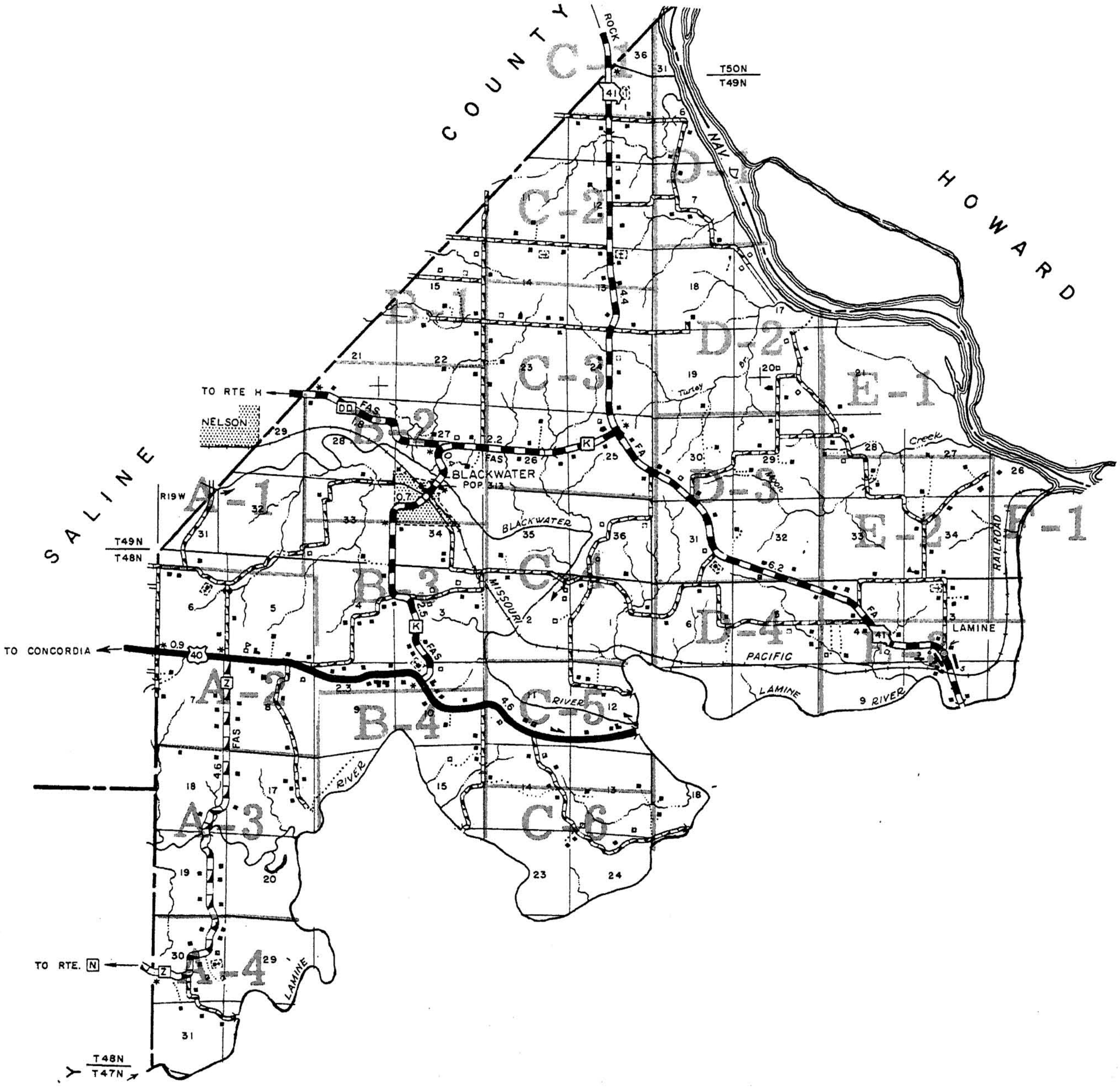


Photo-maps arranged in vertical rows lettered alphabetically from left to right and numerically from top to bottom. The letter number combinations appearing on this map designate the photo-map which covers that area. The photo-map is attached on page 2.

AVAILABLE MISSOURI SOIL SURVEY REPORTS

Reports Similar to the Blackwater-Lamine 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

Howard County—University of Missouri, College of Agriculture, Bulletin 749, 1961.

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.