

1967

A Geographical Interpretation of Coles County Soils Through a Comparative Analysis of Modern Soil Classification Systems

John C. Klink

Eastern Illinois University

This research is a product of the graduate program in [Geology/Geography](#) at Eastern Illinois University. [Find out more](#) about the program.

Recommended Citation

Klink, John C., "A Geographical Interpretation of Coles County Soils Through a Comparative Analysis of Modern Soil Classification Systems" (1967). *Masters Theses*. 4190.
<https://thekeep.eiu.edu/theses/4190>

This is brought to you for free and open access by the Student Theses & Publications at The Keep. It has been accepted for inclusion in Masters Theses by an authorized administrator of The Keep. For more information, please contact tabruns@eiu.edu.

PAPER CERTIFICATE #3

To: Graduate Degree Candidates who have written formal theses.

Subject: Permission to reproduce theses.

The University Library is receiving a number of requests from other institutions asking permission to reproduce dissertations for inclusion in their library holdings. Although no copyright laws are involved, we feel that professional courtesy demands that permission be obtained from the author before we allow theses to be copied.

Please sign one of the following statements.

Booth Library of Eastern Illinois University has my permission to lend my thesis to a reputable college or university for the purpose of copying it for inclusion in that institution's library or research holdings.

9/1/67
Date

Author

I respectfully request Booth Library of Eastern Illinois University not allow my thesis be reproduced because _____

Date

Author

A GEOGRAPHICAL INTERPRETATION

OF COLES COUNTY SOILS THROUGH A COMPARATIVE

ANALYSIS OF MODERN SOIL CLASSIFICATION SYSTEMS

(TITLE)

BY

JOHN C. KLINK

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

MASTER OF SCIENCE IN EDUCATION

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

1967

YEAR

I HEREBY RECOMMEND THIS THESIS BE ACCEPTED AS FULFILLING
THIS PART OF THE GRADUATE DEGREE CITED ABOVE

9/7/67
DATE

ADVISER

9/7/67
DATE

ACKNOWLEDGEMENTS

I wish to express my gratitude and appreciation to Dr. Paul Mausel, my adviser, for the time, assistance, and critical guidance which he so willingly has given throughout the past year. I wish to express my appreciation to Dr. Dalias A. Price and Dr. Glen McConkey for serving as members of my graduate committee and to the Geography Department for the facilities that were made available to me during the study.

I wish to thank Mr. J.K. (Pete) Johnson, the Work Unit Conservationist, and his staff for their untiring and fullest cooperation during the many hours of the data gathering process, and Mr. Joe Fasic, the Work Unit Conservationist of Douglas County, and his staff for making prepared soil profiles available to be photographed.

I also wish to thank my wife, Marcia, for her patience and understanding throughout the study and for unselfishly contributing the many long hours of typing and proofreading this thesis.

September, 1967

John C. Klink

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	iii
LIST OF TABLES	iv
LIST OF ILLUSTRATIONS	v
INTRODUCTION	1
Chapter	
I. STATEMENT OF PURPOSE AND OBJECTIVES	4
Selected Geographic Aspects Of Coles County Soils Validity Of The 7th Approximation In A Geographi- cal Analysis Objectives Essential In Development Of The Study	
II. SOIL DEVELOPMENT IN COLES COUNTY	9
Origin And Formation Of The Soils Analysis Of The Five Genetic Soil-Forming Factors Operating In Coles County	
III. SOIL RESOURCES OF COLES COUNTY	44
Soil Series Classification In Coles County A Resume Of Soil Resources, Soil Series Data	
IV. DEVELOPMENT OF SOIL REGIONS IN COLES COUNTY	70
The Need For Geographic Soil Regions Tools For Development Of Soil Regions Procedure For Developing Soil Regions Soil Regions Using The U.S.D.A. 1949 Soils Classi- fication System Soil Regions Using The 7th Approximation Evaluation Of The U.S.D.A. 1949 Soils Classification And The 7th Approximation For Use In A Geographic Analysis	

	Page
Chapter	
V. POTENTIAL APPLICATIONS, SUMMARY, AND CONCLUSIONS OF THE STUDY	120
Potential Applications	
Summary	
Conclusions	
APPENDIXES	133
BIBLIOGRAPHY	149

LIST OF TABLES

Table		Page
3-1	Selected characteristics of prominent soil series in Coles County	50
4-1	Selected characteristics of the great soil groups in Coles County	88
4-2	1949 great soil group equivalents of the 7th Approximation orders in Coles County	92
4-3	Selected characteristics of the great groups in Coles County	107
4-4	Selected characteristics of the subgroups in Coles County	111

LIST OF ILLUSTRATIONS

Figure		Page
2-1	Extent of Wisconsin glaciation in Coles County	11
2-2	Topographic features of Coles County	12
2-3	An exposure of Wisconsin till in a Charleston Stone Company quarry approximately four miles east of Charleston, Illinois	15
2-4	Climatic graph for Coles County	17
2-5	Natural vegetation of Coles County	20
2-6	Parent materials of Coles County	26
2-7	An example of the heterogeneous mixture of material within Wisconsin glacial till, Coles County	28
2-8	Slope regions of Coles County	40
3-1	The Drummer silty clay loam found in Coles County	49
3-2	Selected chemical and morphological characteristics of soil series in Group I	49
3-3	The Flanagan, Dana, and Raub silt loams of Coles County	53
3-4	Selected chemical and morphological characteristics of soil series in Group II	53
3-5	The Fincastle, Strawn, Miami, Reesville, Russell, and Xenia silt loams of Coles County	56
3-6	Selected chemical and morphological characteristics of soil series in Group III	56
3-7	The Lawson silt loam of Coles County	61
3-8	Selected chemical and morphological characteristics of soil series in Group IV	61

Figure		Page
3-9	A picture of the Cisne silt loam used as representative of the Cowden silt loam of Coles County	63
3-10	Selected chemical and morphological characteristics of the soil series in Group V	63
3-11	Selected chemical and morphological characteristics of the soil series in Group VI	66
4-1	1949 order regions in Coles County	76
4-2	1949 suborder regions in Coles County	79
4-3	1949 great soil group regions in Coles County	82
4-4	7th Approximation order regions in Coles County	91
4-5	7th Approximation suborder regions in Coles County	96
4-6	7th Approximation great group regions in Coles County	101
4-7	7th Approximation subgroup regions in Coles County	109
5-1	Corn yield regions in Coles County	122
5-2	Soybean yield regions in Coles County	123



INTRODUCTION

Soil has been recognized as an important phenomenon in geographic investigation for some time. Carl O. Sauer, in 1922, urged geographers to acquaint themselves with soils and to formulate guidelines for the study of soils geography.¹ It was pointed out, in 1937, that "the study of soils has risen to the status of a distinct science" and "soil science is extending the application of its discoveries, in a multiplicity of directions into fields where hitherto its service has been more or less doubtful and confused."² Geographers have accepted the study of soils by the geographic method and have recognized it as a subfield of geography as evidenced by the devotion of an entire chapter to soils geography in American Geography: Inventory and Prospect.

Ekblaw has suggested two roles for soils in geographic studies: (1) a direct role as a component of a region
(2) an indirect role as an expressive resultant of

¹C.O. Sauer, "Notes on the Geographic Significance of Soils," Journal of Geography, XXI, No. V (May, 1922), p. 187.

²W. Elmer Ekblaw, "The Role of Soils in Geographic Interpretation," Annals of the Association of American Geographers, XXVIII (September, 1937), p. 149.

the many interrelationships of other components of a region.¹

The former is relatively straight-forward and easily understood, but the latter is, perhaps, less obvious. Soil, in an "indirect" role, has no power of movement and is influenced by many of the forces that operate within the environment such as climate and vegetation. It is the interrelationships of these forces that are reflected in the distinctive characteristics of a soil profile. Few other geographic phenomena possess this trait. For example, climate is modified by terrestrial features, but is ultimately dependent on extra-terrestrial forces. Landforms exhibit some results of precipitation and temperature, but they are also dependent upon lithic composition and geologic forces. Plants, animals, and men are all able to adjust or/and adapt to their surroundings. In addition, men are capable of altering their surroundings. Ekblaw is quick to point out that "as such, soils offer the best single basis for the classification . . . of the attributes of place in any region" because this is perhaps the one phenomenon that represents the largest number of qualities of the region in which it is found.²

Both roles of soils in geography indicate that soils should be very important in many aspects of physical and cul-

¹Ibid.

²Ibid., p. 151.

tural geography. However, soils geography, despite being accepted as a subfield of geography, generally receives little attention in geographic studies. Future development of soils geography requires that new ideas be conceived and critically examined through investigations carried out with capability, interest, and enthusiasm. It is hoped that this study will be only one of a great many contemporary studies needed in soils geography.

CHAPTER I

STATEMENT OF PURPOSE AND OBJECTIVES

The twofold purpose of this study is: (1) to analyze selected geographical aspects of Coles County soils which will serve as a basis (2) to test the validity of the 7th Approximation soil classification system¹ as a methodological concept in soils geography.

Selected Geographic Aspects Of Coles County Soils

Soils geography, as a important subfield of geography, is essential for a complete regional geography of an area of the earth's surface. The importance of the interrelationships between soil and other aspects of regional geography is particularly noticeable in Coles County, Illinois, because of the interest this agriculturally-oriented county has for its soils. The future agricultural, industrial, recreational, and educational development of Coles County have all pointed out the need to plan for the future. Soils are a resource of irreplaceable value that must be studied carefully and utilized wisely for

¹Refer to page 73 for a discussion of the 7th Approximation.

maximum growth of Coles County. There is no modern comprehensive soils survey of Coles County¹ and little has been written about the significant characteristics of the soils that are suitable for area planning in the future. Soils geography, however, does interpret the arrangement and character of soils as one of the geographic phenomena which give character and variation to the earth's surface from place to place.

To conduct the study, it is necessary to select aspects of the soils for study that: (1) make the most important contribution in understanding the total character of the soils in the area, and (2) result in areal variation of soils from place to place. The selected aspects that are studied in order to better understand the areal character of Coles County soils are:

- (1) identification and areal characteristics of significant soils in Coles County
- (2) soil profile characteristics
- (3) soil problems
- (4) use-potential of the soils.

¹R.S. Smith, E.E. DeTurk, F.C. Bauer, and L.H. Smith, Coles County Soils, Soil Report No. 44 (Urbana: University of Illinois Agricultural Experiment Station, August, 1929). The soils were described rather simply in terms of soil color, texture, and natural vegetation. Today, identification of soils is much more complex in which many chemical and physical characteristics of the soil profile are used. Thus, there is little similarity of the modern soil surveys and the existing one for Coles County.

Identification of the significant soils with some of their selected areal characteristics is perhaps the most basic information needed in a geographic soils study of an area; however, knowledge of the contemporary soils is not sufficient. Sound study and areal interpretation must consider the processes and factors working to produce the soils and their variation from place to place. Therefore, the five most significant genetic soil-forming factors: climate, parent material, time, the biosphere, and slope, are considered as they have operated in Coles County.

It is necessary to identify the significant soils found in Coles County in order to better understand the total areal soil character of the county. A sampling technique utilizing the soil series category¹ of modern soil classifications is used in the identification of soils. Soil series data provide location, profile characteristics, productivity indexes, and land-capability information needed for a geographic analysis of Coles County soils.

The location and areal extent of the various soil series found in Coles County are mapped in order to bring out soil patterns that possibly exist. It then is necessary to seek categories defined by selected criteria in order that the material can be organized into manageable form suitable for cartographic presentation. It is possible to generalize and to define soil regions derived from these categories.

¹Refer to page 44 for an explanation of soil series.

Hopefully, this investigation will not only reveal and provide geographically analyzed information concerning the soils of Coles County but, will also lead to the development and testing of a methodology that is viable in soils geography research.

Validity Of The 7th Approximation In A Geographical Analysis

The U.S.D.A. 1949 soils classification system has been used in soils geography for nearly two decades, but it has imposed some limitations on its geographical usefulness through the nature of its structural framework. Soil region maps will be constructed from soil series data using both the U.S.D.A. 1949 classification and the 7th Approximation. The characteristics of the resulting maps will be compared and analyzed in order to determine if the 7th Approximation provides groupings that are more meaningful and useful in a study of the geographic aspects of Coles County soils than does the 1949 classification.

Objectives Essential In Development Of The Study

The basic approach that is used to analyze selected geographical aspects of Coles County soils and to test the validity of the 7th Approximation as a methodological concept in soils geography is presented in the two previous sections.

In the process of developing this basic approach, several questions are considered: (1) What are the major chemical and morphological characteristics of selected, representative Coles County soils? (2) What interrelationships exist between soil characteristics and other selected phenomena in Coles County? (3) How may useful soil regions be defined and applied in Coles County? (4) Can a regional representation of soil resources in Coles County be constructed? (5) How may the current and potential uses of Coles County soils be interpreted? (6) Can methodological concepts in soils geography be developed in this study? (7) What conclusions may be drawn about the geographic aspects of Coles County soils and the validity of the 7th Approximation in a geographic analysis?

CHAPTER II

SOIL DEVELOPMENT IN COLES COUNTY

Origin And Formation Of The Soils

General Physical Geography of Coles County

Geology. Preglacial Coles County was located in the Pennsylvanian Lowland, a physiographic province, approximately 600 to 650 feet above sea level. The surface material was Pennsylvanian sedimentary rock composed mainly of weak shales, thin limestones, and some sandstones.¹ Preglacial topography was characterized by maturely eroded, rolling hills with local relief of 100 to 150 feet² and well developed stream patterns, particularly the preglacial Embarras River.³

Approximately two million years ago marked the beginning of the Pleistocene period during which much of the present land surface material of Coles County was deposited. Three of four glacial advances in North America (the Kansan, Illinoian, and the Wisconsin, respectively) are represented in Coles

¹Leland Horberg, Bedrock Topography of Illinois, Bulletin No. 73 (Urbana: Illinois State Geological Survey, 1950), p. 35.

²Nevin M. Fenneman, Physiography of Eastern United States (New York: McGraw-Hill Book Co., Inc., 1938), p. 303.

³Leland Horberg, Bulletin No. 73, p. 36.

County, but comparatively little is known about the effects of the Kansan glacial stage due to the age of the material and subsequent glaciation. The Illinoian glacial advance leveled many of the existing topographical features and deposited a relatively uniform layer of drift, 30 to 50 feet in depth,¹ upon the area. The Wisconsin glacial advance began about 50,000 years ago and reached its maximum southern extent in Illinois, as marked by the Shelbyville Moraine, about 25,000 years ago² (Fig. 2-1). The layer of Wisconsin drift, approximately 50 to 150 feet thick in Coles County,³ is the primary material from which present day surficial features are derived.

Topographic Characteristics. The Shelbyville Moraine, cutting across the central and southern portions of the county, is one of the most important and notable topographic features in Coles County (Fig. 2-2). Much of the Shelbyville Moraine is between 720 to 750 feet above sea level. However, the area of Coles County north of the Shelbyville Moraine generally lies at an elevation of 680 to 690 feet above sea level while areas south of the moraine are approximately 640 to 660 feet

¹Frank Leverett, The Illinois Glacial Lobe, Monograph No. 38 (Washington, D.C.: U.S. Geological Survey, U.S. Government Printing Office, 1899), p. 27.

²Herman L. Wascher, John D. Alexander, B.W. Ray, A.H. Beavers, and R.T. Odell, Characteristics of Soils Associated with Glacial Till in Northeastern Illinois, Bulletin 665 (Urbana: University of Illinois Agricultural Experiment Station, November, 1960), pp. 16-17. The Shelbyville Moraine is approximately 25,000 years old according to geological dating and 14,700 to 18,000 years old by radio-carbon dating.

³Frank Leverett, Monograph No. 38, p. 735.

SOURCE: GEORGE E. EKBLAW'S "GLACIAL MAP OF NORTHEASTERN ILLINOIS", 1960.

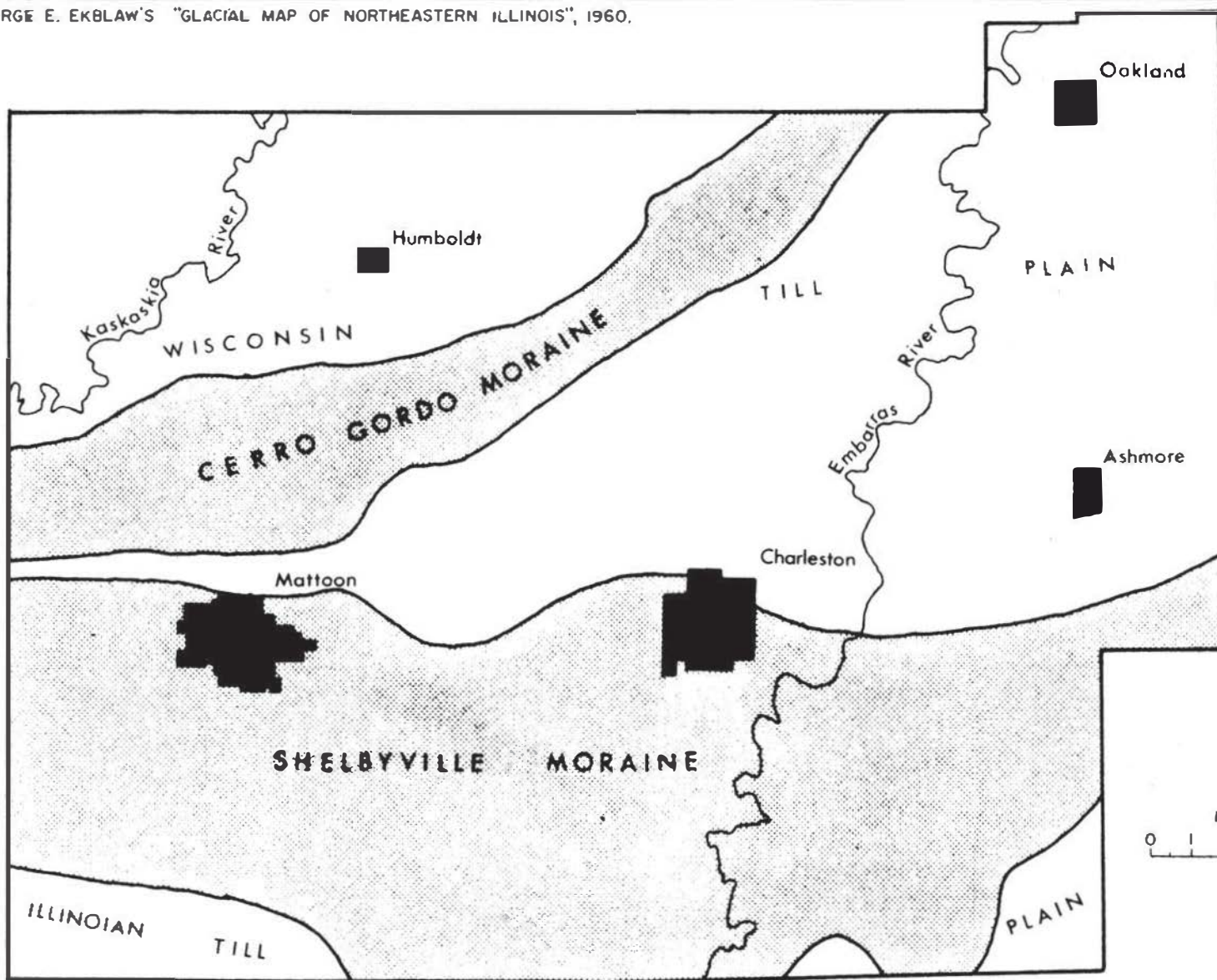


Fig. 2-2

TOPOGRAPHIC FEATURES OF COLES COUNTY

J.K. 8/67

above sea level. The highest elevation in the county is approximately 780 feet above sea level, found on the Shelbyville Moraine, and the lowest point is approximately 550 feet where the Embarras River crosses the Coles-Cumberland County line.

The portion of the study area on and north of the Shelbyville Moraine is typically undulating interfluvial land with slopes of 0 to 4 percent and local relief of 10 to 20 feet. Development of the Kaskaskia and Embarras River valleys and their tributaries have created greater local relief than in the interfluvial areas. Local relief along these streams range from 30 to 50 feet on the Kaskaskia River and up to 100 feet along the Embarras River. Slopes are very steep along the Embarras, over 10 percent,¹ whereas slopes on the Kaskaskia River are generally 6 to 10 percent. The outer edge of the Shelbyville Moraine is quite noticeable with slopes of 4 to 5 percent and a local relief of approximately 80 feet that occurs within a distance of 2 to 3½ miles. Relatively level land with slopes of 0 to 4 percent are found between the edge of the Shelbyville Moraine and the Coles-Cumberland County line on the Illinoian till in an "area distinguished mainly by its flatness."²

The surficial material in Coles County is of glacial origin except for minor outcropping of Greenup limestone in the south-central portion of the county and Livingston lime-

¹See Appendix A for definition of percent slope.

²M.M. Leighton, George Ekblaw, and Leland Horberg, Physiographic Divisions of Illinois, Report of Investigations No. 129 (Urbana: Illinois State Geological Survey, 1948), p. 26.

stone in the east-central portions of the county. The area of Coles County north of and including the Shelbyville Moraine has surface material composed of friable, calcareous¹ Wisconsin till and an overlying layer of loess 18 to 60 inches in thickness (Fig. 2-6) in areas of very minor erosion. The surface color of the till is usually quite dark, but the sub-surface is brownish-yellow for 8 to 20 feet below the surface and grades into a blue-gray color in the main body of the till² (Fig. 2-3). Surface colors are lighter along the valleys of the Embarras and Kaskaskia Rivers where loess deposits are thinner or perhaps absent on the stronger slopes. Varying quantities of glacial outwash material from the Wisconsin age are found on the outer face of the Shelbyville Moraine, in the moraine where the Embarras River has cut its valley, and in some areas south of the moraine.³ Glacial drift of the Illinoian age is found only in the southeastern and southwestern portions of Coles County. The Illinoian drift is much older than the Wisconsin material and has been weathered very intensely. Thus, surface colors usually range from light yellowish brown to light gray but may be darker, depending on the amount of loess present. The light surface colors usually grade into darker hues of gray or brown in the subsurface and between 8 and 20 feet the color becomes a dark blue-gray.⁴

¹Refer to Appendix A for definition of calcareous.

²Frank Leverett, Monograph No. 38, p. 97.

³Ibid., pp. 208-210.

⁴Ibid., p. 58.



Fig. 2-3 An exposure of Wisconsin till in a Charleston Stone Company quarry approximately four miles east of Charleston, Illinois.

The Kaskaskia River drains the northwest corner of the study area into the Mississippi River, whereas the Embarras and Little Wabash Rivers drain the rest of the study area into the Wabash River. However, away from the main bodies of these three rivers, the drainage pattern is poorly developed. Gentle slopes, low local relief, and the youth of the Wisconsin topography are the major factors responsible for poor natural drainage in Coles County. Artificial drainage is used extensively, particularly in central Coles County in order to make the land suitable for cultivation of crops.

Climatic Characteristics. The climate of Coles County is humid continental with warm summers (Daf) as categorized by the Köppen climatic classification system. Continental location, latitude, and cyclonic storms are the three principal controls of climate in the study area. Continental location and latitude are responsible for the contrast of summer and winter temperature.¹ January is generally the coldest month of the year with an average temperature of 29.6 degrees Fahrenheit and July is usually the warmest month with an average temperature of 77.1 degrees Fahrenheit² (Fig. 2-4). Cyclonic storms passing over Coles County at the rate of approximately

¹John L. Page, Climate of Illinois, Bulletin 532 (Urbana: University of Illinois Agricultural Experiment Station, April, 1949), p. 99.

²Department of Registration and Education, Local Climatological Data 1901-1962 Charleston, A Report Prepared by the Illinois State Water Survey Division (Urbana: State of Illinois, 1964). The climatic data is compiled from the above report using Charleston as representative of Coles County.

SOURCE: LOCAL CLIMATOLOGICAL DATA 1901-1962 CHARLESTON,
ILLINOIS STATE WATER SURVEY.

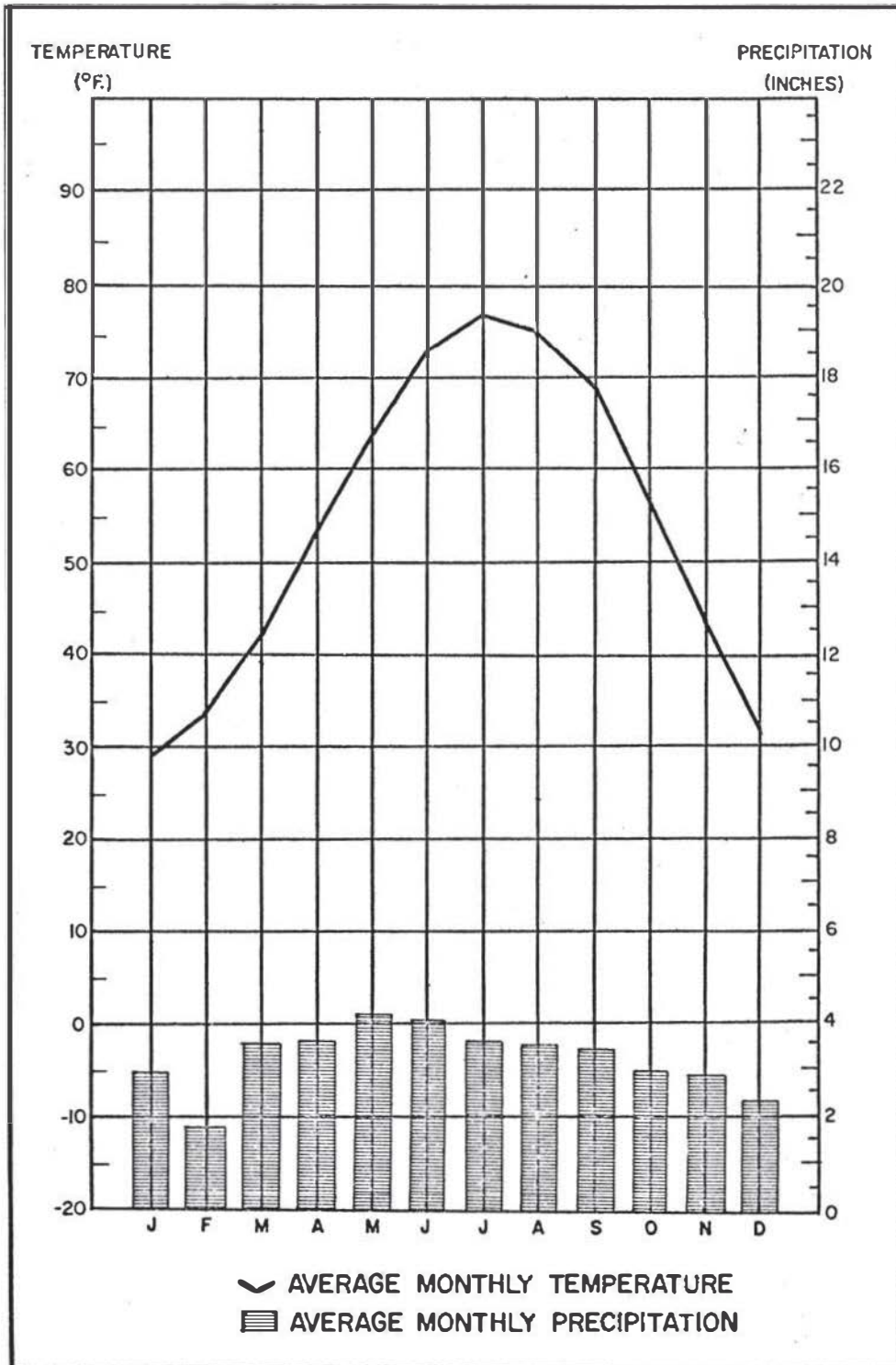


Fig. 2-4 CLIMATIC GRAPH FOR COLES COUNTY

25 per year are largely responsible for the variety of weather and much of the annual precipitation. The average yearly precipitation in Coles County is 38.43 inches with the average monthly precipitation varying from 1.95 inches in February to 4.20 inches in May. During the winter half-year (October to March) Coles County receives 42 percent of its annual precipitation and nearly all of its average annual snowfall of 17 inches. The average daily range of temperature in this period is from 16 to 24 degrees and the winds are generally from the west or northwest.¹

Coles County receives 58 percent of its annual precipitation during the summer half-year (April to September), much of which results from thunderstorms. The daily range of temperature averages 22 degrees to 25 degrees Fahrenheit and winds are generally from the west or southwest during these months.²

The growing season in Coles County coincides closely with the summer-half period. Normally, April 23rd is the date of the last frost in the spring and the first frost of the fall is on October 19th. Thus, Coles County has a growing season that is 178 days long. Wind directions and diurnal temperature ranges during the growing season are approximately the same as described for the summer half-year and it is during the

¹Ibid.

²Ibid.

growing season that Coles County receives 56 percent of its yearly precipitation.¹

Vegetation. Most of Coles County on and north of the Shelbyville Moraine was in prairie grass before man moved into the county in the mid to late 1800's (Fig. 2-5). The low, wet areas of youthful, poorly drained Wisconsin till were filled with bulrushes or slough grasses, while short and tall blue-stem grasses were located on higher, better drained land.² Prairie grasses of the same varieties were also found on the outer edge of the Shelbyville Moraine and in areas south of the moraine where forests had not been able to invade the locale.³

Trees were, nevertheless, able to grow along the Embarras and Kaskaskia River valleys to form galleria-type forests. Here, the soils were well drained and erosion had cut into the prairie sod which gave trees a chance to grow. Trees were also able to grow on portions of the outer edge of the Shelbyville Moraine on well-drained slopes and in eroded valleys. Thus, most of the Shelbyville Moraine in Coles County had a natural vegetation of forests due to extensive cutting by the Embarras River and its tributaries (Fig. 2-5). Generally,

¹Ibid.

²Homer C. Sampson, An Ecological Survey of the Prairie Vegetation of Illinois, Bulletin XIII, Art. XVI (Urbana: Illinois State Natural History Survey, August, 1921), pp. 569-570.

³Ibid., p. 547.

SOURCE: A. G. VESTAL, A PRELIMINARY VEGETATION MAP OF ILLINOIS.

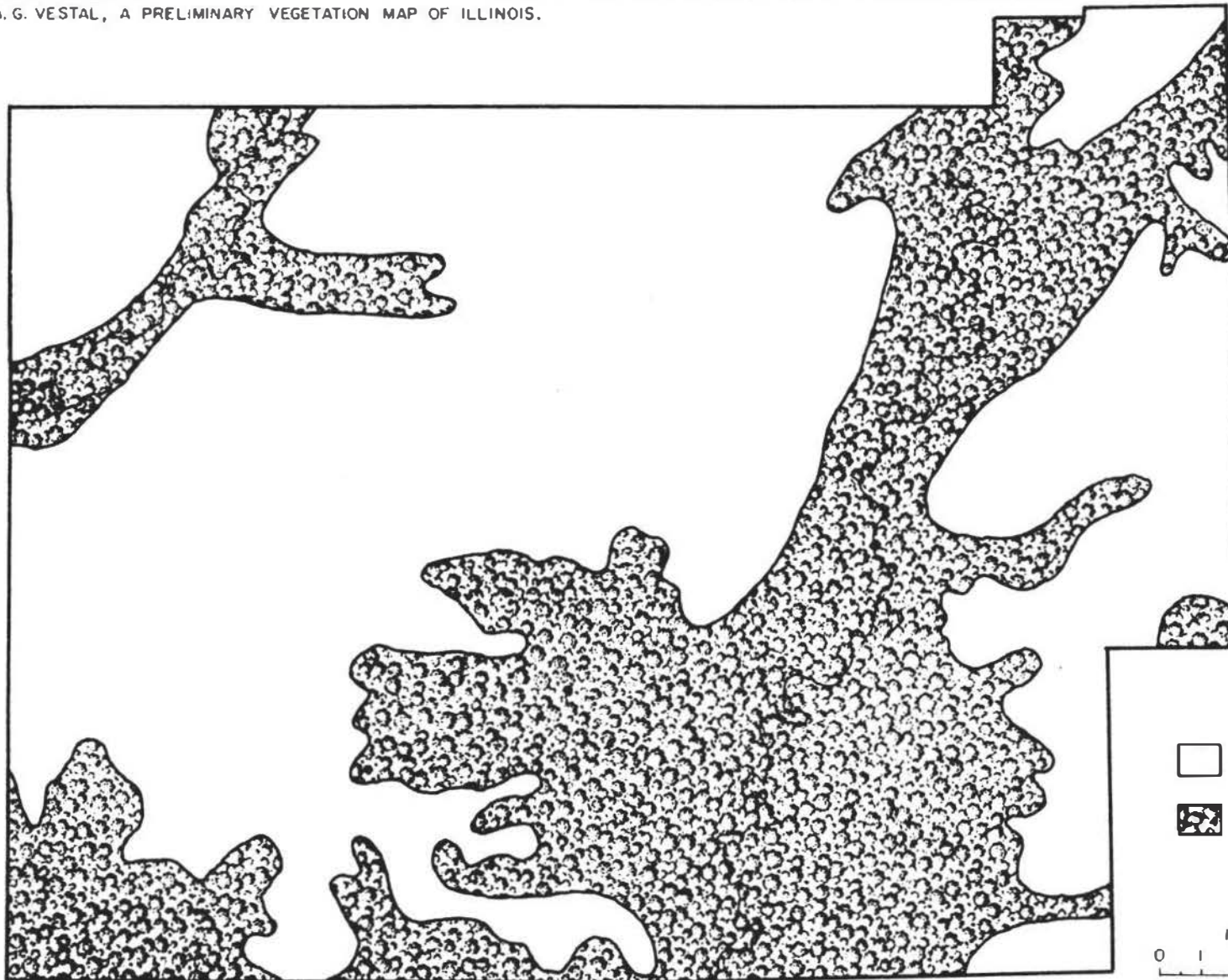


Fig. 2-5

NATURAL VEGETATION OF COLES COUNTY

JK 8/67

mixed hardwoods (black walnut, hard maple, ash, and various varieties of oaks and hickories) are located on the well-drained uplands, whereas trees such as the soft maple, willow, and sycamores are located in the poorly-drained areas.

Men have changed the vegetation pattern in Coles County greatly since the early 1800's. Tiling and open drainage ditches were used to lower the water table and the dark, rich prairie soils were plowed under so the land could be used for agriculture. Forested areas covered approximately 31 percent of Coles County in the early 1800's¹ and all but 6.8 percent of this has been cleared away by man.² The forests and woodlands have been utilized by man for his own consumption and for the farmland that became available once the trees were cleared away on the more level areas.

Analysis Of The Five Genetic Soil-Forming Factors Operating In Coles County

Time, parent materials, climate, the biosphere, and slope are recognized as the five most important genetic soil-

¹Clarence J. Telford, Third Report on a Forest Survey of Illinois, Bulletin XVI, Art. I (Urbana: Illinois State Natural History Survey, March, 1926), p. 59.

²College of Agriculture, Illinois Soil and Water Conservation Needs Inventory, A Report Prepared by the Illinois Soil and Water Conservation Needs Committee (Urbana: University of Illinois, 1st ed.: August, 1962), p. 39.

forming factors. Climate is usually recognized as the single most important factor because it influences such things as vegetation type and the types and rate of weathering in an area. However, variations in the other four factors usually occur within an area that has the same climate and thus are responsible for very different soils in the area. Each one of the five factors are analyzed as they operate in Coles County in order to better understand the origin and morphological characteristics of Coles County soils.

Time

The length of time required for development of a soil profile depends on many factors, such as climate, relief, and parent materials as they vary in space and operate through time. Consequently, it is difficult to establish a specific period of time that is needed for the evolution of soils in an area the size of Coles County. However, the study area does have parent materials of distinctly different age which has contributed to areal variation of the soils.

The parent material in the section of Coles County north of and including the Shelbyville Moraine is calcareous Wisconsin drift overlain by approximately 18 to 60 inches of calcareous Richland loess.¹ The two materials were deposited

¹John C. Frye, H.D. Glass, and H.B. Willman, Stratigraphy and Mineralogy of the Wisconsin Loesses of Illinois, Circular 344 (Urbana: Illinois State Geological Survey, 1962), p. 6.

in Coles County approximately 18,000 to 25,000 years before the present and have continually been subjected to soil-forming factors. The northern area of Coles County has moderately well developed soils. The soils are very fertile and productive; few serious limitations are imposed on agriculture. Intense weathering and great alteration of soils has not taken place in this part of Coles County. In fact, the soils reflect many of the qualities of the parent material from which they are derived.

The portions of Coles County south of the Shelbyville Moraine has 18 to 60 inches of Richland loess over Illinoian till as parent material for the soils. Illinoian till was deposited in Coles County approximately 120,000 years before the present. During the following 70,000 years, very strongly developed soils formed on the Illinoian till. Profiles are often 10 to 20 feet deep; the surficial five feet is intensively oxidized, leached, and chemically decomposed.¹ Easily weathered minerals and nutrients are absent and only a few pebbles are found in the upper five feet of the profile. The soils became very acidic throughout most of the solum and a very compact plastic layer, entitled gumbotil, was formed 20 to 25 inches below the soil surface.² Richland loess then

¹M.M. Leighton and Paul MacClintock, "Weathered Zones of the Drift-Sheets of Illinois," Report of Investigations, No. 20 (Urbana: Illinois State Geological Survey, 1930), pp. 43-44.

²Ibid., p. 46.

began to accumulate, probably very slowly,¹ on the acidic Illinoian till soils. Leaching of the calcareous loess was relatively rapid and by the close of the period of deposition the carbonate content was completely leached out.² Acidic conditions of the soil favored easy breakdown of minerals and organic matter of the soil. Therefore, soils in this part of Coles County were able to develop much more rapidly than those north of the Shelbyville Moraine because of a lack of free lime in the loess. Eluviation and illuviation³ of the loess began soon after deposition. Bases were leached rapidly and organic matter had little opportunity to accumulate in the A horizon. The soils formed under these conditions are very strongly developed. The soils are acidic and have fertility problems because of a lack of organic matter and available plant nutrients. A claypan is frequently formed in the B horizon which hampers drainage and makes it difficult for plant roots to grow. Located adjacent to one another in Coles County, the soils developed from the old Illinoian till-Richland loess combination present an amazing contrast to those developed from the young Wisconsin till-Richland loess combination.

¹Guy D. Smith, Illinois Loess - Variations in Its Properties and Distribution: A Pedological Interpretation, Bulletin 490 (Urbana: University of Illinois Agricultural Experiment Station, July, 1942), p. 143.

²Ibid., p. 178.

³Refer to Appendix A for definitions of eluviation and illuviation.

Some Coles County soils found along the river and stream bottoms have developed on alluvial materials. The alluvium is deposited periodically during times of flooding; thus, the material is so young that little or no soil development has taken place. However, the alluvial soils are generally fertile and productive for agricultural uses if flooding or high water table problems can be solved.

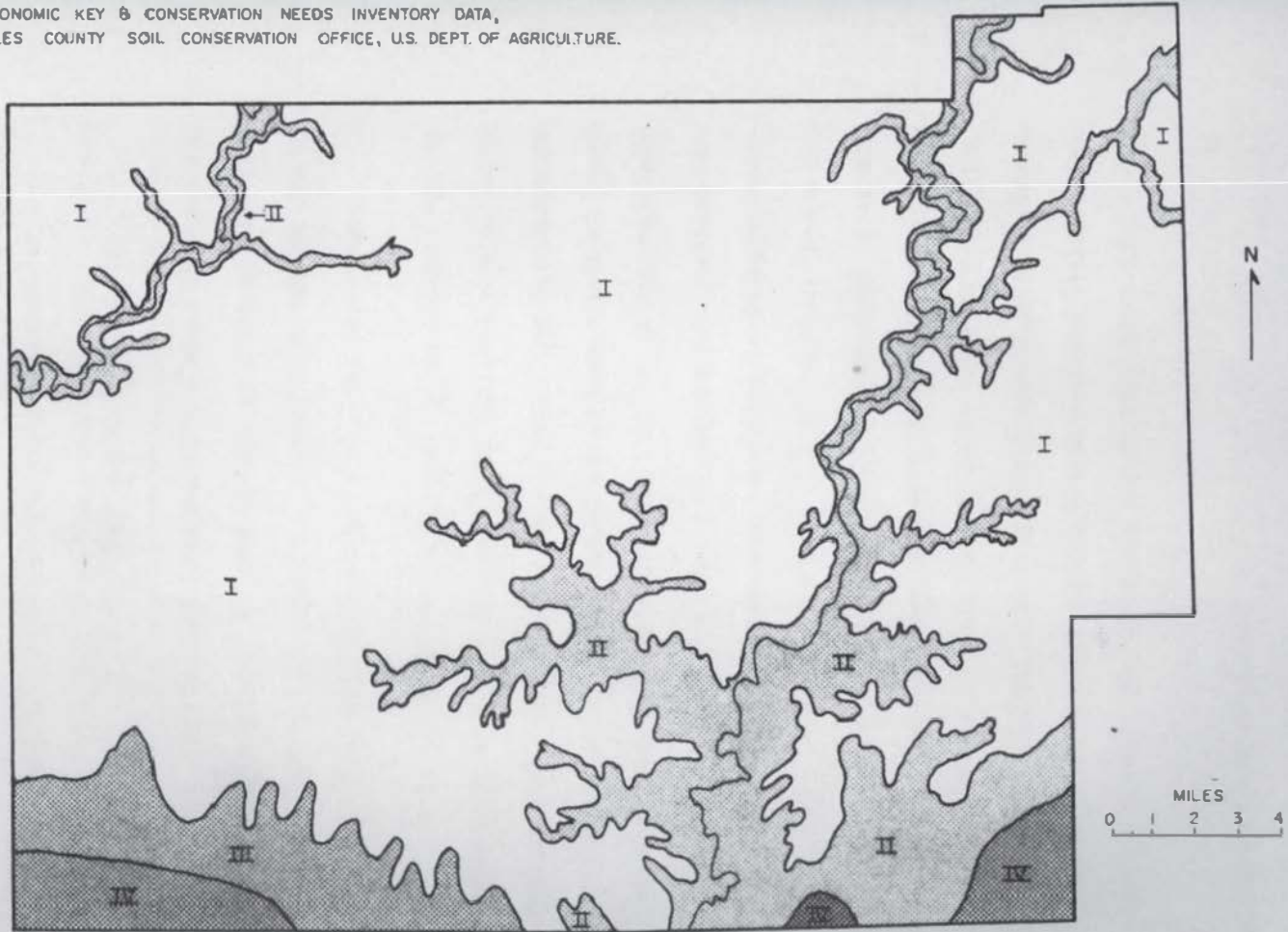
Parent Material

Coles County has several different parent materials important in soil development. The parent materials are nearly all unconsolidated, sedimentary materials but come from different sources and ages. Varying combinations of the parent materials have helped to produce significant areal variations in soils in Coles County.

The primary parent material in Region I in Fig. 2-6 is calcareous Wisconsin glacial till overlain by 18 to 60 inches of Richland loess. The loess, gray to yellow tan,¹ was carried by westerly winds from the floodplains of the Pleistocene Mississippi and Illinois Rivers and deposited in Coles County. The loess was probably nonstratified, homogenous, porous, and calcareous. Mineralogical studies of the loess in Coles County have not been undertaken, but similar materials

¹John C. Frye, H.D. Glass, and H.B. Willman, Circular 344, p.6.

SOURCE: TAXONOMIC KEY & CONSERVATION NEEDS INVENTORY DATA,
 COLES COUNTY SOIL CONSERVATION OFFICE, U.S. DEPT. OF AGRICULTURE.



PARENT MATERIALS OF COLES COUNTY SOILS

J.K. 8/67

LEGEND.





- | | | | |
|---|-----|-----------|--|
|  | I | PRIMARY | - 18-60" Loess on Wisconsin till |
|  | II | PRIMARY | - 0-60" Loess on Wisconsin till |
| | | SECONDARY | - Alluvium |
|  | III | PRIMARY | - 0-60" Loess on Wisconsin till |
| | | SECONDARY | - 18-60" Silty material on Wisconsin outwash |
|  | IV | PRIMARY | - Over 45" Loess on Illinoian till |
| | | SECONDARY | - 18-60" Silty material on Wisconsin outwash |

Fig 2-6

-26-

elsewhere consist of particles of quartz, feldspars, calcite, dolomite, limestone, and other minerals that are held together by clay particles.¹

The A and part of the B horizons of soils in Region I have several characteristics derived from the loess cover. For example, the Richland loess has a silt loam texture² and consequently, soils in Region I have loam, silt loam, or silty clay loam textures. As a result, the soils are easily penetrated by plant roots and water. Drainage is usually adequate but enough moisture is held to sustain abundant plant life. Also, leaching is relatively slow and thus, organic material can be easily accumulated to accompany the mineral-holding clay fraction of the soil that produces very fertile soils. Loess is easily weathered enabling Region I soil profiles to be moderately well developed with well defined horizons and thick solums. Another important factor in this development is the presence of the underlying Wisconsin age till.

Wisconsin till is a loam textured material and contains on the average approximately 1 percent cobbles and boulders, 9 percent pebbles, 35 percent sand, 35 percent silt, and 30 percent clay (Fig. 2-7). However, this may vary 50 percent in

¹ William D. Thornbury, Principles of Geomorphology (New York: John Wiley and Sons, Inc., 1954), p. 312.

² See Appendix A for definition of soil texture and textural classes.

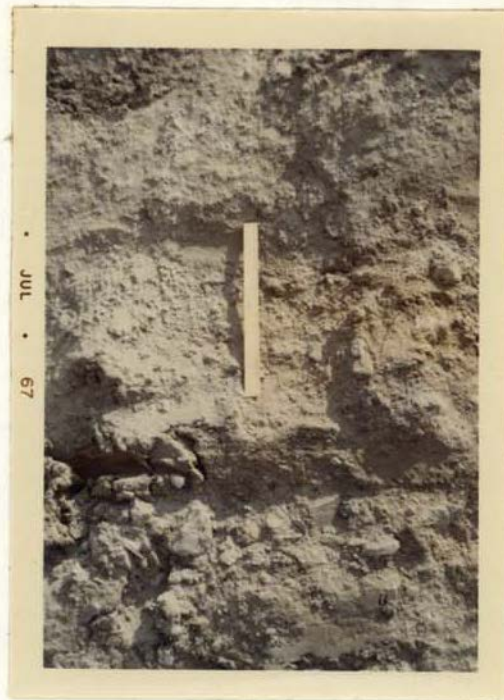


Fig. 2-7 An example of the heterogeneous mixture of material within Wisconsin glacial till, Coles County. (Taken in a Charleston Stone Company quarry approximately four miles east of Charleston, Illinois.)

any of the fractions.¹ Limestone and dolomite commonly compose 20 to 40 percent of the till² and limestone often accounts for more than 60 percent of the material over 2 mm. (about 1/12 inch).³ Approximately the lower 1/3 of the B horizon in the soil profile is Wisconsin till and is generally calcareous within 1 foot of the bottom of the B horizon. Since Wisconsin till is calcareous, medium textured and unweathered, it acts as a favorable C horizon with qualities similar to those of loess. Consequently, Richland loess and calcareous Wisconsin drift have combined to form well developed, desirable soils, especially for agricultural use.

The parent materials of primary importance in Region II are loess over Wisconsin till and Wisconsin till. Soils developed on slopes of less than 7 percent have generally retained from 39 to 60 inches of loess over the Wisconsin till. These soils are very similar to the soils of Region I in fertility, profile development, and texture. They are very productive and have few limitations for agricultural use. Soils developed on slopes of 7 to 12 percent have generally retained 18 to 39 inches of loess over the Wisconsin till. They have loam, silt loam, or clay loam textures as do soils of Region I.

¹H.B. Willman, H.B., Glass, and John C. Frye, Mineralogy of Glacial Till and Their Weathering Profiles in Illinois, Circular 400 (Urbana: Illinois State Geological Survey, 1966), p. 53.

²Ibid., p. 11.

³H.L. Wascher, "Glacial Till of Wisconsin Age in Illinois," Agronomy Facts, No. SP-7 (Urbana: University of Illinois College of Agriculture, May 2, 1955), p. 1.

The soil profiles are well developed but thinner than those in Region I because of erosion. Rapid runoff of water also washes much of the organic matter and mineral content out of the soil rapidly. Fertility and erosion are the major problems of these soils.

Some Region II soils are formed on alluvial materials along the Embarras River and tributary valleys. The parent material for the soils is dark colored, mildly to moderately alkaline,¹ and has a moderately fine to medium texture. The alluvial soils are only very slightly to moderately developed and the dark colors indicate a relatively high organic matter content. The loam to silt loam textures are favorable for easy plant growth and water movement through the soil. Periodic flooding helps to renew the fertility of the alluvial soils, but may, along with a high water table, make them difficult to use for agricultural purposes.

Due to severe erosion or/and slopes of over 12 percent on which the loess could not accumulate, the Wisconsin till is exposed and becomes the primary parent material for soils. The soils derived from Wisconsin till usually have a loam or silt loam texture and a solum thickness of approximately one foot. The profile is characteristically poorly developed or non-existent on the steeper slopes because of severe erosion and rapid runoff. Fertility is, likewise, often a problem

¹Refer to Appendix A for pH values.

because of little chance for the accumulation of organic matter.

Parent materials of Region III are primarily loess over Wisconsin till and Wisconsin till. The characteristics of the loess on Wisconsin till and the Wisconsin till parent materials and their soils are the same as those discussed as being of primary importance in Region II.

The parent material of secondary importance in Region III is 18 to 60 inches of silty material over Wisconsin outwash. The soils developed from this combination are usually found in level or nearly level areas. They have moderately well developed or well developed soil profiles and silt loam to silty clay loam textures. In the areas where the silty material and Wisconsin outwash are located on Wisconsin till, the soils are high in organic matter, fertile, only slightly acid, and have a structure¹ favorable for plant growth and easy movement of water. However, in some portions of Region III, the silty material and Wisconsin outwash were deposited on Illinoian till. Soils formed here are moderately acid, low in organic matter, have a platy A₂ horizon, and may have a claypan in the B₂ horizon. The claypan and platy A₂ horizon hamper easy movement of water through the soil and make it difficult for plant root growth. Drainage and fertility are major problems of these soils.

¹See Appendix A for definition of soil structure.

The parent material of soils in Region IV are primarily derived from approximately 45 inches of loess on weathered Illinoian till. The soils developed from the 45 inches of loess on Illinoian till have a silt loam texture in the A and in portions of the B horizons reflecting the silt loam texture of the thick loess. The remaining characteristics of these soils is largely attributed to the underlying Illinoian till. The main body of the Illinoian till has approximately the same mineralogical composition and texture as the Wisconsin till. However, as has been pointed out, the Illinoian till is much older than the Wisconsin till and is weathered so badly that it is scarcely recognizable as once having been unaltered till. The loess was leached of its carbonate content by the acidic, weathered soils on which it was deposited and soil development proceeded quickly. The profiles of the soils are acidic and very strongly developed with well defined horizons. The strongly leached A₂ horizon is nearly a foot thick with a platy structure and a claypan is found in the B horizon about 20 to 40 inches below the soil surface. Fertility is usually low because of the rapid leaching of organic matter and available minerals in the A and B horizons. The claypan hampers drainage and plant roots have difficulty in penetrating this nearly impervious layer. Thus, poor structure, poor drainage, and low fertility are problems of the soils of this area.

Eighteen to sixty inches of silty material on Wisconsin outwash is the parent material of secondary importance for soils

in Region IV. The two materials have been deposited primarily on Illinoian till. The soils have well developed profiles and silt loam to silty clay loam textures. As it was brought out in the discussion of the parent materials of secondary importance in Region III, soils formed from this combination are moderately acid and infertile. Water moves through the soil very slowly and has drainage problems.

Climate

One of the most influential factors in the development of Coles County soils is the climate. Climate is primarily responsible for the nature and rate of the weathering processes which are essential in most soil development. This may be more fully recognized by recalling the major change in composition and appearance of the Illinoian till as it became extremely weathered. In the study area, disintegration of rocks and minerals takes place during the winter when temperatures are commonly below freezing (Fig. 2-4). Chemical decomposition proceeds rapidly and efficiently during the summer when temperatures are commonly 75 to 85 degrees Fahrenheit, precipitation is plentiful and is frequent, and the relative humidity is high. Also summer climatic conditions are very favorable for a high rate of biological activity which helps to decompose organic matter in the soil.

The climate, through temperature and precipitation is also primarily responsible for the type of vegetation that is

able to exist in an area. The natural vegetation in Coles County is both prairie and forest. This does not, however, indicate that the study area has several different climates. It is believed by Homer C. Sampson,¹ John R. Borchert,² and others that the prairies were established in portions of the area when a drier climate prevailed as the Wisconsin glacial age came to a close. In the past few thousand years, the climate has become more humid and favorable for tree growth and thus, forests have encroached upon the prairies. Therefore, climate may be the reason for the two different types of vegetation in Coles County as well as being a major factor in soil formation.

The climate, through the nature of precipitation, greatly influences the rate of erosion and the fluctuating water table level in portions of Coles County. During much of the winter half-year, the soil is frozen. Erosion is relatively slow and the water table level is near normal during this period. As the soil thaws and the spring rains begin, erosion rate increases rapidly, particularly on the more sloping land. The Embarras and Kaskaskia Rivers are usually flooded with soil laden water. The more level land experiences some erosion, and the water table level may be near or at the soil surface. During the

¹Homer C. Sampson, Bulletin XIII, Art. XVI, p. 569.

²John R. Borchert, "The Climate of the Central North American Grassland," Annals of the Association of American Geographers, XL (March, 1950), p. 36.

time of a high water table, the normal soil formation processes are nearly completely halted. The sudden, violent downpours of rain during July, August, and September are also responsible for short periods of rapid soil erosion and high water tables.

Biosphere

Plant and animal life, particularly the former, are very important in the formation of soils in Coles County and they are one of the principal factors responsible for major soil differences within the county. Every form of life, no matter how large or minute, plays one or possibly all of the following roles in soil formation: (1) breakdown or synthesizes organic matter, air or water into more useful forms, (2) adds organic matter to the soil, and (3) mixes soils, thus affects the soil structure.

Macroanimals, such as mice, moles, and groundhogs, aerate and incorporate organic matter into the soil. Ants, beetles, snails, and slugs are only a few of the animals that feed on raw organic matter and thus, initiate the decomposition process. One of the most important of the macroanimals is the earthworm. Earthworms dig up the soil and ingest much of the organic matter that is present in the soil; they not only digest the organic matter, but also break down various minerals into forms more easily used by plant life. The importance of earthworms is pointed out by the fact that it is common to find $\frac{1}{2}$ million earthworms per acre in the types of soils found in

Coles County and these worms often pass 15 tons of dry earth per acre through their bodies annually.¹ Man is a "macroanimal" who is often neglected as a factor in soil development. True, he is a relatively new factor, but his increasing technology for using soils makes him very influential in their development. For example, he may slow soil formation by landscaping or plowing, speed it through irrigation or drainage, or alter it by fertilization or burning. As the human population grows, man will have increasingly important effects on soils that cannot be neglected.²

Soil microanimals, such as nematodes and protozoa, serve to breakdown organic matter. Both nematodes and protozoa are numerous in soils, but the nematodes often carry disease to higher plants. Rotifers are recognized as an important micro-animal but their function is not clearly understood.

Microflora are more abundant and influential in soil development than are microfauna. Plant roots are probably more important than all other forms of microflora combined. An acre of corn, for example, has been estimated to add 6,000 pounds of roots to the soil as organic residue.³ As well as

¹Harry D. Buckman and Nyle C. Brady, The Nature and Properties of Soils (New York: MacMillan Company, 1964), p. 108.

²O.W. Bidwell and F.D. Hole, "Man as a Factor of Soil Formation," Soil Science, IC (Jan, 1965), pp. 71-72.

³Harry D. Buckman and Nyle C. Brady, p. 114.

adding organic material to the soil, roots have organic acids that dissolve organic matter and make it more useful for themselves. The roots also help form various compounds which stimulate vigorous activity by other microflora that normally act very slowly.¹ It is difficult to study the specific functions of some microflora, such as algae, fungi, and bacteria, because of their complex interactions. However, green algae and fungi are known to breakdown organic matter and bring nitrogen into the surface layers of the soils. The algae are generally more numerous in grasslands than in the forested areas. Bacteria are the most important microorganisms found in Coles County soils. The bacteria are generally present in the breakdown of organic material and some of the microorganisms are able to perform nitrification, sulfur oxidation, and nitrogen fixation.² These enzymic transformations must be carried on for higher plant life to survive.

The two basic types of native vegetation in Coles County, tall prairie grasses and broadleaf deciduous forests (Fig. 2-5), is one of the most influential factors responsible for the major variations of soil character within the county. The prairie grasses that were present in Coles County over 150 years ago had very thick, deep root systems that were high in organic content that prevented nutrients from leaching out of soils. Thus, soils formed under the prairie vegetation have a

¹Ibid.

²Ibid., p. 122.

thick, dark colored A horizon that is rich in organic content. The clays and bases have been retained so that leaching is held to a minimum and a pH of 6 to 6.5 is maintained. Roots of the broadleaf deciduous trees are very deep and take minerals from the soil. Organic matter is returned to the soil more slowly by the tree leaves than by prairie grasses and leaching of bases and clays is carried on more rapidly under the forest vegetation than under the grass vegetation. The forested soils, thus, have a thinner A₁ horizon with little organic content and a leached, platy, light colored A₂ horizon. The A horizon of the forested soil is usually somewhat more acidic (pH - 5.0 to 6.0) than the A horizon of the prairie soil and often contains much less clay due to leaching and accumulation in lower horizons. With other factors held relatively constant, the two different types of vegetation present in Coles County has resulted in two types of soils with very different physical and chemical characteristics.

Slope

The variation in slope is another of the main causes for soil differences from place to place in Coles County. Soil profile development is affected by the degree of slope in three ways: (1) by influencing the amount of precipitation that is absorbed and retained in the soil, (2) by influencing the rate of erosion, and (3) by directing the movement of materials

from one area to another.¹ It is apparent, therefore, that the amount of slope may determine such things as moisture content, organic content, horizon color and development, and thickness of the solum in soils. Thus, it is possible to develop slope regions that, in turn, promote different soil characteristics from region to region.

A generalized map of the slope regions in Coles County is shown in Fig. 2-8. Region I is characterized by average slope of $\frac{1}{2}$ percent and individual slopes from 0-4 percent. The soils in this region receives organic matter, minerals, and water from the surrounding slopes. Soil profiles have dark colored surfaces and are usually 3 to 4 feet deep. The drainage is generally poor and the water is near the soil surface in the wetter seasons. Thus, the B horizon is usually poorly developed or differentiated from the A horizon because little eluviation or illuviation is able to take place. The B horizon is very dark gray or brown with various colored mottles present indicating the poor drainage.

The areas of low slope designated as Region I A are found on the nearly level or level areas of loess over Wisconsin till. The calcareous quality of the loess and Wisconsin till, slow movement of water through the soil, and prairie have all helped to keep the soils from being acid and leached. The soils are therefore very productive for growing crops if artificial drainage is provided.

¹C.E. Millar, L.M. Turk, H.D. Foth, Fundamentals of Soil Science (New York: John Wiley and Sons, Inc., 1958), p. 124.

SOURCE: SOIL SERIES SHEETS & CONSERVATION NEEDS
 INVENTORY DATA, COLES COUNTY SOIL
 CONSERVATION OFFICE, U.S. DEPT. OF AGRICULTURE.

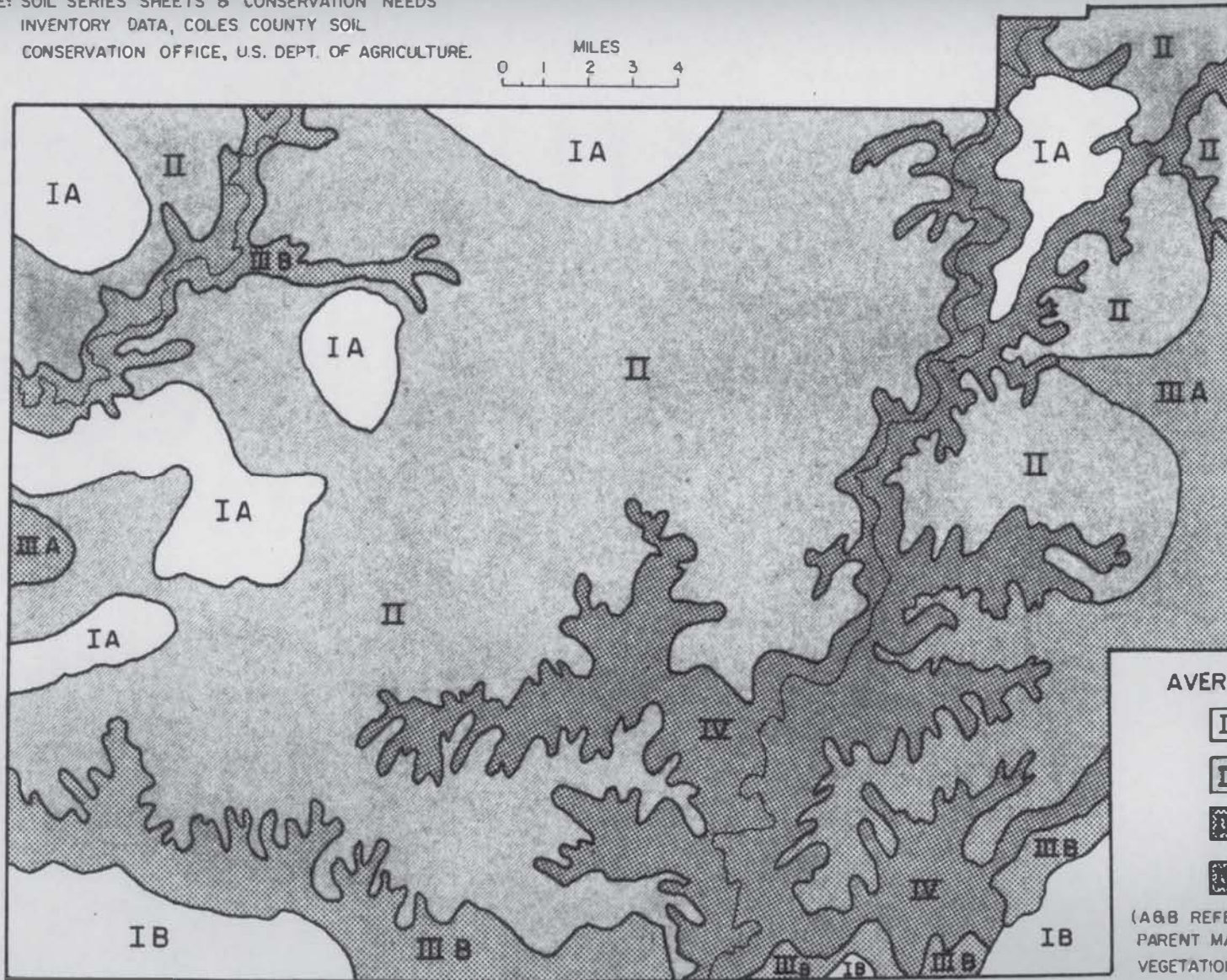
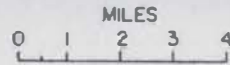


Fig. 2-8

-40-

AVERAGE SLOPE

- I .5%
- II 1.5%
- III 3.0%
- IV 6.0%

(A&B REFER TO VARIATION OF
 PARENT MATERIAL OR NATURAL
 VEGETATION IN A REGION)

SLOPE REGIONS OF COLES COUNTY

J.K. 8/67

Soils in Region I B have been developed from loess that was deposited on the acidic Illinoian till. The loess was soon leached of its bases and became acidic. This speeded up soil formation and resulted in more strongly developed soils than in Region I A. The A₁ horizon is acidic but may be dark colored due to organic matter and minerals received from surrounding soils. A light colored, strongly leached A₂ horizon exists below the A₁. The B₂ horizon may have a claypan due to eluviation and illuviation of clays. Fertility as well as drainage problems must be solved in order to use soils in Region I B for cultivation.

Soils in Region II have average slopes of 1½ percent and individual slopes of 1 to 7 percent are most common. The A horizon of soils in Region II have developed primarily from loess on Wisconsin till under a prairie vegetation similar to Region I A. The A horizon is very dark colored due to a high organic matter content whereas the B horizon is lighter in color because organic matter is broken down rapidly on the relatively well-drained soils. The B horizon has a higher clay content than the A horizon which indicates eluviation and illuviation is present. The soil profiles are 3 to 4 feet thick, much like those of Region I. Erosion and rapid runoff on the soils on the higher slopes of Region II keeps the soil profiles from becoming thicker than profiles in Region I. The leaching of minerals and organic matter and erosion due to the higher slopes in Region II make these the major problems in the cultivation of the soils.

Slopes in Region III have average slopes of 3 percent and individual slope range from 0 to 12 percent. Soil profiles of Region III are approximately 3 to 3½ feet thick and have developed on 18 to 60 inches of loess over Wisconsin till. The A horizon is somewhat darker than the B horizon because of a higher organic matter content. The B horizon is well developed and has a higher clay content than does the A horizon because of eluviation and illuviation. Erosion and fertility are the main agricultural problems of these soils.

Soils in Region III A have developed under a prairie vegetation. They have dark surface colors due to the high amount of organic matter that has been returned to the soils. They have not been leached of their bases; therefore they do not become highly acidic. However, the soils in Region III B have generally developed under a forest vegetation. They have a light colored A₁ horizon and an A₂ horizon which indicated relatively strong leaching. Consequently, they are more acidic and somewhat less fertile than soils in Region III A.

Slopes in Region IV average 6 percent and commonly range from 2 to 15 percent. Soil profiles may be absent or nearly so on slopes of over 12 percent. Severe erosion and little downward movement of water through the soil do not readily permit soil development. Loess is often eroded away and Wisconsin till is the parent material for the soils. A broadleaf deciduous forest is the natural vegetation type on the soils that are able to form. Thus, there is an acidic

A₁ horizon with a loam or silt loam texture and a leached A₂ horizon beneath it. The B horizon is very stony and has more clay than the A₁ or A₂ horizons due to leaching. Erosion and fertility are major problems of soils that are found on the steep slopes; they can seldom be used for crop cultivation. Soils that occur on slopes of 2 to 12 percent in Region IV have profiles deeper than soils on the steeper slopes but have erosion and fertility problems.

CHAPTER III

SOIL RESOURCES OF COLES COUNTY

Soil Series Classification In Coles County

A general description of the physical geography of Coles County and the development of Coles County soils have been presented. It is necessary to understand the interrelationships between the soil character and other phenomena in an areal framework in order to geographically analyze Coles County soils. It is also necessary to find and use a soils grouping that will divide the soils into distinctive units and provide information about the phenomena related to the soils in that unit.

Basic Character of Soil Series

"A soil series is a group of soils developed from the same kind of parent material, by the same genetic combination of processes, and whose horizons are quite similar in their arrangement and general characteristics."¹ The series name is a shorthand term for soils with the same horizons with

¹Harry D. Buckman and Nyle C. Brady, p. 322.

regard to: (1) number, (2) order, (3) thickness, (4) color, (5) structure, (6) acidity or alkalinity, (7) humus content, and (8) texture in the subsurface horizons.¹ A soil series can, thus, convey a general picture of topography, drainage conditions, general nutrient content, and productivity for crops raised on the soils. There may be variations within a series with regard to the texture of the surface horizon, slope of the surface, stoniness, and degree of erosion, although these variations are usually slight and tend not to make a difference in agricultural activities.

The suitability of the soil series for use in this study becomes more apparent upon examination of the categories immediately larger and smaller than the soil series. Soil series may be grouped, theoretically, into soil families. However, the guidelines for defining the soil family have not yet been formulated. The great soil group follows the family in a soils classification hierarchy and it is used for grouping the soils of large areas such as large states.

The soil type is the category into which soil series have been subdivided based upon differences in the texture of the A horizon. However, it is unlikely that the differences of surface texture will be great within a series because the soil series, by definition, has developed similar soil profiles by similar processes on the same kind of parent material. A soil

¹C.E. Millar, L.M. Turk, H.D. Foth, p. 129.

series also usually has one dominant surface texture and thus, one dominant type with several minor types. However, the importance of texture size in the A horizon is highly variable and it has been abandoned in the 7th Approximation. The soil series grouping is designed to be used on a topographic scale. The soil series level is used to map areas of $\frac{1}{2}$ to 100 acres in Coles County. To summarize, the soil series provides needed information on a scale that is much more suitable in the study of an area the size of Coles County than do any of the other levels of soil classification.

Soil Series Data - Coles County

Coles County lacks a modern soils survey, therefore it is necessary to use sources that provide relatively up-to-date soil series information about Coles County soils. The Soil and Water Conservation Needs Inventory is a national inventory of soil, land use, and land-capability used to estimate the soil and water conservation practices that are needed to maintain and improve the present soil resources for agriculture.

The inventory in Coles County was based upon data gathered from a set of randomized, one-fourth-section samples. The sampling technique was carried out in a manner that insures an adequate geographical distribution of quarter-sections would be obtained. Approximately 2 percent of the land area of the county was considered sufficient for the needs of the survey. Each quarter-section was mapped and the information was plotted

on an aerial photograph with a scale of 16 inches to one mile. The author gained access to each one of the 44 quarter-sections that had been mapped in Coles County. Each soil series in each quarter-section was planimetered in order to obtain areal distribution of the series. It was found, however, that additional soil series data was needed for portions of the county in order that analysis and interpretation would be more complete and accurate. Soil series data comparable to that provided by the inventory was obtained from 25 additional quarter-sections enrolled in the Coles County conservation program by the soil and water conservation district co-operators. Thus, the total area sampled in this study was 10,559 acres or approximately 3 $\frac{1}{2}$ percent of the total land area of Coles County.

Fifty-six soil series that are known to exist in Coles County were encountered during the data gathering process. However, many of the fifty-six series are insignificant in regard to the acreage and the percent of the total sample area that they occupy (refer to Appendix B). Therefore; the eleven soil series, each of which account for over 2 percent of the total sample area, are considered to be the most significant soils suitable for closer consideration. The eleven soil series contain characteristics of all but two major great soil groups found in Coles County. To compensate for this lack of representation, two soil series that each account for between 1 and 2 percent of the total sample area and possess characteristics of the two respective groups are added to the original

eleven soil series. An analysis of selected characteristics of the thirteen representative soil series, which together account for over 82 percent of the total sample area, will help to portray a clearer, more accurate representative picture of all Coles County soils.

Analysis of the Prominent Series

The thirteen representative soil series have been divided into six groups for the analysis. Each group has similarities in physical characteristics, problems, and relationships to other physical and cultural phenomena.

Group I contains only one soil series, the Drummer silty clay loam (Fig. 3-1), that accounts for 29½ percent of the total sample area (Table 3-1). The Drummer has two main well developed genetic horizons, the A₁ and B₂, that together are approximately 4 feet in thickness and rest on the C horizon (parent material) (Fig. 3-1). The A₁ is relatively thick, 12 to 20 inches, and has a black color partially due to the high organic matter content that has been contributed to it by the natural vegetation of sedges and slough grass. The soil has been formed on level to depressional slopes, and thus, poor drainage is also partially responsible for the dark color and is the main problem for agricultural practices on the soil. The A₁ horizon has a silty clay loam texture and a granular structure. Both the texture and structure are favorable for



Fig. 3-1 THE DRUMMER SILTY CLAY LOAM FOUND IN COLES COUNTY.
 (All profile photographs were taken at the Douglas County Soil Conservation Service, Tuscola, Ill.)

Fig. 3-2 SELECTED CHEMICAL AND MORPHOLOGICAL CHARACTERISTICS OF SOIL SERIES IN GROUP I



- | | |
|----------------|--|
| A ₁ | color - black
thickness - 12-20"
texture - silty clay loam
structure - granular
pH - 5.6-6.5 |
| B ₂ | color - dk. gray (yellow and gray mottles)
thickness - 18-24"
texture - silty clay loam
structure - subangular blocky
pH - 6.1-6.5 |
| C | color - mixed gray and brown
texture - loam, silt loam, sandy loam
pH _{cent} - 7.9-8.4
parent material - non-calcareous Wisconsin till |

(Characteristics for all representative profiles are from soil series sheets and the Work Unit Handbook, Coles County Soil Conservation Service, Charleston, Ill.)

Table 3-1 SELECTED CHARACTERISTICS OF PROMINENT SOIL SERIES IN COLES COUNTY

No.	Soil Series	Percent Of Total Area	Problems ^a	Average ^a Percent Slope	Natural ^{a+b} Vegetation	Parent ^c Material	Land ^d Capab.	Productivity ^e		
								Low Level Managem.	Mod. High Level Managem.	
GROUP I	152	Drummer silty clay loam	29.52	(1) drainage (2) maintenance of tilth	$\frac{1}{2}$	Sedges, slough grasses	39-60" loess over Wisc. till	II	100	120
	154	Flanagan silt loam	12.80	(1) erosion (2) drainage	2	Prairie	39-60" loess over Wisc. till	I, II	85	125
GROUP II	481	Raub silt loam	6.37	(1) erosion (2) drainage	2	Prairie	18-39" loess on Wisc. till	I, II	90	125
	56	Dana silt loam	2.02	(1) erosion (2) fertility	$4\frac{1}{2}$	Prairie	18-39" loess on Wisc. till	I, II, III, IV	65	105
	291	Xenia silt loam	5.64	(1) erosion (2) fertility	3	Forest	18-39" loess on Wisc. till	I, II, III, IV	80	115
	496	Fincastle silt loam	5.0	(1) drainage (2) erosion	1	Forest	18-39" loess on Wisc. till	II	70	100
	224	Strawn silt loam	4.79	(1) erosion (2) fertility	10	Forest	Wisc. till	II, III, IV, VI, VII	45	85
GROUP III	236	Reesville silt loam	4.22	(1) drainage (2) erosion	$1\frac{1}{2}$	Forest	18-39" loess on Wisc. till	II	70	110
	322	Russell silt loam	4.06	(1) erosion (2) fertility	$7\frac{1}{2}$	Forest	18-39" loess on Wisc. till	II, III, IV, VI	50	100
	27	Miami loam - silt loam	2.56	(1) erosion (2) fertility	7	Forest	Less than 18" loess on Wisc. till	II, III, IV, VI	45	85
GROUP IV	451	Lawson silt loam	2.68	(1) drainage (2) overflow	$\frac{1}{2}$	Prairie	Alluvium	I, II, V	75	110
GROUP V	112	Cowden silt loam	1.78	(1) fertility (2) drainage	1	Prairie	More than 45" loess on Ill. till	II	40	95
GROUP VI	25	Hennepin silt loam	1.02	(1) erosion (2) fertility	$12\frac{1}{2}$	Forest	Wisc. till	IV, VI	10	20

Source: a = Soil series sheets, Charleston, Illinois: Coles County Soil Conservation Service.

b = H.L. Wascher, J.B. Fehrenbacher, R.T. Odell, and P.T. Veale, Illinois Soil Type Descriptions, No. AG-1443 (Urbana: University of Illinois Agricultural Experiment Station, 1950).

c = U.S. Soil Conservation Service, "Taxonomic Key," Coles County Work Unit Handbook, Sec. I, Part 3 (Charleston, Illinois: Soil Conservation Service).

d = U.S. Soil Conservation Service, "Land Capability," Coles County Technical Guide, Sec. II, A-1 (Charleston, Illinois: Soil Conservation Service). A full explanation of each class can be found in Appendix A.

e = These are productivity indexes given in Illinois Soil Type Descriptions. The method of arriving at the index is discussed on pp. 33-35. However, it is used here merely as a way of comparing over-all productivity of the soil series.

easy penetration by plant roots and water as well as having more surface area which provides a large available supply of minerals and soil moisture suitable for good plant growth. The A₁ horizon is slightly to moderately acid which is favorable for plant growth but lime is often added to the soil to compensate for the acidity.

The B₂ horizon, 18 to 24 inches thick, is dark gray with a silty clay loam texture as is present in the A₁ horizon. However, the B₂ horizon has a subangular blocky structure and it is mottled with yellow and gray due to poor drainage and a fluctuating water level. There is an area of gleying in the upper portion of the B₂ horizon due to saturation of the soil with water in the presence of organic matter over long periods of time. The blocky structure and gley portion of the B₂ horizon tend to slow water drainage and hamper root growth very slightly. Soil reaction is very favorable for plant growth in the B₂ horizon as it is only slightly acid near the top of the horizon and it is neutral near the C horizon.

The upper portion of the C horizon is approximately 6 inches of gray and brown, loam textured, waterlaid material of the Wisconsin age that rests on Wisconsin till. Soil reaction in the upper portion of the C horizon is moderately alkaline with some free carbonates contained in it and it is definitely calcareous approximately 5 feet below the surface of the soil when unaltered Wisconsin till is reached.

A high natural fertility and its other favorable characteristics for plant growth makes the Drummer silty clay loam a good soil for agricultural uses. It does have poor natural drainage but that may be corrected by the use of artificial drainage. The Drummer silty clay loam is a class II soil in the land-capability classification system¹ which indicates that any problem the soil might have can be solved relatively easily and then adapted to a wide variety of agricultural practices. The natural fertility is high enough that productivity is good even under poor management practices, however, the productivity of the soil does not rise appreciably when used under a moderately high level of management.

Group II contains three soil series, Flanagan, Raub, and Dana silt loams (Fig. 3-3), that are responsible for over 21 percent of the sample area (Table 3-1). The A₁ and B₂ horizons together are usually 3 to 4½ feet thick (Fig. 3-4). The A₁ horizon, 10 to 18 inches thick, is very dark brown to black because of a relatively high humus content accumulated under prairie grass vegetation and frequent saturation by water. The slightly lighter colored and thinner A₁ horizon indicates that the soils are developed on more sloping land, the natural drainage is better, and leaching is carried on at a more rapid

¹This is a system devised by the U.S. Soil Conservation Service which groups soils according to their ability to respond to management when used for cultivation. Class I soils have few limitations and respond the best to good management while those in class VIII have limitations so severe that they cannot be used for cultivation.

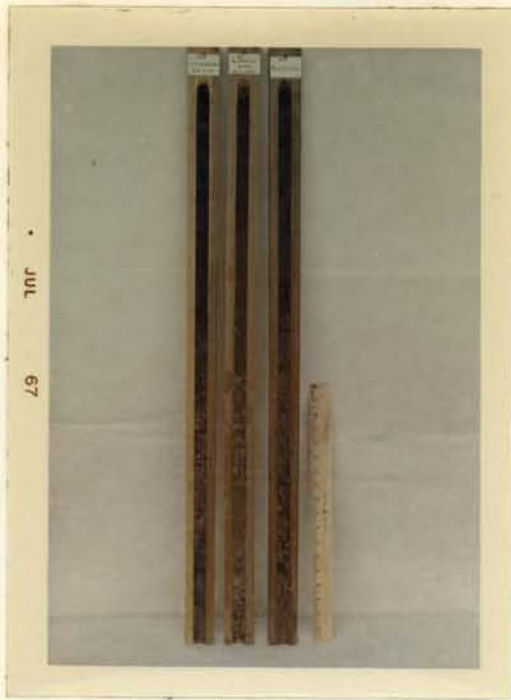
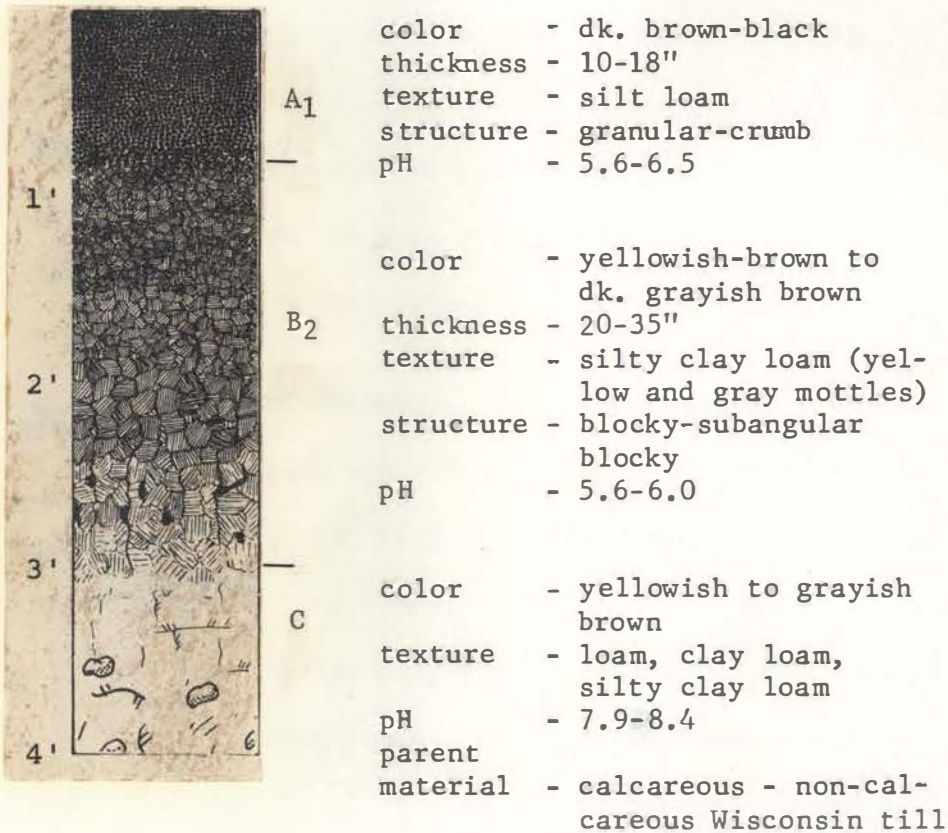


Fig. 3-3 THE FLANAGAN, DANA, AND RAUB SILT LOAMS OF COLES COUNTY.

Fig. 3-4 SELECTED CHEMICAL AND MORPHOLOGICAL CHARACTERISTICS OF SOIL SERIES IN GROUP II



rate than in Group I. A silt loam texture and a crumb structure in the A₁ horizon are excellent for plant growth. The A₁ is slightly to moderately acid and occasionally must have lime added to provide a better environment for plant growth.

The B₂ horizon is 20 to 35 inches thick and is a yellowish-brown loam with yellow and gray mottles. The lighter colors are due to less organic matter than in the A₁ horizon and good drainage or/and aeration for parts of the year. The yellow and gray mottling indicates a fluctuating water level is present. A change from the silt loam textured A₁ horizon to a silty clay loam texture in the B₂ horizon points to active illuviation and eluviation. The B₂ horizon is medium acid which reflects the leaching that has occurred.

The C horizon is yellowish to grayish-brown and may have yellow or/and gray mottles present if the drainage is periodically poor. A silt loam textured loess or clay loam Wisconsin till that is moderately alkaline is present approximately 3 to 4 feet below the soil surface and becomes calcareous approximately 4 feet below the soil surface.

Slope differences, from an average of 2 percent on the Flanagan and Raub silt loams to an average of 4½ percent on the Dana silt loam, have caused a noticeable difference in the three series. The Flanagan and Raub can be either class I or class II in the land-capability classification depending upon the slope. Lower slopes have some drainage problems, but not

enough to require conservation practices when used for most agricultural purposes. The higher slopes on the Flanagan and Raub series usually makes them class II soils because erosion becomes a problem that requires minor conservation practices. Productivity at both the low level and moderately high level of management is approximately the same for the two series. The natural fertility is somewhat lower than in the Group I (Drummer) soil and consequently these soils do not yield as well at the low level of management. However, the Flanagan and Raub respond well to good management and thus, productivity can be increased nearly twice as much as on the Drummer.

The Dana silt loam ranges from a class I soil on the lower slopes to the more difficult to manage class IV soil on the higher slopes. Erosion is the main problem in all the capability classes but fertility may become an important problem on the steeper, well-drained slopes. The productivity of the Dana silt loam does not compare favorably with the Flanagan and the Raub silt loams at the low management level because of a lower humus content and erosion problems. However, the productivity on the Dana may be increased as much as either the Raub or Flanagan if well managed.

Six of the thirteen representative soil series (Fig. 3-5) and over 26 percent of the total sample area are contained in Group III (Table 3-1). The solums of the series in this

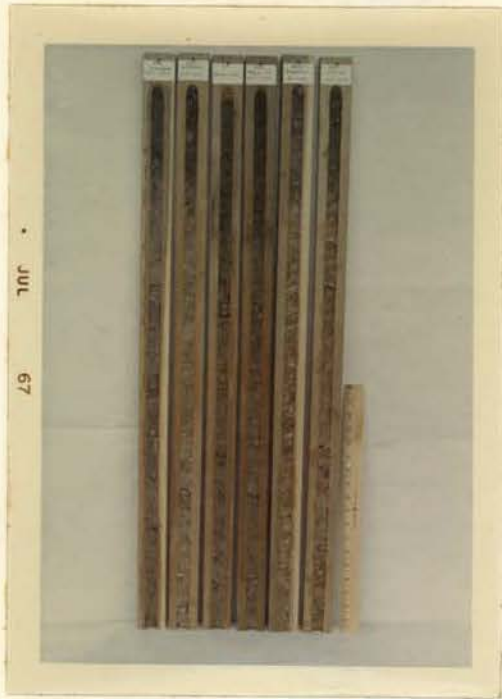
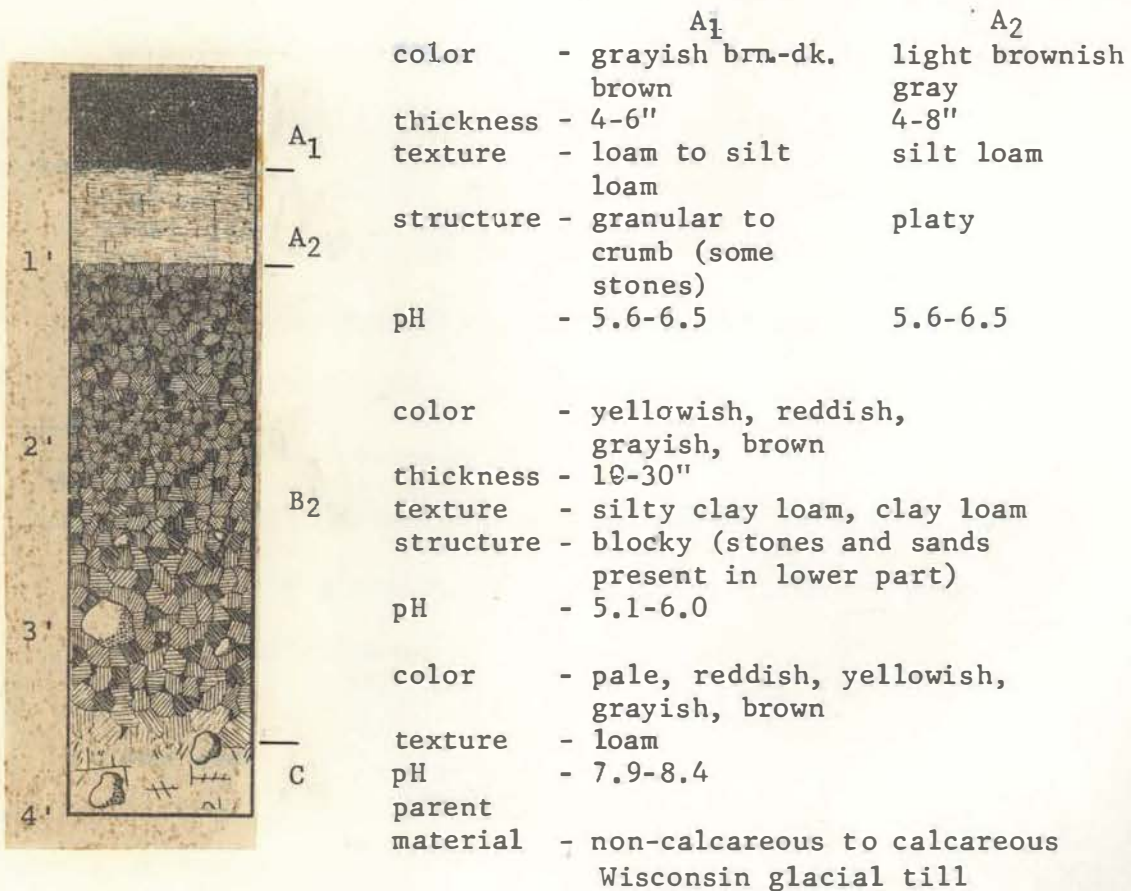


Fig. 3-5 THE FINCASTLE, STRAWN, MIAMI, REESVILLE, RUSSELL, AND XENIA SILT LOAMS OF COLES COUNTY.

Fig. 3-6 SELECTED CHEMICAL AND MORPHOLOGICAL CHARACTERISTICS OF SOIL SERIES IN GROUP III



group are 3 to 3½ feet thick (Fig. 3-6). The A₁ horizon is 4 to 6 inches thick, if erosion has not taken place, and it has a grayish-brown to dark grayish-brown color. The series were developed under a forest vegetation which contributes less organic matter to the soil than the prairie grasses which results in a brown color. The soils occur on slopes averaging from 1 to 10 percent on which thin A₁ horizons with light colors are generally developed due to rapid leaching of materials, such as humus, and rapid erosion. As a result, the A₁ horizon is slightly to medium acid and often requires liming for the best plant growth conditions. Loam to silt loam textures and granular or crumb structures provide for easy root penetration and relatively rapid water movement.

An A₂ horizon, approximately 4 to 8 inches in thickness, is present in Group III soils. The A₂ is a light brownish-gray horizon that is slightly to medium acid. Strong leaching has removed nearly all organic matter and perhaps some of the clay, iron, and aluminum from the A₂. Thus, this is a zone of accumulated resistant minerals, such as quartz, that give the A₂ its light color and acidic properties. It is often difficult for plant roots to grow well in the acidic soil that has such a low organic matter content. The A₂ has a silt loam texture but the structure is platy which tends to impede root growth and water movement.

The B₂ horizon may be yellowish, reddish, or grayish brown, depending upon soil aeration and soil drainage. Yellow and gray mottling is present in the blocky structured B₂ horizon when water is frequently present. Illuviation of clay from the A₁ horizon into B₂ horizon has resulted in a silty clay loam or clay loam texture subsoil. The upper part of the B₂ is generally more acidic (medium to strongly acid) than either the A₁ or A₂ horizons because of the strong leaching and little humus added to the soil at this depth. However, the B horizon usually becomes less acid as the C horizon is approached.

The upper portion of the C horizon is Wisconsin loam till or silt loam loess that varies in color from a pale, to a yellowish, to reddish, or grayish-brown. The C horizon is moderately alkaline and generally becomes calcareous at a depth of 3 to 4 feet below the soil surface.

As in Group II, the variation in slope appears to be the most important factor in the differentiation of series within the group. The Fincastle and Reesville series are found on slopes averaging 1 to 1½ percent. Both series are in class II because of minor drainage and erosion problems that are easily overcome by conservation practices if used for agricultural purposes. The two series are not quite as productive as the soils in Groups I or II under either the low level or moderately high level of management but they respond well to good

agricultural practices.

The Xenia silt loam is found on slopes averaging 3 percent and may vary in land-capability from class I to class IV. Erosion is the main problem of the series but low fertility also becomes a severe problem on higher slopes. The drainage of the Xenia is better than on the Fincastle or Reesville which is reflected by higher productivity than on the Fincastle or Reesville when used under a low level of management. The productivity of the Xenia is also higher than it is on either the Fincastle or Reesville when cultivated under a moderately high level of management, but the productivity may be increased by approximately the same amount on all three series from a low level of management to a moderately high level of management.

The Miami, Russell, and Strawn series are found on slopes averaging 7 to 10 percent. Thus, severe erosion and poor fertility are the major problems of the three series. The three series are found in capability classes II, III, IV, and VI. Classes II and III require some conservation practices but are generally suitable for cultivation. Class IV may have some limited cultivation but class VI is so steeply sloping that cultivation is not practical although it may be used for pasture and woodland. The three series have a very low productivity when used under a low level of management. Severe erosion cuts away the surface layers of the soil rapidly and organic matter is leached or/and eroded away nearly as quickly

as it is deposited. However, if proper conservation practices are used and fertilizers are added to nourish the soils under a moderately high level of management the productivity may be nearly doubled.

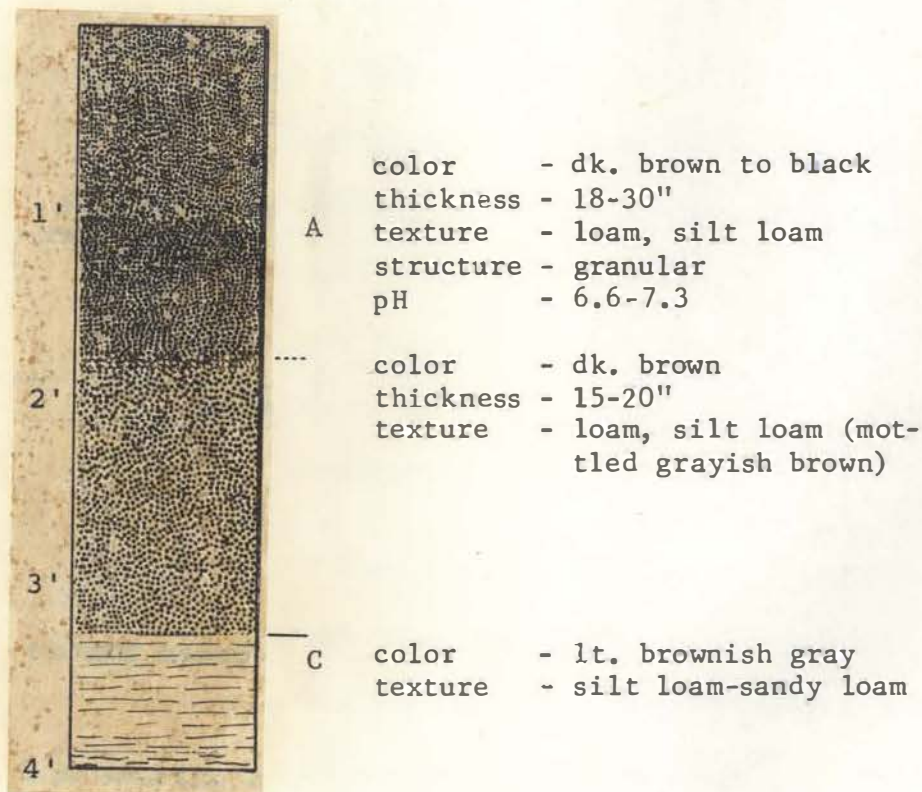
Group IV is represented by one soil series, the Lawson silt loam, which is an alluvial soil that covers approximately 2.7 percent of the sample area (Table 3-1). The solum consists entirely of an A₁ horizon 3 to 3½ feet thick that rests upon the C horizon. The physical characteristics of the Lawson are relatively uniform throughout the A₁ horizon. The organic matter content is very high in the top 18 to 30 inches of the A₁ due to prairie vegetation. A dark brown color is present in the lower 15 to 20 inches of the A₁ where less organic matter is able to accumulate. The loam or silt loam texture throughout the A₁ horizon and the granular structure in the upper portion of the A₁ are favorable for easy plant growth and water movement through the soil. Grayish-brown mottling is present in the lower 15 to 20 inches of the A₁ horizon due to a high water table during wetter seasons of the year. The soil reaction is neutral throughout the A₁ horizon which indicates a high content of bases and little if any leaching of the soil.

A light brownish silt loam to sandy loam waterlaid material makes up the C horizon and the soil reaction is neutral as it is in the A₁ horizon.



Fig. 3-7 THE LAWSON SILT LOAM OF COLES COUNTY.

Fig. 3-8 SELECTED CHEMICAL AND MORPHOLOGICAL CHARACTERISTICS OF THE SOIL SERIES IN GROUP IV.



Since the Lawson silt loam is an alluvial soil it has level or nearly level slopes. When the drainage is poor and overflowing is frequent, it is a class V soil which is not generally suitable for cultivation. If the two problems are relatively minor, the Lawson is a class I or II soil that requires little conservation practices to be suitable for cultivation. The natural fertility of the Lawson is high and consequently it has a relatively high productivity when used under a low level of management and responds well to a moderately high level of management. Thus, the productivity of the Lawson compares favorably with those of the soils in Groups I and II.

Group V consists of one soil series, the Cowden silt loam (Fig. 3-9), that covers 1.78 percent of the total sample area (Table 3-1). The solum of the Cowden silt loam is approximately 4 feet thick and has A₁, A₂, and B₂ horizons (Fig. 3-10). The A₁ horizon is a dark grayish-brown color that has developed under a prairie vegetation. The light color in the A₁ is the result of rapid leaching of the humus under the medium acid condition of the soil. The silt loam texture and granular structure favor good plant growth but lime must generally be added to the acidic A₁ horizon in order to obtain the best possible growth conditions.

Cowden silt loam has a A₂ horizon that is 10 to 14 inches thick and has a gray color due to the intense leaching of humus and other easily removed minerals. Thus, minerals resistant to weathering, such as quartz, tend to accumulate and to produce

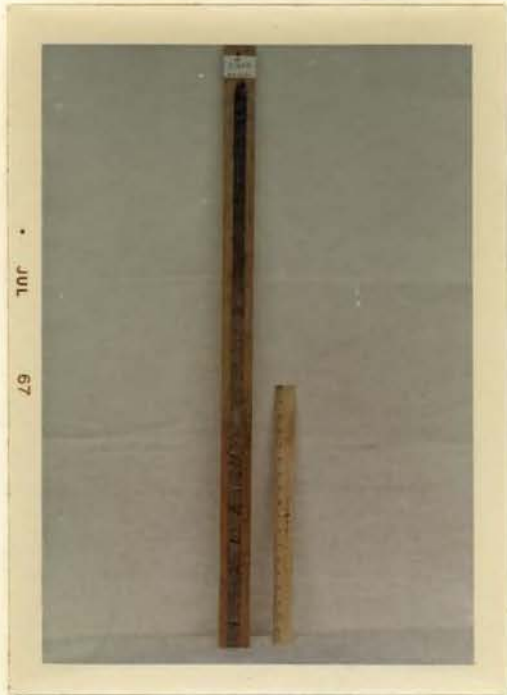
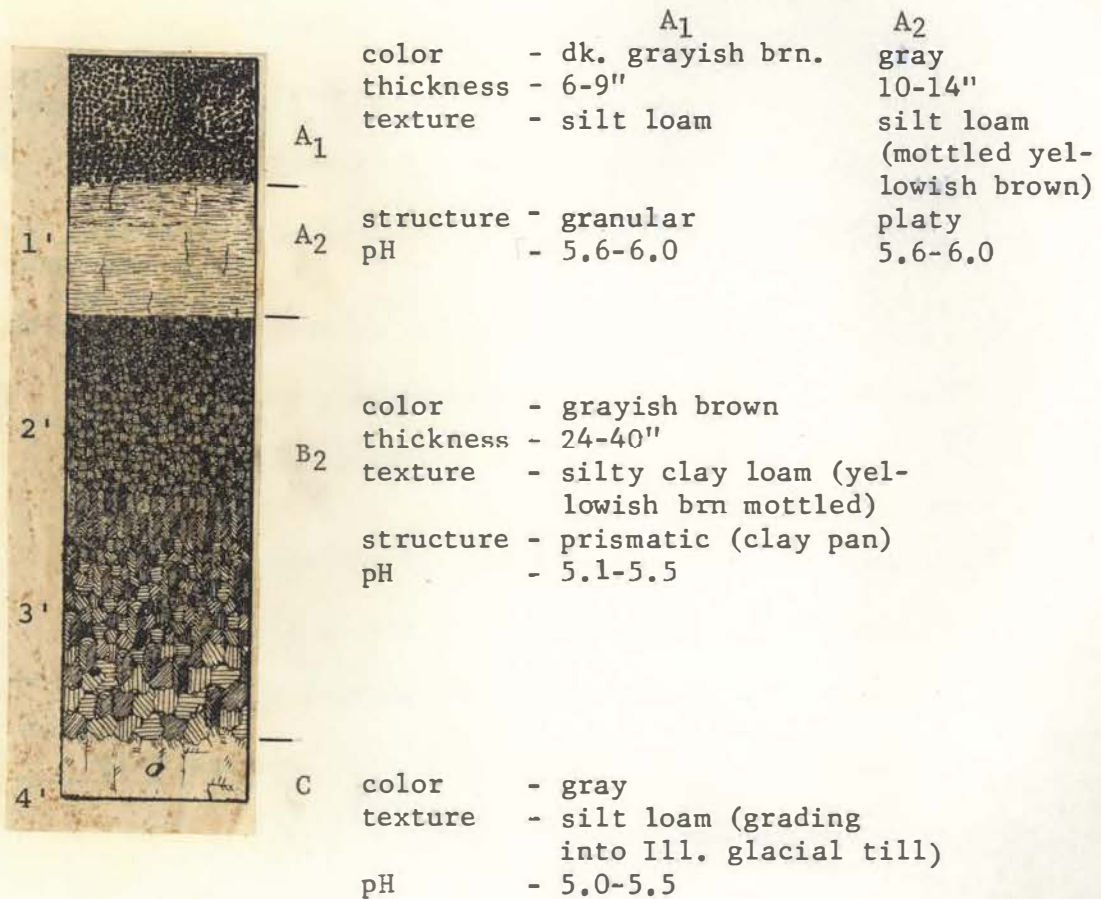


Fig. 3-9 The Cisne silt loam profile pictured here is very similar to the Cowden silt loam of Coles County.

Fig. 3-10 SELECTED CHEMICAL AND MORPHOLOGICAL CHARACTERISTICS OF THE SOIL SERIES IN GROUP V



a light colored, infertile A₂ horizon. The A₂ has a silt loam texture but a platy structure due to the intense weathering. Plant growth and water drainage tend to be impeded by the platy structure and yellowish-brown mottles are present in the A₁ as a result of poor drainage.

The B₂ horizon is 24 to 40 inches thick and has a grayish-brown color due to the low humus content. The silty clay loam texture of the B₂ horizon rather than a silt loam texture is mainly the result of illuviation of clay particles from the A horizon. The structure of B₂ is prismatic or/and blocky, and a claypan that may be 20 inches thick is present in the upper portion of the B₂ horizon. Eluviation and illuviation of clay particles and sodium from the A horizon causes the claypan. Consequently, drainage is poor in the B₂ and it has yellowish-brown mottles. Further evidence of strong leaching is the strongly acid condition of the upper 1 to 1½ feet of the B₂ horizon with moderately alkaline conditions in the lower one-half of the B₂ horizon where many bases are deposited.

The C horizon is a gray, silt loam, acidic material that grades into strongly weathered Illinoian till approximately 5 feet below the soil surface.

Although the Cowden silt loam has been developed from thick loess, it is a well developed acidic soil because the loess was quickly leached free of carbonates by the acidic, weathered Illinoian till upon which it was deposited. Thus, Cowden silt loam is a class II soil that has a problem of low

fertility. Poor drainage is the second most prevalent problem of the Cowden series because of its low slope (average of 1 percent) and poor soil structure in the A₂ and B₂ horizons which do not permit easy movement of water. The Cowden series has a low productivity when poorly managed, but if good artificial drainage and fertilizers are used the productivity may be more than doubled.

Hennepin loam is the only series in Group VI and covers 1.02 percent of the study area (Table 3-1). A₁, A₂, and B₂ horizons tend to develop in the Hennepin and may be nearly one foot thick if uneroded (Fig. 3-11). The Hennepin loam occurs on slopes averaging 12½ percent and thus, the horizons are often eroded away quickly and have little opportunity to develop. When a horizon is able to develop, it has many characteristics of the C horizon from which it is derived. It is yellowish-brown or perhaps a grayish-brown if a little organic matter is able to accumulate. A loam rather than a silt loam texture is found in the solum because the rapid movement of water through the soil carries away many of the silt particles very quickly. Some stones are present in the genetic horizon because they have not had an opportunity to be decomposed and disintegrated in the poorly developed Hennepin loam. The genetic horizon has a neutral reaction because of little opportunity for leaching to have taken place.

The parent material for the Hennepin loam is yellowish-brown to reddish-brown Wisconsin glacial till. The calcareous

Fig. 3-11 SELECTED CHEMICAL AND MORPHOLOGICAL CHARACTERISTICS OF THE SOIL SERIES IN GROUP VI



A
color - grayish brn.-yellowish brn.
thickness - 6-14"
texture - loam
structure - granular (small stones)
pH - 6.7-7.3

C
color - yellowish brn. to reddish brn.
texture - silt loam
parent material - calcareous silt loam, sandy loam, Wis. glacial till
pH - 7.9-8.4

till has a silt loam or sandy loam texture.

Hennepin loam may be a class IV soil on the lower slopes and thus, has a limited amount of cultivation on it if erosion and fertility problems are overcome. Even with a moderately high level of management, the productivity is quite low and this is the poorest soil for cultivation of the entire thirteen series. Hennepin loam is most generally a class VI or class VII soil that is suited to pasture or woodland uses only.

A Resume Of Soil Resources,
Soil Series Data

The total area of the thirteen prominent soil series examined represents approximately 82 percent of the total sample area. Data used in the analyses of the thirteen soil series point out some aspects of the soil resources in the sample area which, for many purposes can be expanded to be representative of the entire county. The soil series with similar productivity characteristics at both the low and high levels of management have been grouped together for the resume. By discussing the most productive to the least productive groups and some of their characteristics, it is hoped that a more complete picture of the total soil resources of Coles County can be obtained.

The Drummer silty clay loam, Flanagan silt loam, and Raub silt loams, Group A soils, are the most productive soil

series of the thirteen at both the high and low levels of management. The three soils account for 48.69 percent of the sample area. They have all formed on 18 to 60 inches of loess over Wisconsin till and under sedges or a prairie vegetation. The three soil series all have an average slope of 2 percent or less. They only have slight erosion and drainage problems to hamper cultivation.

The Dana, Xenia, Fincastle, Reesville, and Lawson silt loams are the Group B soils. The Group B soils account for 19.56 percent of the total sample. These soils are less productive than the Group A soils at a low level of management. However, they respond well to a moderately high level of management and may be nearly as productive as the Group A soils.

The Lawson silt loam, accounts for only 2.68 percent of the sample area; it is the only alluvial soil in Group B. The major problems in cultivation on the Lawson is a high water table and periodic flooding. The rest of the Group B soils have developed on 18 to 39 inches of loess on Wisconsin till. The Dana silt loam has developed under a prairie vegetation. With an average slope of $4\frac{1}{2}$ percent, erosion and fertility are the main problems on the Dana silt loam. The Xenia, Fincastle, and Reesville silt loams have developed under a forest vegetation. Average slopes on these soils range from 1 to 3 percent. Erosion, fertility, and drainage problems are characteristic of the three soils.

Group C soils account for 13.19 of the sample area. They are only about one-half as productive as the soils in Group A when used under a low level of management. The productivity of this group is less than the Group B soils when used under a moderately high level of management. The Strawn, Russell, and Miami series cover 11.41 percent of the study area. These soils have formed on Wisconsin till or up to 39 inches of loess on Wisconsin till under a forest vegetation. They have average slopes of 7 to 10 percent which create severe erosion and fertility problems. The Cowden silt loam is formed under a prairie vegetation on at least 45 inches of loess over Illinoian till. The acidic, well developed Cowden has an average slope of only 1 percent. Thus, low fertility and poor drainage are the main problems of the Cowden silt loam.

Group D is made up of only one soil, the Hennepin silt loam which accounts for 1.02 percent of the sample area. The Hennepin silt loam has developed on Wisconsin till under a forest vegetation. With an average slope of $12\frac{1}{2}$ percent, the productivity is extremely low, even under a high level of management.

CHAPTER IV

DEVELOPMENT OF SOIL REGIONS IN COLES COUNTY

The Need For Geographic Soil Regions

The characteristics of the most widespread soil series of Coles County were discussed in the previous chapter in order to gain a more complete understanding of the total soil character of the county. It is essential, in seeking to determine soil regions and their interrelationships, to group and map soils in such a way that meaningful comprehensive regions that exhibit a considerable degree of flexibility for interpretation and analysis are obtained. Thus, the question of how to group the soil series of Coles County into distinct regions, each with its own characteristics that are essentially derived from the major soil series comprising it, and each having apparent relationships to other phenomena, becomes a matter of the utmost importance. Once the comprehensive soil regions are delimited, it is possible to more fully relate and understand the soils as they are associated with surrounding cultural and natural phenomena.

The U.S. Soil Conservation Service has constructed land resource maps that use associations of two or three

principal soil series found in various areas in Coles County (see Appendix C). These maps present a general distributional picture of the prominent soil series but they are vague and incomplete areal representations of the total soil character of Coles County. Their usefulness is very limited to the soils geographer for several reasons. The maps are primarily derived from the 1929 Coles County soil survey report which describes soils in terms of color, prominent textural characteristics, and vegetational development (prairie or forest). Soil scientists field checked the map in order to be able to use the modern soil series names. However, they did not determine the soil association areas by requiring that each soil series or each soil association account for a certain amount of the area; instead, series considered dominant were determined rather arbitrarily by general physical observation alone.¹ Since the soil association regions are not based on any pre-determined criteria, they can hardly be reliable soil regions or provide information by which soil regions useful for widespread application can be derived. Thus, this map is superficial and cannot be used for extensive geographical analysis and interpretation of Coles County soils.

¹Telephone interview with J.K. Johnson, Work Unit Conservationist, July 24, 1967, (Charleston, Illinois: Coles County Soil Conservation Service).

Tools For Development Of Soil Regions

In soils geography it is necessary to devise comprehensive geographic soil regions that provide useful and relatively accurate geographical information about areas. Soil scientists have devised soil classification systems which group soils that have similar significant characteristics. These classifications synthesize knowledge about the soils, their relationships to one another and their environment, and develop an understanding of soil use.¹ The soil scientist's studies generally become very detailed but if the soil classification system accomplishes the foregoing purposes, it is very possible that the soils geographer is able to use the more general and pertinent aspects of the classification system in order to devise useful soil regions for a particular area.

The U.S.D.A. 1949 soils classification system was published in its preliminary form in 1938 by Baldwin, Kellogg, and Thorp² and revised by Thorp and Smith in 1949.³ The U.S.D.A.

¹Charles E. Kellogg, "Why a New System of Soil Classification?" Soil Science, XCVI, No. 1 (July, 1963), pp. 1-2.

²M. Baldwin, Charles E. Kellogg, and J. Thorp, "Soil Classification," Soils and Men (Washington, D.C.: U.S. Dept. of Agriculture Yearbook, 1938, U.S. Government Printing Office), pp. 979-1001.

³J. Thorp and Guy D. Smith, "Higher Categories of Soil Classification: Order, Suborder, and Great Soil Groups," Soil Science, LXVII, pp. 117-126.

1949 system has been and is still being used by geographers to define soil regions, particularly using the great soil group categories on small scale maps. However, the U.S.D.A. 1949 classification system does not provide a satisfactory place for all United States soils. Consequently, work on a new soils classification system was began in 1951 by the Soil Survey Staff of the United States Department of Agriculture.

In 1960, the Soil Classification - A Comprehensive System (7th Approximation) was published and is still undergoing modification and revision. The new soils classification system, commonly called the 7th Approximation, has seemingly been well accepted by most soil scientists judging by the number of articles in Soil Science that have been written to introduce the system, its characteristics, and terminology. The 7th Approximation is now being introduced into geography through textbooks such as the fifth edition of Physical Elements of Geography as the apparent successor of the U.S.D.A. 1949 classification system. Even so, little geographic research has been conducted to determine the geographic viability of the 7th Approximation.

Procedure For Developing Soil Regions

Therefore, there exists two soil classification systems from which geographic soil regions can be derived. In this study, the soils geographer's immediate task is the construction of soil region maps of Coles County on various

levels of both classification systems.¹ The Conservation Needs Inventory material used in the discussion of the prominent soil series of Coles County provides the basic soil data.

The Conservation Needs Inventory data gathered on each 160 acre plot was recorded in order that the number of acres for each soil series in that plot was noted. Thus, it is possible to develop regions using the categories at a particular level² in the classification system by: (1) determining the percent of each 160 acre plot area that is in each soil category, and (2) grouping the soils of plot areas that are the most similar quantitatively and qualitatively, at the particular classification level used.³ In this way, it is hoped that soil regions can be developed and yet each soil region will be of significantly different character from every other

¹Some levels of the two systems often have similar names and have the same approximate position in the hierarchy of the classification systems but they are not necessarily equal.

²Soil series were grouped into the U.S.D.A. 1949 categories by using the "Taxonomic Key" for Coles County soils and into the 7th Approximation categories from the U.S. Soil Conservation Service's Soil Surveys - Review of February, 1963, Soil Family Groups (Champaign, Ill.: January, 1964).

³Soil regions based on categories at the highest level (order) in the hierarchy of the two systems will be denoted by Roman numerals and a particular shaded background. Soils regions constructed using categories at the succeeding lower levels will be denoted as having subdivided out of the higher level soil regions. It is recognized that the soil regions constructed using categories of lower levels of the two systems may be equally well labeled as separate entities unto themselves rather than being parts of a more general soil region that is constructed using higher level categories. However, through subdividing the soil regions it is hoped that the hierarchies of the two systems as well as subtle but significant discontinuities within the two hierarchies may be brought out.

region defined at the same level. If a soils region map is constructed on the various levels in both classification systems, it is possible to determine:

- (1) the amount and detail of information revealed about Coles County soils by the regions developed
- (2) possible geographical applications of each regional map
- (3) which map provides the most comprehensive and applicable soil regions for Coles County
- (4) comparative geographic advantages and disadvantages of the two classification systems.

Soil Regions Using The U.S.D.A. 1949

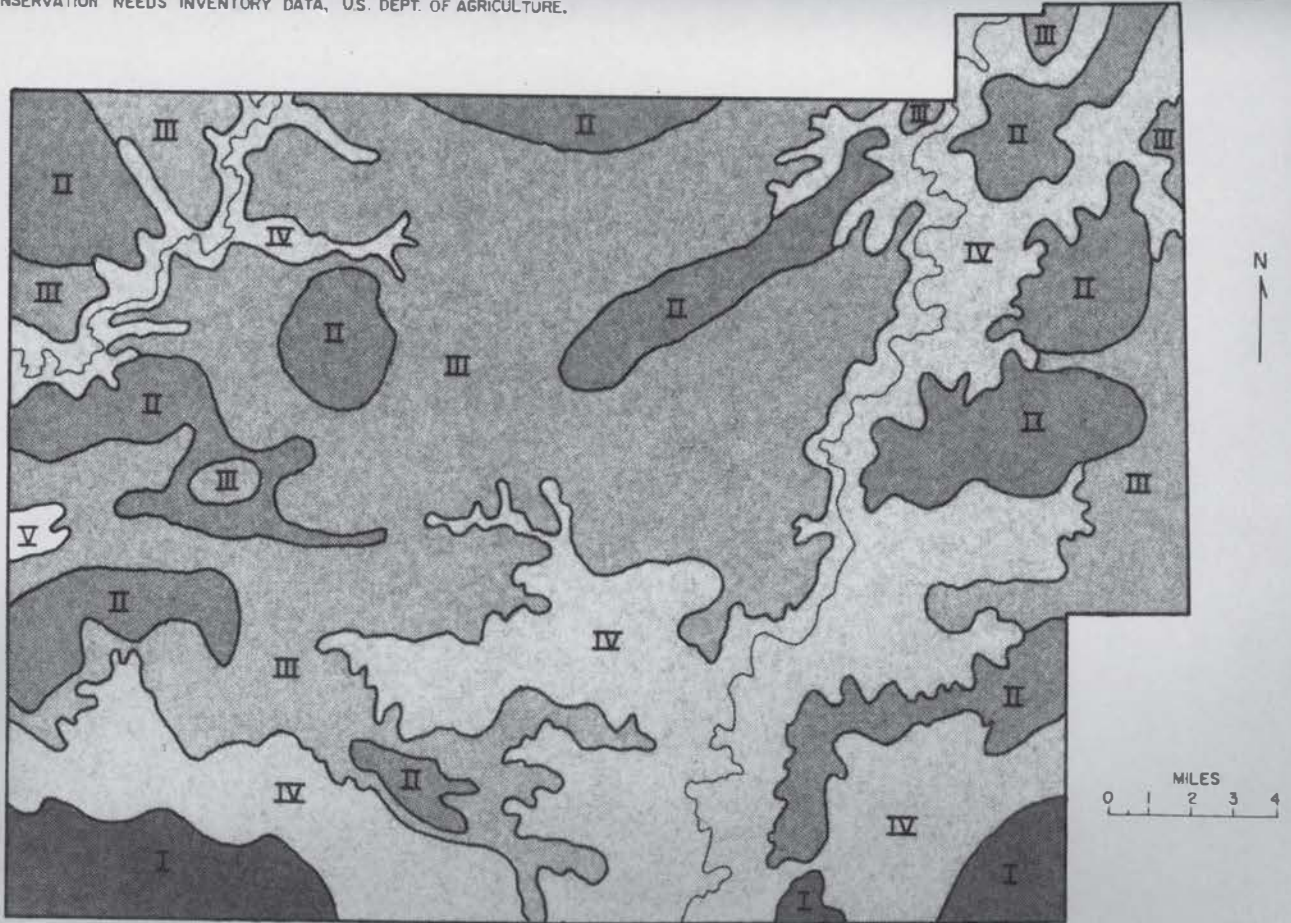
Soils Classification System

Order Level

The map presented in Fig. 4-1 is constructed using categories of the highest level of the 1949 U.S.D.A. soils classification system, the soil order. A relatively complex regional pattern is presented and appears to give relatively detailed and accurate information about Coles County soils. However, examination of the criteria for the three categories (zonal, azonal, and intrazonal soils) at the order level does not support this conclusion.

Zonal soils include soils with well developed profile characteristics that reflect the influence of the five active factors of soil genesis, particularly climate and vegetation. The zonal soils are best developed on gently undulating upland areas with good drainage, from parent material not of extreme texture or chemical

SOURCE: CONSERVATION NEEDS INVENTORY DATA, U.S. DEPT. OF AGRICULTURE.



1949 ORDER REGIONS IN COLES COUNTY

J.K. 8/67

Fig. 4-1 LEGEND

	I PRIMARY - Intrazonal	SECONDARY - Zonal	(Over 80% Intrazonal, Over 15% Zonal)
	II PRIMARY - Intrazonal	SECONDARY - Zonal	(Over 50% Intrazonal, Over 30% Zonal)
	III PRIMARY - Zonal	SECONDARY - Intrazonal	(Over 50% Zonal, Over 30% Intrazonal)
	IV PRIMARY - Zonal	SECONDARY - Azonal	(Over 60% Zonal, Over 10% Azonal)
	V PRIMARY - Zonal		(Over 90% Zonal)

Fig. 4-1

composition that has been in place long enough to register the full influence of the factors. The intrazonal soils have well developed soil profiles that are a result of some local factor of relief or parent material that dominates the normal influence of vegetation or climate. The azonal soils have nonexistent or poorly developed soil profiles because of their youth or a local factor such as relief or parent material.¹

Thus, the soil regions of Fig. 4-1 are not well defined and by themselves tell only that soils in Regions III, IV, and V of Fig. 4-1 primarily have well developed profiles and soils in Regions I and II primarily have poorly developed profiles; it gives little indication as to why this is true. Chemical or morphological characteristics of the soils in each region are not revealed and there is no way, from this map, to decide how the regions differ in respect to actual soil characteristics. Also, the criteria for the terms "zonal", "azonal", and "intrazonal" provide nothing that relates to phenomena such as vegetation or topography in the various portions of Coles County. If much additional information were provided about Coles County soils the order map would become more meaningful, generally, but still not for each specific region. Zonal, azonal, and intrazonal are useful terms to generally describe the degree of soil development in a region but they are too broadly defined and they can be ambiguous from one large area to another. In the use of the three terms, it becomes necessary to determine which of the five genetic soil-forming factors are the most important to soil formation in any particular area which is

¹M. Baldwin, Charles E. Kellogg, and J. Thorp, p. 987.

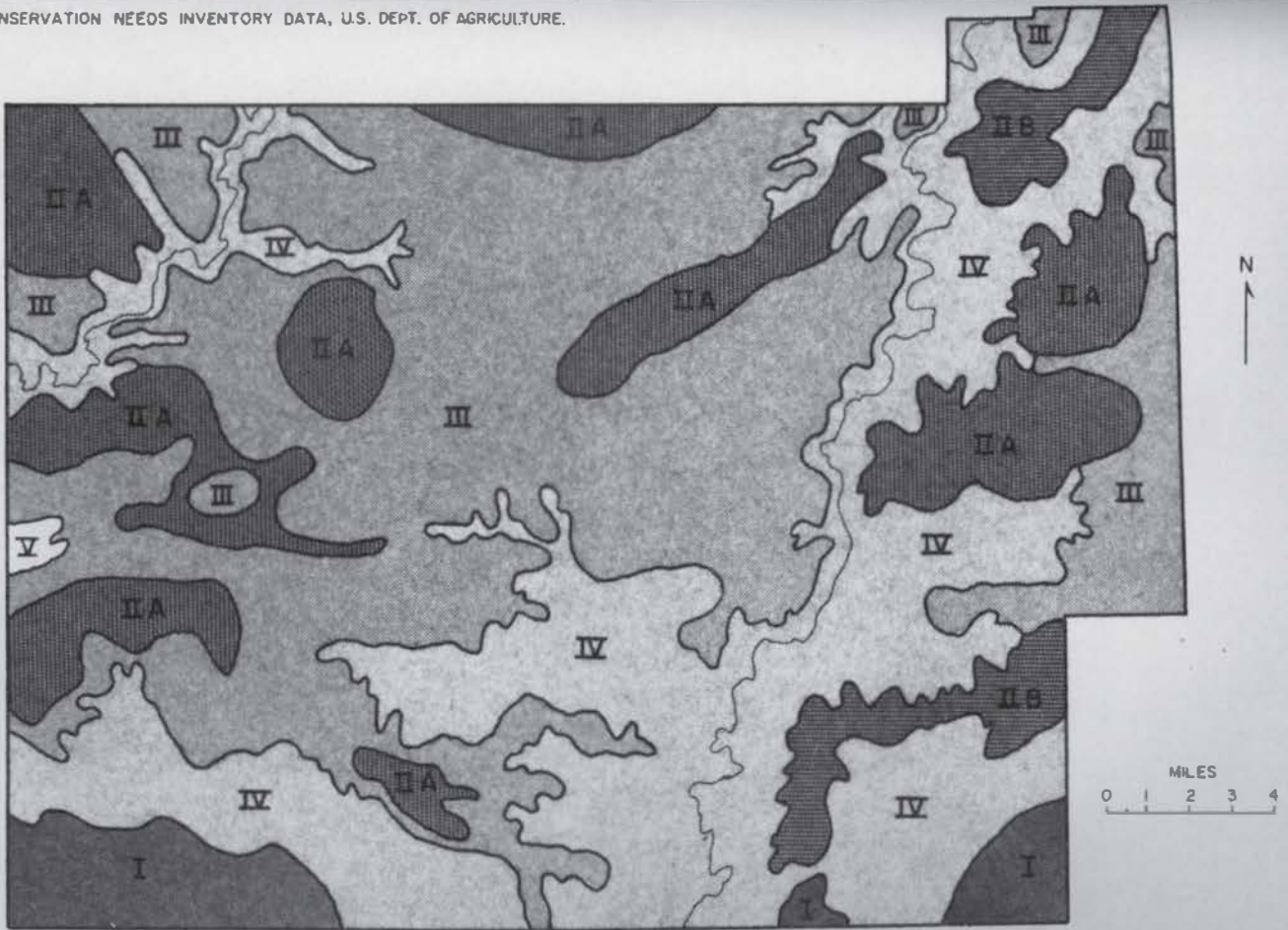
often impossible.

Suborder Level

The regions based on the categories of the next lower level, or suborder level, of the U.S.D.A. 1949 soils classification system are presented in Fig. 4-2. The suborder categories are determined principally in terms of the climate or/and vegetation under which the soils have formed. Soils in Regions IV and V are predominately light colored soils (zonal) that have developed under a timber vegetation and a "temperate and moist"¹ climate. The soils have undergone the process of podzolization during which a thin surface layer with some organic matter has formed but the horizon immediately beneath it is leached of part or all of its clays, iron compounds, and organic matter to the extent that the horizon is much lighter in color than the horizons above or below it. The podzolized soils are characteristically acidic as well as light in color.

Dark colored grassland soils (zonal) dominate in Region III. The grassland soils are found in semiarid, subhumid, and humid areas, and they have a wide variation in profile characteristics. The grassland soils generally contain a high amount of organic matter in the surface horizons and they are basic to slightly acidic.

¹Harry D. Buckman and Nyle C. Brady, p. 301.



1949 SUBORDER REGIONS IN COLES COUNTY

J.K. 8/67

Fig. 4-2

Fig. 4-2 LEGEND

- | | | |
|--|---|---|
| | <p>I PRIMARY - Hydromorphic soils
(Over 80% Hydromorphic soils, Over 15% Podzolized timber soils)</p> <p>II A PRIMARY - Hydromorphic soils
(Over 50% Hydromorphic soils, Over 30% Grassland soils)</p> <p>B PRIMARY - Hydromorphic soils
(Over 50% Hydromorphic soils, Over 30% Podzolized timber soils)</p> <p>III PRIMARY - Grassland soils
(Over 50% Grassland soils, Over 30% Hydromorphic soils)</p> <p>IV PRIMARY - Podzolized timber soils
(Over 60% Podzolized timber soils, Over 10% Azonal soils)</p> <p>V PRIMARY - Podzolized timber soils
(Over 50% Podzolized timber soils, Over 40% Grassland soils)</p> | <p>SECONDARY - Podzolized timber soils</p> <p>SECONDARY - Grassland soils</p> <p>SECONDARY - Podzolized timber soils</p> <p>SECONDARY - Hydromorphic soils</p> <p>SECONDARY - Azonal soils</p> <p>SECONDARY - Grassland soils</p> |
|--|---|---|

Hydromorphic soils of marshes, swamps, flats, seepage areas (intrazonal soils) dominate in Regions I, II A, and II B. These soils may be formed under a wide range of climate and vegetation. There are no characteristics necessarily associated with the soil profile in this group except that it has an excess of water.

Azonal soils are not subdivided on the suborder level and thus, they are still called azonal soils in Fig. 4-2. The azonal soils, which have little or no profile development because of youth or a condition of parent material or slope, play minor roles in Region IV.

Therefore, the information about Coles County soils that can be ascertained from the regions of Fig. 4-2 on the suborder level reveals that the soils have developed under a semiarid, subhumid, or humid climate and that soils in some portions of the county have developed chiefly under a grass or forest vegetation. Reference to Fig. 4-1 points out the regions which are likely to have well developed or poorly developed soil profiles. The chemical and morphological characteristics of the soil profiles of each suborder category, with an emphasis on color, have been described in very general terms. Even so, little is told of the actual profile characteristics of the various soil regions in Fig. 4-2. The soils region map in Fig. 4-2 has approximately the same pattern as the map in Fig. 4-1. However, the different nomenclature used in Fig. 4-2 provides additional and more specific information about the soils of Coles County than does Fig. 4-1.

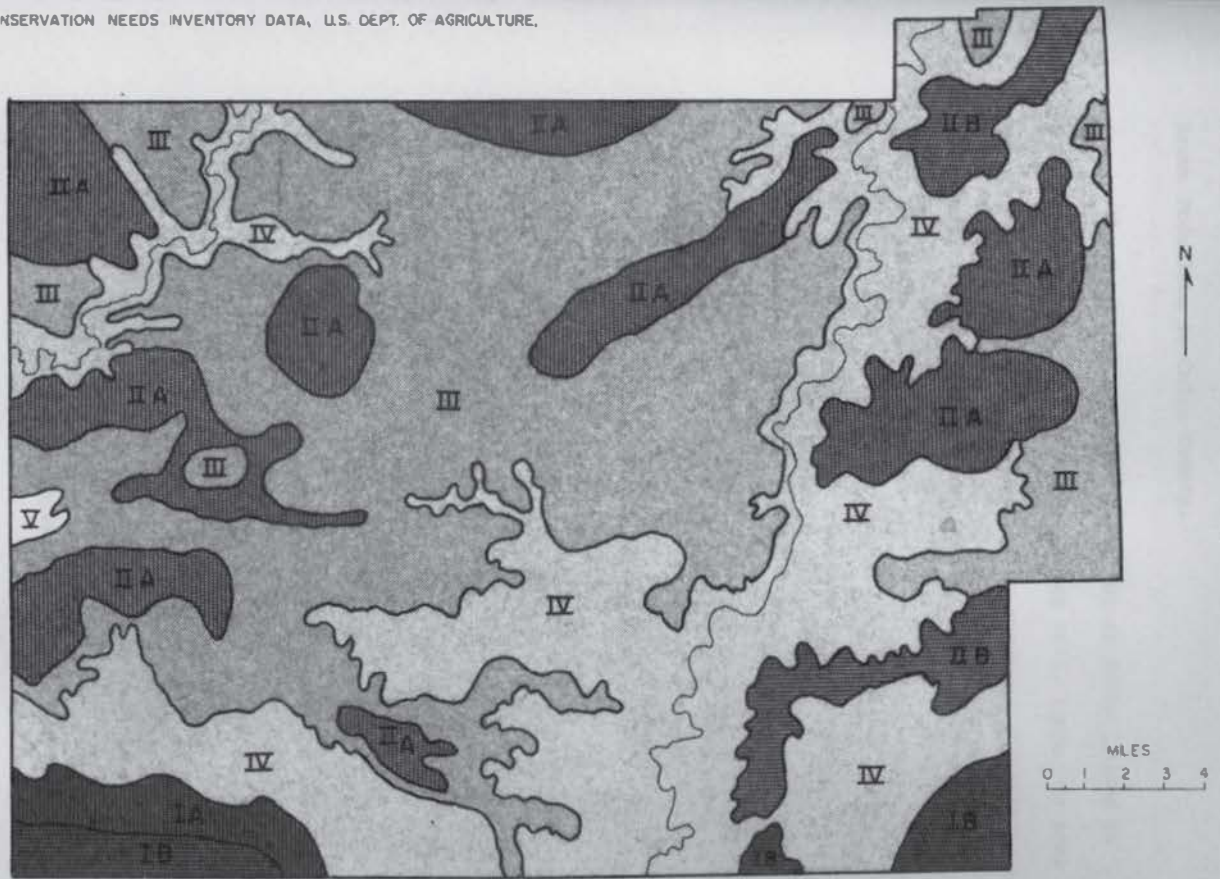
Great Soil Group Level

Soil regions that are based at the great soil group level are presented in Fig. 4-3. Again, the criteria for defining each of the categories or the great soil groups found in Coles County is general and broad. The Gray-Brown Podzolics, dominant in Regions IV and V, are developed under deciduous broadleaf or, perhaps, some needleleaf forests and a humid climate. The type and age of parent material, as well as the degree of slopes upon which Gray-Brown Podzolics are formed, is highly variable.

"The Gray-Brown Podzolic soils have distinct profiles with well developed horizons, somewhat less striking than those of the Podzols. The soils are acid and the normal solum is about 30 to 50 inches in depth. The mat of leaves and twigs lying on top of the soil is only one to three inches thick, yet the dark colored A₁ horizon . . . is about two to three inches thick. The light colored, leached A₂ horizon is about six to fifteen inches thick and grayish-brown or yellowish-brown in color. There is a transitional horizon some five to ten inches thick to the well developed B horizon where fine clay, leached from the horizon above, has accumulated."¹ "The B horizon of these soils show some accumulation of silicate clays and often possess a blocky structure that does not always facilitate drainage. Oxides of iron and aluminum also accumulate in this horizon."²

¹Charles E. Kellogg, The Soils That Support Us (New York: The Macmillan Company, 12th ed., 1961), p. 153.

²Harry D. Buckman and Nyle C. Brady, p. 308.



1949 GREAT SOIL GROUP REGIONS IN COLES COUNTY

J.K. 8/67

Fig. 4-3 LEGEND

■	I A PRIMARY - Humic-Gley (Over 80% Humic-Gley, Over 15% Gray-Brown Podzolic)	SECONDARY - Gray-Brown Podzolic
■	B PRIMARY - Planosol (Over 40% Planosol, Over 15% Humic-Gley)	SECONDARY - Humic-Gley
■	II A PRIMARY - Humic-Gley (Over 50% Humic-Gley, Over 30% Brunizem)	SECONDARY - Brunizem
■	B PRIMARY - Humic-Gley (Over 50% Humic-Gley, Over 30% Gray-Brown Podzolic)	SECONDARY - Gray-Brown Podzolic
■	III PRIMARY - Brunizem (Over 50% Brunizem, Over 30% Humic-Gley)	SECONDARY - Humic-Gley
■	IV PRIMARY - Gray-Brown Podzolic (Over 60% Gray-Brown Podzolic, Over 10% Alluvial)	SECONDARY - Alluvial
■	V PRIMARY - Gray-Brown Podzolic (Over 50% Gray-Brown Podzolic, Over 40% Brunizem)	SECONDARY - Brunizem

Fig. 4-3

103

The profiles of Fig. 3-5 and Fig. 3-6 are examples of the Gray-Brown Podzolics in Coles County.

The Brunizems are very important in Coles County in Region III. Brunizems often have young till, loess, or some other sedimentary material as a parent material although it is not always the case. Slopes on which Brunizems develop are level to gently rolling.

"The climate is much the same as that operative in the Gray-Brown Podzolic soil region But because the native vegetation was tall grass instead of forest, the soils are strikingly different. The abundant native grass cover of the prairie soil area has resulted in a deep, rich, dark-brown A horizon with a varied and active microorganic flora. The structure of the surface soil is decidedly granular, due to the influence of the grass cover. The exchangeable calcium is high, in spite of the definite acidity, and little downward movement of iron and aluminum has occurred. In places the presence of clay pans indicates considerable translocation of clay. The B horizon is brownish and grades into a parent material that is often rich in lime."¹

Profiles in Fig. 3-3 and Fig. 3-4 are representative of the Brunizem soils in the study area.

The Humic-Gley or Wiesenboden soils dominate in Regions I A, II A, and II B.

"The Wiesenboden group is encountered primarily in association with the zonal prairie soils (Brunizems) which they resemble in many respects when properly drained. These soils occur in relatively flat areas of restricted drainage and have a dark colored surface horizon which is usually near neutrality."²

¹Ibid., p. 310.

²Ibid., p. 318.

It can thus be assumed that the type and age of parent material and natural vegetation of the Humic-Gley are similar to that of the Brunizem. Figures 3-1 and 3-2 are profiles of the Humic-Gleys in Coles County.

Planosols dominate in only one soil region (IB) of Fig. 4-3. The natural vegetation, parent material, and climate present during development of the Planosols may vary widely. However, the Planosols are:

"Associated with the podzolic soils, especially the Gray-Brown Podzolic soils and the prairie soils They are developed on flat land where there is little or no natural erosion under the vegetation. In the normal podzolic soils the normal erosion gradually removes portions of the surface horizons; thus the upper part of the B horizon is changing into A horizon and the B horizon is extending into new, fresh parent material. But in the Planosol the leached material remains in place; the acid, leached character of the A horizon becomes intensified; and the deposition in the B is always in the same place, since it too remains fixed. The B horizon of the Planosol then becomes a zone of intense weathering of minerals to form clay, and a horizon of clay accumulation from above, with the formation of a claypan or hardpan."¹

Figures 3-9 and 3-10 are examples of the Planosols in Coles County.

The Alluvial and Regosol soils play minor roles in some of the regions in Fig. 4-3. There is no particular vegetation or climatic type associated with either group. The Alluvial soils are usually located on level or nearly level areas.

¹Charles E. Kellogg, The Soils That Support Us, pp. 157-159.

"Alluvial soils are those that are so young that no new soil characteristics have developed since the material was laid down by the water. They are found along stream margins in the flood plains Their internal characteristics depend upon the material carried down by the stream."¹

Figures 3-7 and 3-8 are profiles of an Alluvial soil in Coles County, but they may be much different than other Alluvial soils.

Regosols commonly show little to no soil development.

"Regosols are young soils and are located on deep unconsolidated soft mineral deposits . . . they are not usually stony. They are largely confined to areas of sand dunes, loess, and steeply sloping glacial drift."²

Figure 3-11 is an example of a Regosol profile in the study area.

If the commonly used descriptions of the great soil groups presented here are used to develop characteristics for each region in Fig. 4-3, it is evident that some generalizations are necessary. A fairly accurate natural vegetation map, as compared to Fig. 2-5, of Coles County can be constructed from Fig. 4-3. A slope map of Coles County constructed from Fig. 4-3 could be relatively inaccurate because the slopes vary greatly in the Gray-Brown Podzolics and Regosols, less so in the Brunizems, and are level or nearly level in the Planosols, Humic-Gleys, and Alluvial soils. It can be concluded from the descriptions of the Brunizems and Regosols that many of the soils of Coles County were developed on loess, till, or some other

¹Ibid., p. 99.

²Harry D. Buckman and Nyle C. Brady, p. 321.

sedimentary material, although where the particular parent materials occur is not known. The age of the parent materials or the climatic type existing in Coles County can not be readily determined from the great soil group descriptions. A great deal of information can be added to the understanding of the regional complex of Fig. 4-3 by having a knowledge of the glacial history, climatic characteristics, and the more important soil series of Coles County. A slope map as shown in Fig. 2-8 and a parent materials map in Fig. 2-6 also help to understand the soil regions of Fig. 4-3 better. However, specific characteristics of each region still can not be brought out because the characteristics of each great soil group are so broadly defined that the results of an attempt to apply great soil group characteristics to the regions of Fig. 4-3 are unreliable. The soil family can theoretically subdivide the great soil group. However, this level has not been developed and the soil series is thus the next usable level in the U.S.D.A. 1949 soils classification system. Soil series data provide information that is so detailed, particularly with respect to areal distribution, that an attempt to construct regions using the soil series usually proves too complex and detailed. Thus, the geographic regions derived from great soil groups, although broad and generally defined, provide more detailed and useful information than does any other level in the 1949 hierarchy exclusive of extremely microgeographic studies.

There remains another approach which can possibly make the regions of Fig. 4-3 more useful. First, the most significant

soil series, areally, in Coles County are distributed into the great soil groups. If the characteristics of the important soil series comprising each great soil group are similar, it is possible to determine the characteristics of each great soil group for Coles County and perhaps of each region in Fig. 4-3.

The soil series data that was collected from the Conservation Needs Inventory in addition to the author's selection of quarter-sections was the data that is combined into the great soil groups and is used to construct the soil regions of Fig. 4-3. The profiles and descriptions which have been suggested are representative of each great soil group in Coles County. However, it should be pointed out that, as Fig. 3-5 and Fig. 3-6 reveal, the chemical and morphological characteristics of soil series in the same great soil group are subject to wide variation within the study area.

It is necessary to determine how well this approach enables one to establish relationships between the great soil groups of Coles County and other phenomena such as vegetation or agricultural productivity. These relationships are studied by analyzing the characteristics of selected phenomena associated with each of the more significant soil series contained in each of the great soil groups and then grouping these characteristics in order to formulate composite characteristics for each phenomena as it is associated with each great soil group. Table 4-1 shows the results of examining each of the significant soil series in the various great soil groups. It reveals

Table 4-1 SELECTED CHARACTERISTICS OF THE GREAT SOIL GROUPS IN COLES COUNTY

Great Soil Group	No. Of Soil Series Over ½%	Total ^a % Of Sample Area	Natural ^{b+c} Vegetation	Percent ^c Slope	Parent Material ^d	Yields Under A High Level Of Management ^e (bushel/acre) 1963					
						C o r n			S o y b e a n s		
						Lo	Hi	Wt. Avg.	Lo	Hi	Wt. Avg.
Gray-Brown Podzolic	7	27.51	Broadleaf deciduous forest	0-25	Wisconsin till Less than 18" loess on Wisc. till 18-39" loess on Wisc. till 39-60" loess on Wisc. till	42	83	69	16	30	26
Brunizem	7	26.11	Short and tall grasses	0-12	18-39" loess on Wisc. till 39-60" loess on Wisc. till 18-39" silty material on Wisc. outwash	85	101	97	31	39	37
Humic-Gley	3	30.78	Sedges, swamp grasses	0-½	18-39" loess on Wisc. till 39-60" loess on Wisc. till 18-39" silty material on Wisc. till Over 45" loess on Ill. till	87	97	97	35	39	39
Planosol	2	2.67	Grasses or timber	0-2	Over 45" loess on Ill. till	75	75	75	33	33	33
Alluvial	3	4.38	Swamp grass, grass or grass and scattered trees	0-2	Medium textured, dark colored material	95	101	100	35	39	37
Regosol	1	1.02	Timber	10-15 and up	Wisconsin till	Not Adapted - - - -					

Source: a = U.S. Department of Agriculture, Conservation Needs Inventory data. This is unpublished raw data that may be found in Iowa State Statistical Laboratories or the Area Soil Conservation Service, Effingham, Illinois.

b = H.L. Wascher, J.B. Fehrenbacher, R.T. Odell, and P.T. Veale, No. AG-1443.

c = Soil series sheets, Charleston, Illinois: Coles County Soil Conservation Service

d = U.S. Soil Conservation Service, Coles County Work Unit Handbook, Sec. I, Part 3.

e = U.S. Soil Conservation Service, "Yields," Coles County Technical Guide, Sec. III (Soil Conservation Service: Charleston, Ill.). High level of management is defined as follows: (1) corn - application of 130-140 pounds of nitrogen/acre in the current and previous year from legume and non-legume sources and 40 pounds of each or equivalent P₂O₅ and K₂O per acre that is applied or estimated as residual from previous practices; (2) soybeans - 30-40 percent of the above requirements plus the use of additional up-to-date conservation and management practices.

that the natural vegetation characteristics of each great soil group are relatively constant and thus a reliable, relatively accurate natural vegetation map can be constructed from the regions of Fig. 4-3. A parent materials map constructed from the regions of Fig. 4-3 must be somewhat general as some of the great soil groups have three to four parent materials although they are somewhat similar. A slope map constructed from the regions of Fig. 4-3 are relatively accurate in the regions where the Humic-Gleys, Planosols, and Alluvial soils are in combination with each other or heavily dominate the region because the slope ranges are relatively small in these great soil groups. On the other hand, it is nearly impossible to draw a slope map with a very specific slope range where the Gray-Brown Podzolics or Brunizems are important because they may vary so widely in respect to slope. Table 4-1 also shows that if an attempt were made to relate the soil regions of Fig. 4-3 to yields it becomes inaccurate and nearly meaningless. The yield/acre ranges of corn and soybeans on the various soil series contained in each great soil group are so great that even weighted average yield figures for the great soil groups are not suitable to use as representative for some of the great soil groups.

The great group level of the U.S.D.A.1949 soils classification system offers the best defined and most useful way of grouping the important soil series of Coles County into geographic regions when compared to regions derived at the higher

levels. By knowing the main soil series in each great soil group, a general idea of the physical and chemical profile characteristics of the great groups may be brought out but there is a limited degree of relationship that can be established between the regions and other phenomena.

Soil Regions Using The 7th Approximation

Order Level

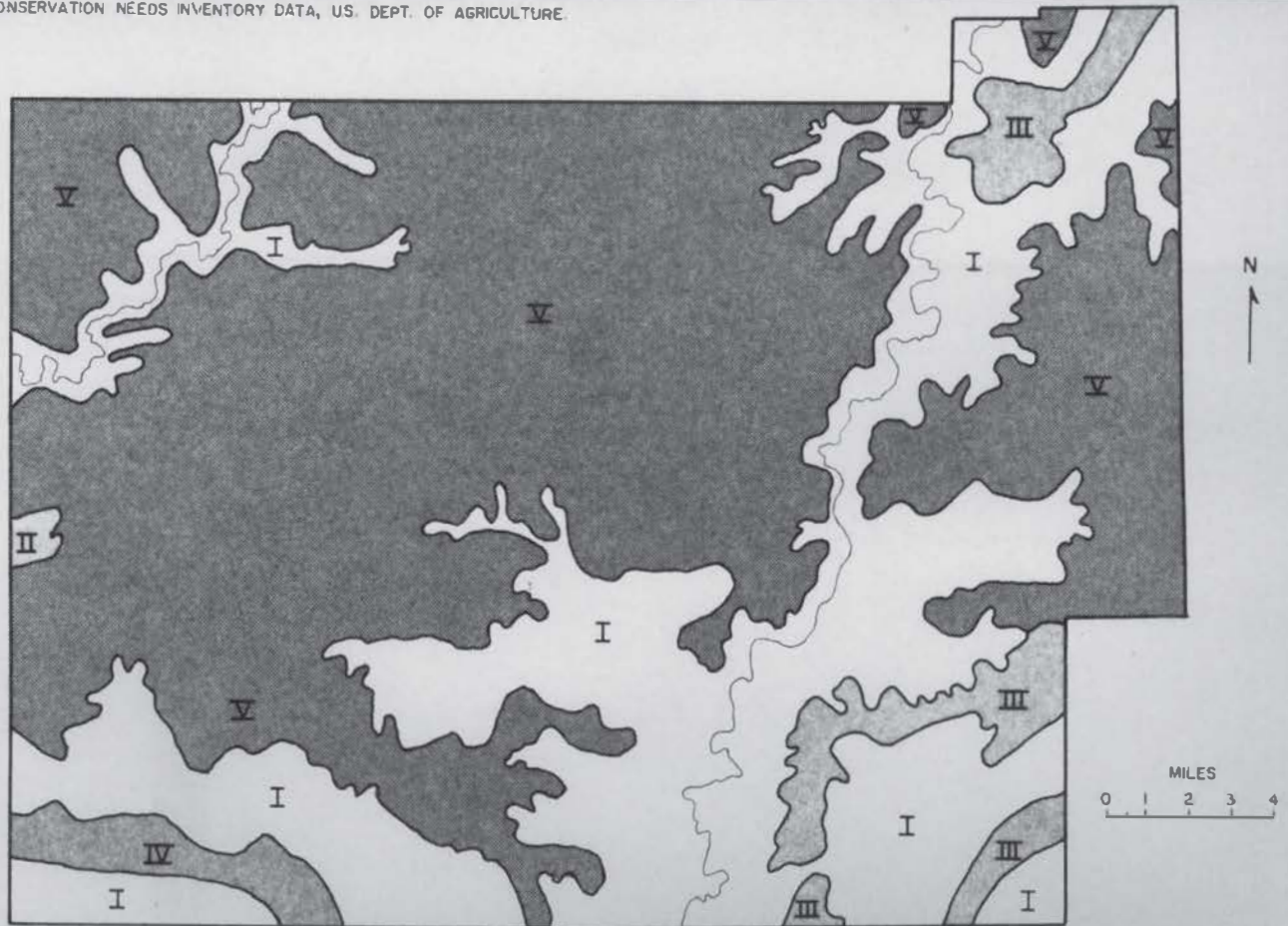
The soil region map in Fig. 4-4 is the result of grouping the Conservation Needs Inventory data into the three categories represented at the highest or order level of the 7th Approximation in Coles County. Formation of the orders are:

" . . . developed largely by generalization of common properties of soils that seem to differ little in the kinds and relative strengths of processes tending to develop horizons. If one abstracts the properties that are always present, he finds that the character of the surface horizon is the most obvious feature that distinguishes these soils from most other soils."¹

Thus, a similarity in the surface horizon is the primary identifying feature of each order category. However, definitions are sometimes modified to assure that soils with similar surface horizons but very different genesis are not grouped together.² Table 4-2 relates the orders to their approximate equivalents at the great soil group level in the U.S.D.A. 1949 classification.

¹Soil Survey Staff, Soil Classification, A Comprehensive System, 7th Approximation (Washington, D.C.: U.S.D.A. Soil Conservation Service, U.S. Government Printing Office, 1st ed., 1960), p. 12.

²Ibid.



7th APPROXIMATION ORDER REGIONS IN COLES COUNTY

J.K. 8/67

Fig. 4-4 LEGEND






- | | | |
|---|--|----------------------------------|
|  | I PRIMARY - Alfisol
(Over 60% Alfisol, Over 10% Mollisol and Entisol) | SECONDARY - Mollisol and Entisol |
|  | II PRIMARY - Alfisol
(Over 50% Alfisol, Over 40% Mollisol) | SECONDARY - Mollisol |
|  | III PRIMARY - Mollisol
(Over 50% Mollisol, Over 30% Alfisol) | SECONDARY - Alfisol |
|  | IV PRIMARY - Mollisol
(Over 80% Mollisol, Over 10% Alfisol) | SECONDARY - Alfisol |
|  | V PRIMARY - Mollisol
(100% Mollisol) | |

Table 4-2

1949 GREAT SOIL GROUP EQUIVALENTS
OF THE 7TH APPROXIMATION ORDERS IN COLES COUNTY

7th Approximation Order	1949 Great Soil Groups
Alfisol	Gray-Brown Podzolic Planosol
Mollisol	Brunizem (Prairie) Humic-Gley
Entisol	Regosol Alluvial Low Humic-Gley

Source: Soil Survey Staff, Soil Classification, A Comprehensive System, 7th Approximation, p. 13.

The Alfisols, dominant in Regions I and II of Fig. 4-4, are associated with a wide variety of climates and a natural vegetation of boreal or broadleaf deciduous forests, tall grass in the humid areas, or grass with scattered xerophytic trees. The parent materials from which the Alfisols develop has either had relatively little water movement through it or it is generally young, unweathered and basic as found in land surfaces that are no older than the late Pleistocene. Alfisols may have formed on strongly weathered materials older than Pleistocene, but this is not generally true.¹ The Alfisols are mineral soils that contain less than 30 percent organic matter if the mineral fraction contains more than 50 percent clay or less than 20 percent organic matter if the mineral fraction has no clay. In portions of the B horizon, the Alfisols show evidence of illuviation and accumulation of silicate clays (argillic horizon) or a prismatic or columnar structure with over 15 percent saturation of exchangeable sodium (natric horizon). There may also be present protrusions or tongues of a lighter colored horizon (albic horizon) into the argillic horizon where clays and free iron have been removed.²

The Mollisols predominate in Regions III, IV, and V of Fig. 4-4. Mollisols are formed under climates ranging from

¹Ibid., p. 202.

²Ibid., Chapters 5 and 14.

boreal to tropical in which dry seasons are quite normal. The Mollisols have or have had a natural vegetation of short or tall grass, sedges, or other water-loving plants, or sometimes a deciduous hardwood forest. Parent materials of the Mollisols are quite variable, but the Mollisols that have developed under a forest vegetation are known only on basic or calcareous materials that have large earthworm populations.¹ Mollisols have a mollic epipedon or surface horizon that is actually the A horizon and often part of the B horizon. The mollic epipedon is over 4 inches thick if resting on rock, over 1/3 of the solum if it is less than 30 inches thick, and over 10 inches thick where the solum is over 30 inches thick. The mollic epipedon is also very dark colored due to a high organic matter content and it has a soil structure that enables it to remain soft and loose even though the upper 7 inches or so has been disturbed. Portions of the B horizon may have an argillic or natric horizon and the alteration may even have been great enough to destroy most of the original rock structure, free iron oxides, form silicate clays, or form a soil structure (cambic horizon). Duripans or hardpans, accumulations of carbonates (ca), or accumulations of salts (sa) may also be present in the B horizon.²

The Entisols, which play a minor areal role in Coles County, are defined in very general terms because they have only the

¹Ibid., p. 168.

²Ibid., Chapters 7 and 12.

beginnings of a genetic horizon, if any at all. They are not associated with a particular climatic type, natural vegetation, or parent material.¹

The soil region map in Fig. 4-4 provides only very broadly defined guidelines to the phenomena, such as vegetation and parent materials due to the general definition of the categories at the order level. Perhaps equally important is the fact that some idea of the chemical and morphological soil profile characteristics of each category is given by the definition of that category. However, the regions are of little value for detailed geographical interpretation of Coles County soils.

Suborder Level

The soil regions of Fig. 4-5 were constructed using the suborder categories of the 7th Approximation.

"Each order has been subdivided into suborders primarily on the basis of the characteristics that seemed to produce classes with the greatest genetic homogeneity . . . the differentials are primarily chemical or physical properties that either reflect the absence of waterlogging, or genetic differences due to climate and its partly associated variable, vegetation. The remaining differential are chemical (or mineralogical) properties and extreme textures that . . . either control the direction and degree of soil development or are themselves the effects of soil development and weathering."²

¹Ibid., p. 105.

²Ibid., pp. 12-13.









Fig 4-5



7th APPROXIMATION SUBORDER REGIONS IN COLES COUNTY

J.K. 8/67

Fig. 4-5 LEGEND

	<p>I A PRIMARY - Udalf (Over 60% Udalf, Over 10% Udoll and Orthent)</p>	<p>SECONDARY - Udoll and Orthent</p>
	<p>B PRIMARY - Aqualf (Over 50% Aqualf, Over 15% Aquoll and Alboll)</p>	<p>SECONDARY - Aquoll and Alboll</p>
	<p>II PRIMARY - Udalf (Over 50% Udalf, Over 40% Udoll)</p>	<p>SECONDARY - Udoll</p>
	<p>III A PRIMARY - Aquoll (Over 50% Aquoll, Over 30% Udalf)</p>	<p>SECONDARY - Udalf</p>
	<p>B PRIMARY - Alboll (Over 50% Alboll, Over 30% Aqualf)</p>	<p>SECONDARY - Aqualf</p>
	<p>IV PRIMARY - Aquoll (Over 80% Aquoll, Over 15% Udalf)</p>	<p>SECONDARY - Udalf</p>
	<p>V A PRIMARY - Aquoll (Over 50% Aquoll, Over 30% Udoll)</p>	<p>SECONDARY - Udoll</p>
	<p>B PRIMARY - Udoll (Over 50% Udoll, Over 20% Aquoll)</p>	<p>SECONDARY - Aquoll</p>

Thus, the regional pattern in Fig. 4-5 is somewhat more complex than was true in Fig. 4-4 because six suborder categories divided out of the three order categories used in Coles County (Fig. 4-4).

The Udalfs, usually called Gray-Brown Podzolics in the U.S.D.A. 1949 classification system, are dominant in Regions I A and II in Fig. 4-5. Udalfs have, in addition to the properties characteristic of Alfisols, developed in a humid climate, have a mean annual temperature of more than 47 degrees Fahrenheit, and usually are associated with a summer maximum of rainfall. Portions of the Udalf solums are generally moist although dry periods may endure for as long as three months. The natural vegetation of the Udalfs is primarily hardwood forest although some coniferous trees may have been present at one time during their genesis. Udalfs are usually formed on Wisconsin age calcareous material although some are formed on Illinoian till.¹ Udalfs have an ochric epipedon or surface horizon that is thin, light colored and low in organic matter.² The ochric epipedon usually includes eluvial horizons near the surface, such as an A2 or albic horizon, and extends to the first diagnostic horizon or to where there is a little darkening by organic material. An argillic horizon is located in the B horizon and an albic horizon or fragipan is frequently located in the B horizon.³

¹Ibid., p. 206.

²Ibid., p. 35.

³Ibid., p. 206.

The Aqualfs, dominant in Region I B, have been called Planosols, Low-Humic Gleys, or Half-Bog soils. Aqualfs, in addition to the characteristics described for all Alfisols, are saturated with water seasonally and consequently may have dark colors or mottles immediately beneath the plow layer or a mineral horizon. The Aqualfs must have an argillic or natric horizon in the B horizon and often have fragipans or duripans located there also.¹

Aquolls, often called Humic-Gleys, predominate in Regions III A, IV, and V A of Fig. 4-5. Aquolls are Mollisols that usually develop under a wide variety of climates with a natural vegetation of grasses, sedges, and perhaps some deciduous forest. The parent material on which Aquolls are developed does not have more than 40 percent calcium carbonate equivalent. Aquolls are strongly hydromorphic and develop in the presence of a permanent or fluctuating ground water table that is near the soil surface.² Aquolls have a histic epipedon which is a thin organic surface horizon if the soil has never been disturbed or is very high in organic matter if disturbed.³ The histic epipedon is also continually or periodically wet due to the high ground-water level.⁴

¹Ibid., p. 202.

²Ibid., p. 169.

³Ibid., pp. 34-35.

⁴Ibid., p. 169.

The Udolls, often called Brunizems, Alluvial soils or Regosols, are dominant in Region V B of Fig. 4-5. Udolls are Mollisols that have usually developed under a tall grass vegetation, although some may have been developed under a forest vegetation. The parent materials for the Udolls are always calcareous or basic in their chemical reactivity. Udolls are found in climates that are humid enough to provide water movement through the soil to the ground water in most years although a summer dry season is characteristic. In addition to the mollic epipedon characteristic of all Mollisols, the Udolls may have an argillic or cambic horizon in the B horizon.¹

Albolls, often called Planosols, are found in major quantities in Region III B. In addition to having the characteristics of all Mollisols, the Albolls have an albic horizon immediately below the mollic epipedon and an argillic horizon below the albic horizon. Water moves through the argillic horizon very slowly and thus the water level often saturates both the overlying albic horizon and the mollic epipedon. Yet, during the summer period and frequent periods of drought, both horizons may become very dry.²

The Orthents are one of the relatively new suborders that have been divided out of the Entisols. Thus, the characteristics, other than those of the Entisols, are not yet published

¹Ibid., p. 174.

²Ibid., p. 168.

or readily available. However, it is evident from Soil Conservation Service classification material that some Alluvial soils as well as Regosols are included in this category.

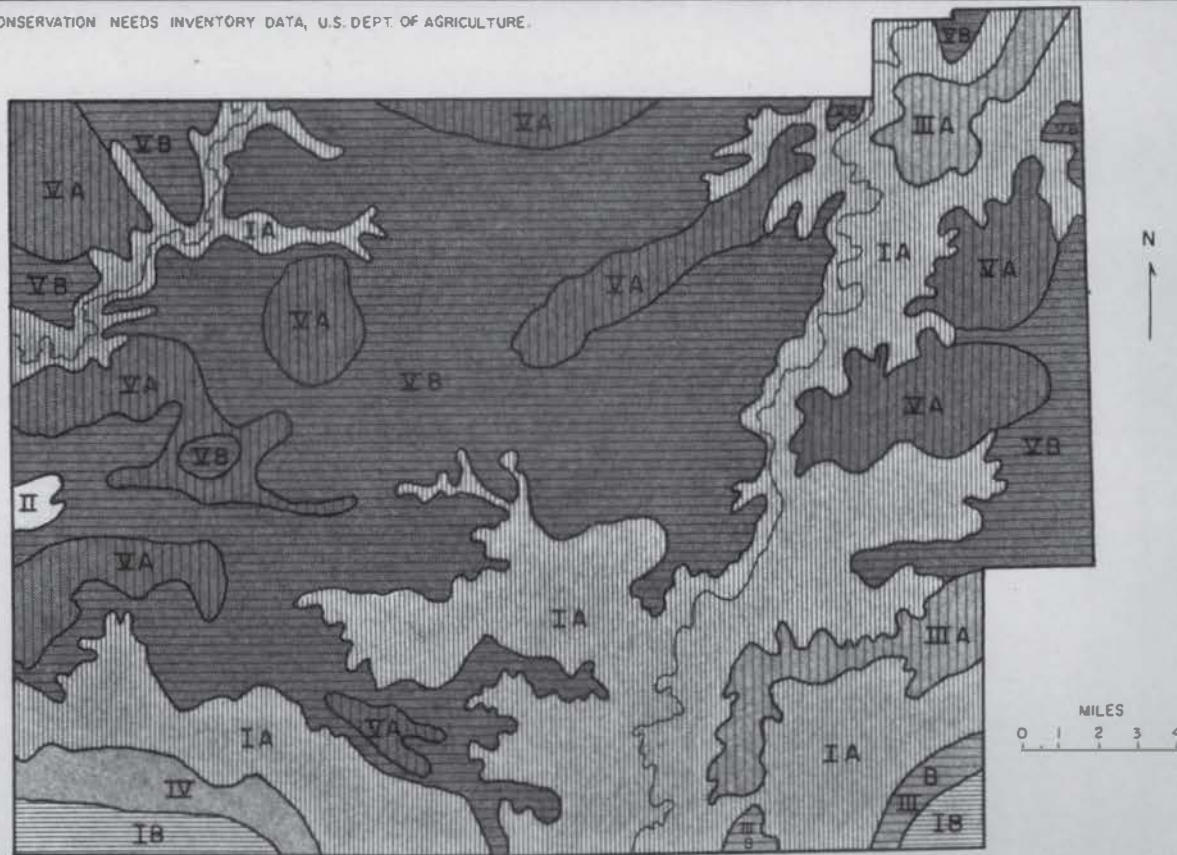
As it has been pointed out, the regional pattern of Fig. 4-5 is more complex than is the regional pattern of Fig. 4-4 due to subdivision of the order categories. The suborders are more meaningful than are the orders because the natural vegetation, parent materials, climatic characteristics, characteristics of soil development, or soil profile characteristics are shown more explicitly. In spite of this, the soil regions can not be assigned characteristics specific enough to be useful in the interpretation and analysis desired for many Coles County studies.

Great Group Level

Soil regions of Fig. 4-6 are based on the categories at the great group level in the 7th Approximation.

"Each great group is defined, within its respective suborder, largely on the presence or absence of diagnostic horizons on the arrangement of those horizons. Where horizon arrangements do not vary within a suborder, other diagnostic properties were used if necessary, The diagnostic horizons selected are those that we believe indicate both major differences in degree of development and minor differences in kind. Horizons used as differential include those horizons that contain illuvial clay, iron, and humus; thick, dark colored surface horizons, pans that interfere with root development, water movement, or both"¹

¹Ibid., p. 14.











7th APPROXIMATION GREAT GROUP REGIONS IN COLES COUNTY

J.K. 8/67

Fig. 4-6

-101-

Fig. 4-6 LEGEND

- | | | |
|---|---|--|
|  | <p>I A PRIMARY - Normudalf
(Over 60% Normudalf, Over 10% Hapludoll and Haplorthent)</p> | <p>SECONDARY - Hapludoll and Haplorthent</p> |
|  | <p>B PRIMARY - Albaqualf
(Over 70% Albaqualf, Over 15% Haplaquoll and Argialboll)</p> | <p>SECONDARY - Haplaquoll and Argialboll</p> |
|  | <p>II PRIMARY - Normudalf
(Over 50% Normudalf, Over 40% Argiudoll)</p> | <p>SECONDARY - Argiudoll</p> |
|  | <p>III A PRIMARY - Haplaquoll
(Over 50% Haplaquoll, Over 30% Normudalf)</p> | <p>SECONDARY - Normudalf</p> |
|  | <p>B PRIMARY - Argialboll
(Over 50% Argialboll, Over 30% Ochraqualf)</p> | <p>SECONDARY - Ochraqualf</p> |
|  | <p>IV PRIMARY - Haplaquoll
(Over 80% Haplaquoll, Over 15% Normudalf)</p> | <p>SECONDARY - Normudalf</p> |
|  | <p>V A PRIMARY - Haplaquoll
(Over 50% Haplaquoll, Over 30% Argiudoll)</p> | <p>SECONDARY - Argiudoll</p> |
|  | <p>B PRIMARY - Argiudoll
(Over 50% Argiudoll, Over 20% Haplaquoll)</p> | <p>SECONDARY - Haplaquoll</p> |

Normudalfts are dominant in Regions I A and II in Fig. 4-6. The Normudalfts, described as "typical" Gray-Brown Podzolics, are Udalfts that were formed primarily under a natural vegetation of deciduous forest although coniferous trees may also have been present at one time or another. The parent material of the Normudalfts is usually Wisconsin age or younger and calcareous with some parent material as old as the Illinoian age. The climate is humid but dry periods are characteristic. Normudalfts have an ochric epipedon resting on an argillic horizon, Immediately beneath the argillic horizon is a mineral horizon that is usually called the C horizon (regolith) or consolidated rock.¹ Figures 3-5 and 3-6 are representatives of the Normudalfts in Coles County.

Albaqualfts are dominant or nearly so in Region I B of Fig. 4-6 and have been called Planosols or "claypan" Planosols. This great group of the Aqualf suborder is formed under a humid climate in which evapotranspiration exceeds rainfall during several months of the growing season. The Albaqualfts may have a natural vegetation of either grasses or forest and they are formed from calcareous materials that are generally of Pleistocene age or younger. The soil profile of the Albaqualf, of which Fig. 3-9 and Fig. 3-10 are representative, has an ochric epipedon over an albic horizon. An argillic horizon is located below the albic horizon and is quite different than the albic horizon in regard to soil texture due to a high clay content.²

¹Ibid., p. 207.

²Ibid., p. 203.

The Haplaquolls, usually called Humic-Gley or perhaps Alluvial soils, are found in topographic depressions, wet drainage ways, or the lower portions of floodplains, and are dominant in Regions III A, IV, and V A. Haplaquolls are the Aquolls that have a natural vegetation of grasses, sedges or other water-loving plants although a deciduous hardwood vegetation may have been present during a part of the genesis. The climatic types associated with the Haplaquolls varies greatly, but they are often formed on basic or calcareous parent materials. The mollic epipedon gradually changes into a gray or olive gray cambic horizon with brown mottles or to the C horizon which is characteristic of the Haplaquolls.¹ Figures 3-1 and 3-2 are representative of the Haplaquolls in Coles County.

The Argiudolls, or a type of Brunizems, account for over one-half of the great soil groups in Region V B. Argiudolls are the Udolls that form in a climate generally described as humid and they have a mean annual temperature of over 47 degrees Fahrenheit. The native vegetation is primarily tall grass but Argiudolls may form under some scattered trees mixed with grass or in a complete forest vegetation in an area that originally had a grass vegetation. The parent material on which Argiudolls form is always highly basic or calcareous. Argiudolls have a mollic epipedon that rests on a brownish argillic horizon.² Figures 3-3 and 3-4 represent Argiudoll soil profiles in Coles County.

¹Ibid., p. 170.

²Ibid., pp. 176-177.

Argialbolls are of major importance in Region III B.

Argialbolls, often called Planosols, are found in humid climates, are wet periodically, and have a tall grass natural vegetation. The parent materials for the Argialbolls are usually basic or calcareous. The Argialboll has a mollic epipedon immediately overlying an albic horizon. There is an abrupt textural change from the albic horizon to the argillic horizon directly below. The argillic horizon is not very porous and thus water movement through it is hindered.¹ Figures 3-9 and 3-10 are representative of Argialbolls of Coles County.

The Hapludolls play a minor role in Region I A. Hapludolls, usually called Brunizems, Alluvial soils, or Regosols, are formed in a humid climate with a tall grass natural vegetation. The parent material of the Hapludolls is usually no older than Wisconsin age. The Hapludoll consists of a mollic epipedon that is less than 20 inches deep and rests on a cambic or C horizon. If a cambic horizon is present, there will be an albic or argillic horizon beneath it.² Figures 3-7 and 3-8 are representative of the Hapludolls in Coles County.

The Ochraqualfs are of minor importance in Region III B. They have all the characteristics of the Aqualfs and have an argillic horizon resting on rock or the parent material.³

¹Ibid., p. 169.

²Ibid., p. 176.

³Ibid., p. 204.

The Haplorthents are Orthents which have been studied and classified; however, a full description of the Haplorthents is not yet available. It is known that both Alluvial and Regosols are included in the Haplorthents. Thus, the Haplorthents have few or no genetic horizons. Figure 3-11 is representative of the Haplorthents in Coles County.

The pattern of the regions in Fig. 4-6 is the same as that of Fig. 4-5 but the great groups are more narrowly defined than are the suborder categories. Thus the regions of Fig. 4-6 are better representative of the soils contained in each region. The definition of each great group in the 7th Approximation is usually best defined with respect to the aspects of the phenomena that seemingly have the most influence on soil profile development for that group. It is very important that information about phenomena related to soil formation be brought out, but the general definition is still often too broad to be of great value for interpretation of the soil regions in Coles County. The soil profiles for each category have been discussed and examples of their appearance has been cited. However, the soil profile descriptions are still subject to significant variation with respect to many characteristics and they are not suited to adequately illustrate all soils in each of the regions of Fig. 4-6. (It should be noted that the many chemical and morphological characteristics of the soil profiles have not been discussed due to the complexity of detail. Some of the intricate detail must be by-passed in order to

consider the soil characteristics of most value and interest to the geographer.)

The approach used to bring out more specific characteristics of the regions in Fig. 4-6 and thus render them more useful for geographic interpretation is the same as used on the great soil group level in the U.S.D.A. 1949 soils classification system. Selected characteristics of the soil series comprising over $\frac{1}{2}$ percent of the total sample area combined and analyzed in order to yield characteristics typical of the great soil group and thus the regions in which they are found. The results of combining the selected characteristics of the more important soil series comprising each great group are shown in Table 4-3. The great group characteristics are homogeneous enough to portray a relatively accurate regional representation of the natural vegetation of Coles County. Slopes and productivity of selected crops can be determined rather accurately for some of the regions. The parent materials vary somewhat within each great group but they are often similar enough in character that they can be used in the construction of a general map of parent material regions for Coles County.

In summary, the soil region map in Fig. 4-6 is useful and very informative, but even when soil series data is used, the great groups and great group regions seemingly do not have characteristics that are homogeneous enough to permit thorough analysis and correlation of soil regions in Coles County. However, there is another alternative that can possibly provide the

Table 4-3 SELECTED CHARACTERISTICS OF THE GREAT GROUPS IN COLES COUNTY

Great Soil Group	No. Of Soil Series Over $\frac{1}{2}$ % ^a	Total % Of Sample Area ^a	Natural Vegetation ^{b+c}	Percent Slope ^c	Parent Material ^d	Yields Under A High Level Of Management ^e (bushel/acre) 1963					
						C o r n			S o y b e a n s		
						Lo	Hi	Wt. Avg.	Lo	Hi	Wt. Avg.
Normudalfs	11	31.14	Timber Timber and grasses	0-25	Wisconsin till Less than 18" loess on Wisc. till 18-39" loess on Wisc. till 39-60" loess on Wisc. till	42	90	70	16	36	27
Albaqualfs	1	1.78	Prairie	0-2	Over 45" loess on Ill. till	75	75	75	33	33	33
Haplaquolls	3	30.78	Sedges and slough grasses	0- $\frac{1}{2}$	18-39" loess on Wisc. till 39-60" loess on Wisc. till 18-39" silty material on Wisc. outwash Over 45" loess on Ill. till	87	97	97	35	39	39
Argiudolls	7	26.11	Prairie	0-12	18-39" loess on Wisc. till 39-60" loess on Wisc. till 18-39" silty material on Wisc. outwash	85	101	97	31	38	37
Hapludolls	3	4.38	Grass and scattered timber	0- $\frac{1}{2}$	Medium textured, dark colored Alluvium	95	101	100	35	39	37
Argialbolls	1	.70	Prairie	0- $\frac{1}{2}$	Over 45" loess on Ill. till	68	68	68	28	28	28
Ochraqualf	2	1.40	Timber	0- $\frac{1}{2}$	39-60" loess on Wisc. till Over 45" loess on Ill. till	66	66	66	28	28	28
Haplothents	1	1.02	Timber	15-25 and up	Wisconsin till	not adaptable - - -					

Source: a = U.S. Dept. of Agriculture, Conservation Needs data.

b = H.L. Wascher, J.B. Fehrenbacher, R.T. Odell, and P.T. Veale, No. AG-1443.

c = Soil series sheets.

d = U.S. Soil Conservation Service, Coles County Work Unit Handbook, Sec. I, Part 3.

e = U.S. Soil Conservation Service, Coles County Technical Guide, Sec. III. High level of management is defined on Table 4-1, p.88.

necessary grouping for the development of comprehensive soil regions in Coles County. This alternative is the use of the next lower level or subgroup level of the 7th Approximation.

Subgroup Level















"The subgroups, as the name implies, are subdivisions of great groups, and can be defined only in terms of reference to the great groups. If we think of a great group as occupying a segment of the spectrum of soil properties, the core, or central part of that area is one subgroup. The fringes, where the properties of one great group merge with those of others, are areas where the soils intergrade between the great groups. The subgroups then are of several kinds, as follows: (1) The central concept of the great group; (2) Intergrades to other orders, suborders, or great groups . . . ; and (3) Subgroups with aberrant properties not indicative of any other great group, suborder, or order."¹

The subdivision of the eight categories at the great group level results in thirteen subgroups that are used to construct the soils region map of Fig. 4-7.

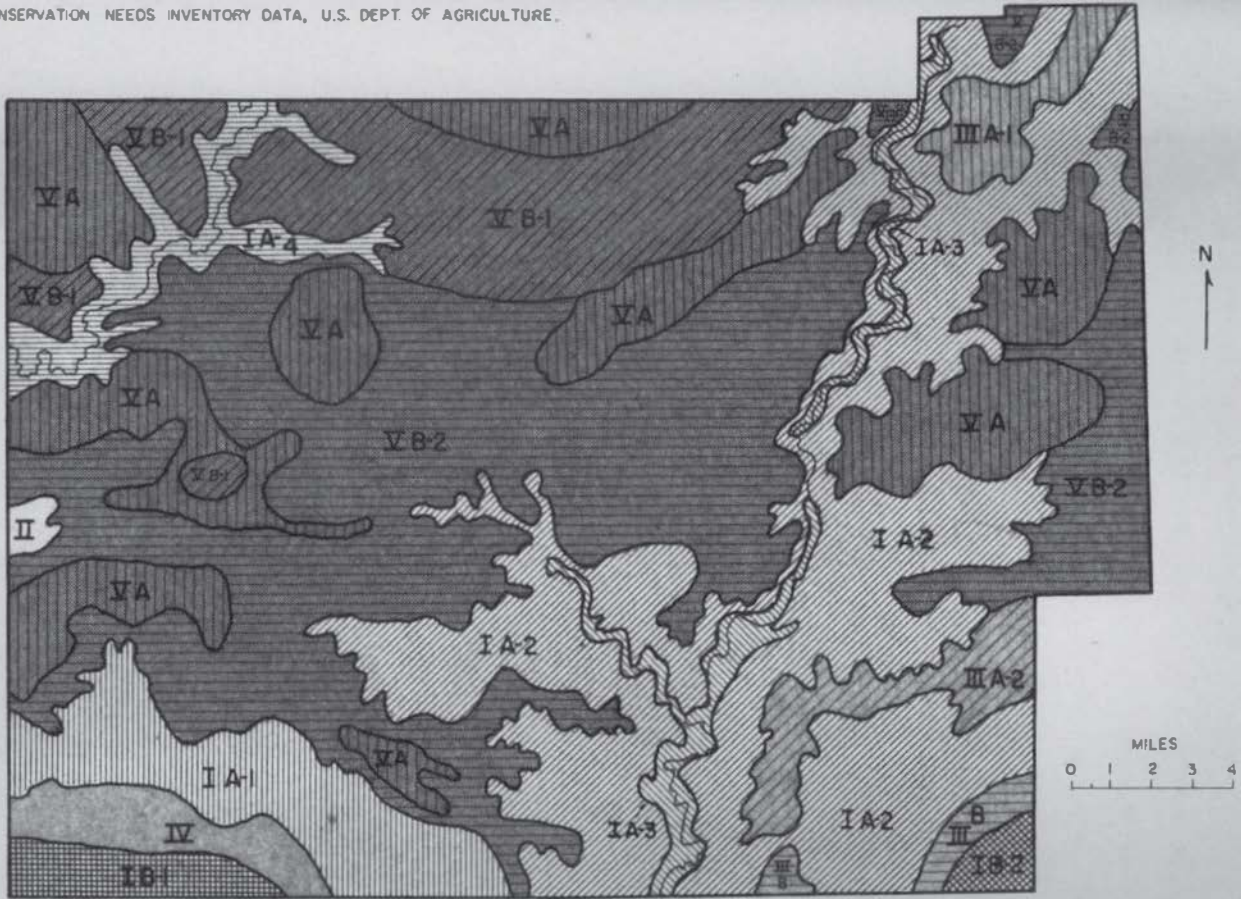
The discussion of definitions of subgroups rely heavily on reference to the great group characteristics and vary from the great groups mainly in respect to chemical or morphological properties of the soil profile. It would, therefore, be of little use to discuss the subgroups in respect to the phenomena, such as natural vegetation or parent materials, with which they are associated because it has already been discussed in the

¹Ibid., p. 14.

Fig. 4-7 LEGEND

	I A 1 PRIMARY - Typic Normudalf (Over 50% Typic Normudalf,	SECONDARY - Aquic Normudalf, Cumulic Aquic Hapludoll (Over 25% Aquic Normudalf, Over 15% Cumulic Aquic Hapludoll)	
	2 PRIMARY - Typic Normudalf (Over 70% Typic Normudalf,	SECONDARY - Aquic Normudalf (Over 10% Aquic Normudalf)	
	3 PRIMARY - Typic Normudalf (Over 50% Typic Normudalf,	SECONDARY - Cumulic Aquic Hapludolls (Over 20% Cumulic Aquic Hapludolls)	
	4	SECONDARY - Typic Normudalf, Aquic Normudalf, Cumulic or Cumulic Aquic Hapludoll (Over 25% Typic Normudalf, Over 30% Aquic Normudalf, Over 20% Cumulic or Cumulic Aquic Hapludoll)	
	B 1 PRIMARY - Mollic Albaqualf (Over 70% Mollic Albaqualf,	SECONDARY - Mollic Natraqualf (Over 15% Mollic Natraqualf)	
	2 PRIMARY - Mollic Albaqualf (Over 50% Mollic Albaqualf,	SECONDARY - Typic Ochraqualf (Over 30% Typic Ochraqualf)	
	II	SECONDARY - Typic Normudalf, Aquollic Normudalf, Aquic Argiudoll (Over 25% Typic Normudalf, Over 25% Aquollic Normudalf, Over 30% Aquic Argiudoll)	
	III A 1 PRIMARY - Typic Haplaquoll (Over 60% Typic Haplaquoll,	SECONDARY - Aquollic Normudalf, Aquic Normudalf (Over 15% Aquollic Normudalf, Over 15% Aquic Normudalf)	
	2 PRIMARY - Typic Haplaquoll (Over 50% Typic Haplaquoll,	SECONDARY - Aquic Normudalf, Typic Normudalf (Over 20% Aquic Normudalf, Over 20% Typic Normudalf)	
	B	SECONDARY - Haplaquic Argialboll, Typic Ochraqualf (Over 40% Haplaquic Argialboll, Over 30% Typic Ochraqualf)	
	IV	PRIMARY - Typic Haplaquoll (Over 80% Typic Haplaquoll,	SECONDARY - Aquollic Normudalf (Over 15% Aquollic Normudalf)
	V A	PRIMARY - Typic Haplaquoll (Over 50% Typic Haplaquoll,	SECONDARY - Aquic Argiudoll (Over 20% Aquic Argiudoll)
	B 1	PRIMARY - Acquic Argiudoll (Over 50% Acquic Argiudoll,	SECONDARY - Typic Haplaquoll (Over 20% Typic Haplaquoll)
	2	SECONDARY - Typic Argiudoll, Typic Haplaquoll (Over 45% Typic Argiudoll, Over 40% Typic Haplaquoll)	

SOURCE: CONSERVATION NEEDS INVENTORY DATA, U.S. DEPT. OF AGRICULTURE.



7th APPROXIMATION SUBGROUP REGIONS IN COLES COUNTY

J.K. 8/67

section concerning the great groups. The main chemical and morphological properties of the soil profiles of each subgroup as described in the 7th Approximation are given in Appendix B. The table in Appendix B reveals that there are explicit definitions given for those subgroups that integrate into other categories or levels while those representing the central or "typic" concept of a great group have often not been further defined. The definitions of the subgroup categories usually provide more information about soils than do the definitions of the great group categories, but still not of the detail that is desired for all geographic purposes.

Table 4-4 gives selected characteristics of the subgroups as determined by an examination of the soil series contained in each subgroup. As expected, natural vegetation characteristics are similar and well defined for each region and can be used for relatively accurate geographic analysis. The slopes vary greatly in only three subgroup categories while the remaining groups have minor slope variation. The subgroups that have a wide range in degree of slope contain soil series that develop on a wide range of slopes and thus they are more accurately describing the subgroup than might be supposed. A relatively accurate slope map of Coles County can be derived from the soil regions of Fig. 4-7. The parent materials of soils in each subgroup are relatively similar and can be grouped for effective geographical analysis through the use of the soil regions. In fact, the soil regions can be used to derive natural vegetation,

Table 4-4 SELECTED CHARACTERISTICS OF THE SUBGROUPS IN COLES COUNTY

Subgroup	a		b+c Natural Vegetation	c Percent Slope	d Parent Material	e Perme- ability	f Yields Under A High Level Of Management (bushel/acre) 1963					
	No. Of Soil Series Over ½%	Total % Of Sample Area					C o r n			S o y b e a n s		
							Lo	Hi	Wt. Avg.	Lo	Hi	Wt. Avg.
Typic Normudalf	4	17.78	Timber	0-25	Wisconsin till 18-39" loess on Wisc. till 39-60" loess on Wisc. till	Mod.	42	83	66	16	30	24
Aquic Normudalf	2	9.22	Timber	0-3	18-39" loess on Wisc. till 39-60" loess on Wisc. till	Mod. slow	71	77	74	27	29	28
Aquollic Normudalf	2	2.44	Timber and grass	0-2	18-39" loess on Wisc. till 39-60" loess on Wisc. till	Mod.-slow to mod.	81	84	82	33	33	33
Mollic Albaqualf	1	1.78	Prairie	0-2	Over 45" loess on Ill. till	Slow	75	75	75	33	33	33
Typic Haplaquoll	2	30.75	Sedges to Slough grass	0-½	39-60" loess on Wisc. till	Mod.-slow to mod.	89	97	97	35	39	39
Typic Argiudoll	4	5.38	Prairie	2-12	18-39" loess on Wisc. till 39-60" loess on Wisc. till 18-39" silty material on Wisc. outwash	Mod. - mod. rapid	85	94	90	31	35	34
Aquic Argiudoll	3	20.74	Prairie	0-4	18-39" loess on Wisc. till 39-60" loess on Wisc. till 18-39" silty material on Wisc. outwash	Mod.	93	101	99	37	38	38
Cumulic Hapludoll	1	.65	Grasses and scattered timber	0-½	Dark, medium-textured Alluvium	Mod.- mod. rapid	101	101	101	39	39	39
Cumulic Aquic Hapludoll	2	3.73	Grasses and scattered timber	0-½	Dark, medium-textured Alluvium	Mod.	95	100	99	33	37	36
Typic Haplorthent	1	1.02	Timber	10-15 and up	Wisc. till	Mod. - mod. rapid	- - not adapted - -					
Typic Ochraqualf	2	1.40	Timber	0-½	39-60" loess on Wisc. till Over 45" loess on Ill. till	Very slow	66	66	66	28	28	28
Mollic Natraqualf	1	.22	Prairie	0-2	Over 45" loess on Ill. till	slow - very slow	65	65	65	26	26	26
Haplaquic Argialboll	1	.70	Prairie	0-½	Over 45" loess on Ill. till	Slow	68	68	68	28	28	28

Source: a = U.S. Dept. of Agriculture, Conservation Needs data.

b = H.L. Wascher, J.B. Fehrenbacher, R.T. Odell, and P.T. Veale, No. AG-1443.

c = Soil series sheets.

d = U.S. Soil Conservation Service, Coles County Work Unit Handbook, Sec.I, Part 3.

e = U.S. Soil Conservation Service, "Permeability," Coles County Work Unit Handbook, Sec. V, Part 4 (Soil Conservation Service: Charleston, Illinois). Permeability or the soil infiltration rates are given in inches/hour in Appendix A.

f = U.S. Soil Conservation Service, Coles County Technical Guide, Sec. III. High level of management is defined on Table 4-1, p. 88.

slope, and parent material maps of Coles County very similar to those presented in Chapter II.

The homogeneity of the soil characteristics of each subgroup makes it possible to devise many other types of regions. It appears that it is possible to construct land-use and land-capability regions from the soils regions which are valid for the geographer's use. The data in Table 4-4 indicates that even regions such as soil permeability regions can be constructed for Coles County which is important to the geographer, farmer, construction engineer, and many others.

There is little doubt that the soil regions of Coles County constructed at the subgroup level of the 7th Approximation are more comprehensive and more applicable for the geographer's use than is true of the other soils region constructed in this study.

The soil families, the next lower level in the 7th Approximation, have been developed. However, when the important soil series of Coles County were divided into their respective family categories, it was found that most families contained only one or perhaps two soil series which is almost equal to working with the soil series level. Thus, this level of the 7 Approximation is so detailed that it apparently cannot be used for an area as large as Coles County except for detailed microgeographic studies.

Evaluation Of The U.S.D.A.
1949 Soils Classification And The 7th
Approximation For Use In A Geographic Analysis

U.S.D.A. 1949 Soils Classification

The U.S.D.A. 1949 soils classification system has several characteristics that limits its usefulness for geographic analysis and interpretation. The primary weakness of the system is that the categories at each of the higher (order, suborder, and great soil group) levels have been defined primarily in terms of the five soil-forming factors rather than in terms of the actual soil properties. For example, the soils are placed into the zonal order if they are well developed for the climatic and vegetation zones in which they are found. The soils are then grouped into suborder categories according to the type of climate and vegetation under which they have developed. Thus, suborders are divided into categories such as "Soils of the forest-grassland transition" or "Dark-colored soils of the semi-arid, subhumid, and humid grassland." It is apparent that the categories are very broadly defined, although they do present valuable information. However, the categories are not defined specifically enough with regard to soil characteristics that are useful for most geographical analyses.

The genetic approach also necessitates that the classifier make decisions as to which soil-forming factor or combination of soil-forming factors have been the most important or how they may have varied during the genesis of the soil. Many experts do not agree on the relative importance of the five soil-forming factors. Often, the exact genesis of a soil cannot be determined. Thus, grouping the soils into the various categories becomes highly subjective in a system of this nature. This may result in categories that are inexact or not uniform and therefore they are not as useful for widespread geographic application as is possible. For example, there are no specific definitions for the great soil groups and thus, general descriptions of the profile characteristics such as those quoted earlier in the chapter must be used. It must be remembered, however, that other authorities may describe and emphasize characteristics of the categories somewhat differently than has the one quoted. It is true that each great group has identifying characteristics such as the eluvial A₂ horizon of the Gray-Brown Podzolic. However, such identifying characteristics of a soil often vary greatly with respect to color, texture, acidity, or in some other manner. Thus, one may not assume that once the main characteristics of the great soil group soil profiles are known, a reliable index to all the characteristics of soils in that great soil group are also known. Rather than being uniform and well defined, " . . . the great soil group is too heterogeneous

to be used for very many objectives."¹

Emphasis on the genetic soil-forming factors has largely been responsible for a lack of development of the family categories in the U.S.D.A. 1949 classification system. Family categories were created to:

" . . . make the similarities and differences among the soils apparent at a level between that of the soil group and that of the soil series. The soil family should consist of similar soil series, and all series within one family should be members of the same great soil group."²

However, to differentiate and group the soil series requires that characteristics homogeneous to both the soil series and the great soil group be selected as the basis for the grouping. Since the great soil groups are not well defined in regard to soil profile characteristics, the family has not been able to serve as a connecting link between the two heterogeneous levels in the 1949 classification system.

The greatest advantage of using the 1949 soils classification system for geographical analysis is that nearly everyone is familiar with the system and its nomenclature, both of which facilitate communication. However, this familiarity may prove to be a handicap as was shown in the case of widespread acceptance of the great soil group profiles that are not as exact and informative as usually supposed.

¹ Soil Survey Staff, Soil Survey Manual, (Washington, D.C.: U.S. Department of Agriculture, U.S. Government Printing Office, 1st ed., August, 1951), p. 100.

²Ibid.

7th Approximation

The 7th Approximation is the soils classification system that has been developed to replace the U.S.D.A. 1949 soils classification system and is not expected to have shortcomings found in the 1949 system. The categories at each level in the 7th Approximation are defined primarily "in terms of observable or measurable soil properties, selected primarily to group soils of similar genesis."¹ The soil properties that are used for definition should be those that:

- (1) exist or can be demonstrated
- (2) result from or influence soil genesis
- (3) are of significance to plant growth or to engineering purposes
- (4) are measureable in the field
- (5) are the measureable results of the dominant processes responsible for the formation of the soil.²

The categories are thus defined using specific properties which assure a degree of uniformity and objectivity when soils are grouped into each category. This, in turn, insures uniformity and a high degree of validity in geographic interpretation when using the categories of the 7th Approximation.

¹ Guy D. Smith, "Objectives and Basic Assumptions of the New Soil Classification System," Soil Science, XCVI, No. 1 (July, 1963), p. 8.

² Ibid., p. 10-11.

Definitions of the categories at each level using measurable soil properties also insure a continuity and uniformity of subdivision within each category. The categories at every level are developed or being more fully developed so it is assured that a full selection of the various levels are available for use in a geographical analysis.

The disadvantages of the 7th Approximation are generally due to the youth of the system. Many of the terms such as names of the categories or various horizons have been constructed especially for the 7th Approximation. New concepts such as the cambic or argillic horizons are used in addition to or perhaps in place of the older, established soil concepts. This requires cultural and physical geographers concerned with soils to become familiar with new terms and concepts although it may play a minor role in their work. For this reason, geographers have been slow in accepting the 7th Approximation. Another handicap in the use of the 7th Approximation is that many properties used to define the categories are not easily shown by the soil profiles now being used. Soil profiles are presently designed to bring out the characteristics described for each great soil group of the U.S.D.A. 1949 classification system that can be seen; the 7th Approximation relies more heavily on chemical and mineralogical characteristics that cannot be shown easily by a profile. However, it is very likely that most of the disadvantages will be overcome as the use of the system becomes widespread and it is more fully adapted to replace the U.S.D.A. 1949 soils

classification system. It is very possible that the entire system will become more useful because it is still in the process of modification.

Close examination of the soil region maps constructed at the higher levels of the two systems reveals that they are very similar in pattern. Also, many of the soil series contained in a particular great soil group of the 1949 classification system are also grouped together in one great group category of the 7th Approximation and thus the same soil profiles were used to illustrate soils of both categories. Thus, one might be led to believe the systems are not significantly different and it is not worth transferring to a new system. As it has been pointed out, the 7th Approximation uses soil properties for their definitions but selects them with soil genesis as a background, therefore, it is logical that the soils of categories in both systems are somewhat similar. It should be pointed out also, that the dominant soil series in Coles County coincidentally fell into the great soil group categories that are comparable to great groups in the 7th Approximation and thus the systems appear similar with only the names of the categories changed. There are great changes in the classification of soil series when using the great groups of the 7th Approximation in Coles County south of the Shelbyville Moraine, where a great number of Planosol soils are found, and in those soils recognized unofficially as Gray-Brown Brunizems in the 1949 classification system. However, in Coles County the areal extent of the soils

series that fall into the great groups where differences are apparent is relatively minor and thus differences in the two systems do not appear. If this study were duplicated in another area, such as Cumberland County, there undoubtedly would be more significant observable differences in the two classification systems. In reality, the two classification systems are substantially different and the 7th Approximation offers a great deal more accuracy and flexibility to one who seeks geographical interpretation and analysis of the soil than does the U.S.D.A. 1949 soils classification system.

CHAPTER V

POTENTIAL APPLICATIONS, SUMMARY, AND CONCLUSIONS OF THE STUDY

Potential Applications

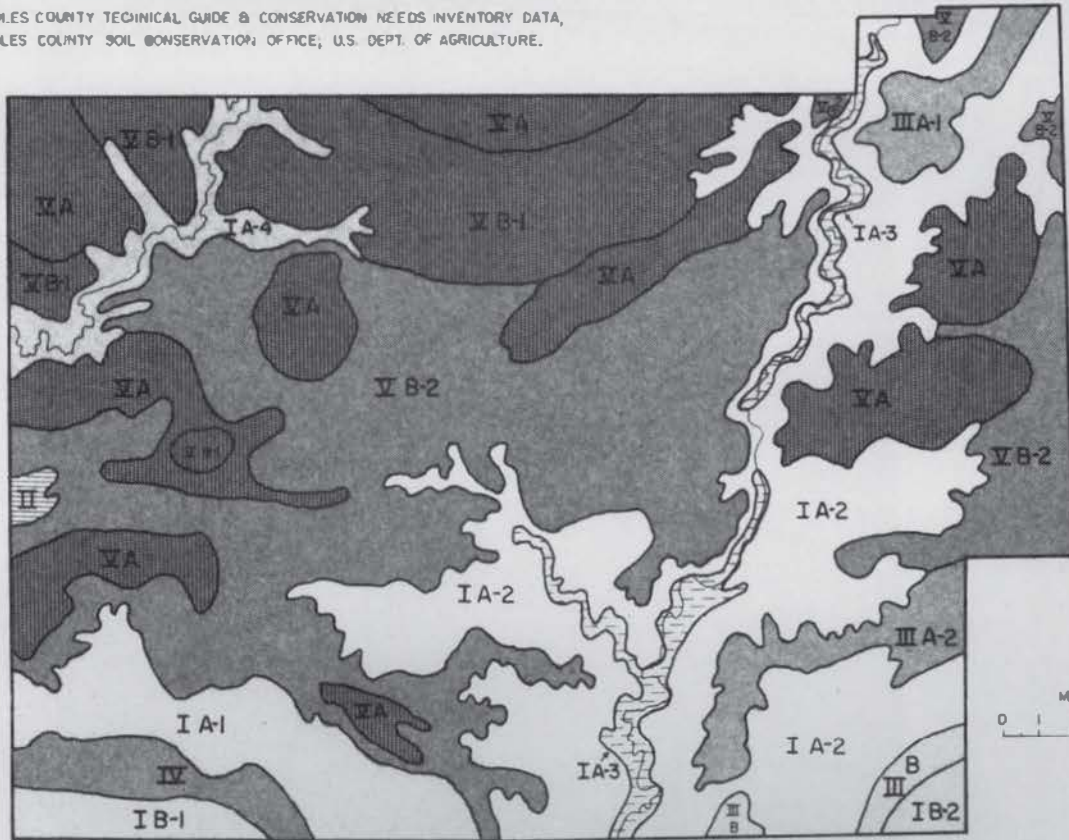
The theoretical foundation and data presented in the study imply that there are many possible applications that are of great potential value to geography. Time and space do not permit a full geographic development of a particular application using soil regions but it can suggest applications for future studies.

An example of an application is the construction of corn and soybeans yield regions in Coles County from the soil regions of Fig. 4-7. Weighted average yields/acre that may be obtained under a high level of management are computed for each subgroup in Coles County by: (1) multiplying the yield/acre of each soil series in the subgroup by the percent of the subgroup area accounted for by the series, and (2) adding these together. Yield figures are then computed for each subgroup soil region by: (1) multiplying the weighted yield per acre averages for each subgroup by the percent of the soil region which it occupies,

and (2) adding them together to give a yield figure/acre for that region for a particular crop. The yield/acre figures for the various regions are grouped into intervals of five bushels per acre for the purpose of easy illustration and comparison on a map but without loss of individualities with respect to yields when compared with other regions. Figures 5-1 and 5-2 are the yield region maps in Coles County for corn and soybeans, respectively, that are the result of using the soil regions at the subgroup level.

To test the validity and accuracy of the yield regions in Figures 5-1 and 5-2, average yield/acre of corn and soybeans are computed for each plot area from which soil series data is obtained. The average yield/acre was found by: (1) multiplying the yield/acre for each soil series by the percent of the plot area in the soil series, and (2) adding these together to obtain an average yield/acre for the plot area. The average yields/acre for each plot area (see Appendix C) are then compared to the yield regions of Figures 5-1 and 5-2. Computed yields/acre for each plot area in a particular soil region are consistently within the yield range computed for the region. There are a very few plot areas whose yields are outside the range of the yield region in which they are found. In fact, the yields of each individual plot area are generally within three percent of either end of the range for the yield region in which the plot area is located.

SOURCE: COLES COUNTY TECHNICAL GUIDE & CONSERVATION NEEDS INVENTORY DATA,
 COLES COUNTY SOIL CONSERVATION OFFICE; U.S. DEPT. OF AGRICULTURE.



CORN YIELD REGIONS IN COLES COUNTY

JK. 8/67

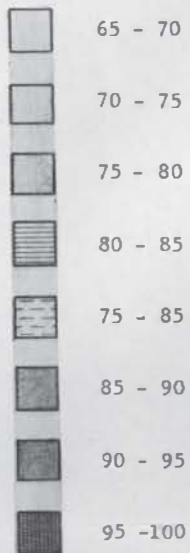
Fig. 5-1

-122-

Fig. 5-1 LEGEND

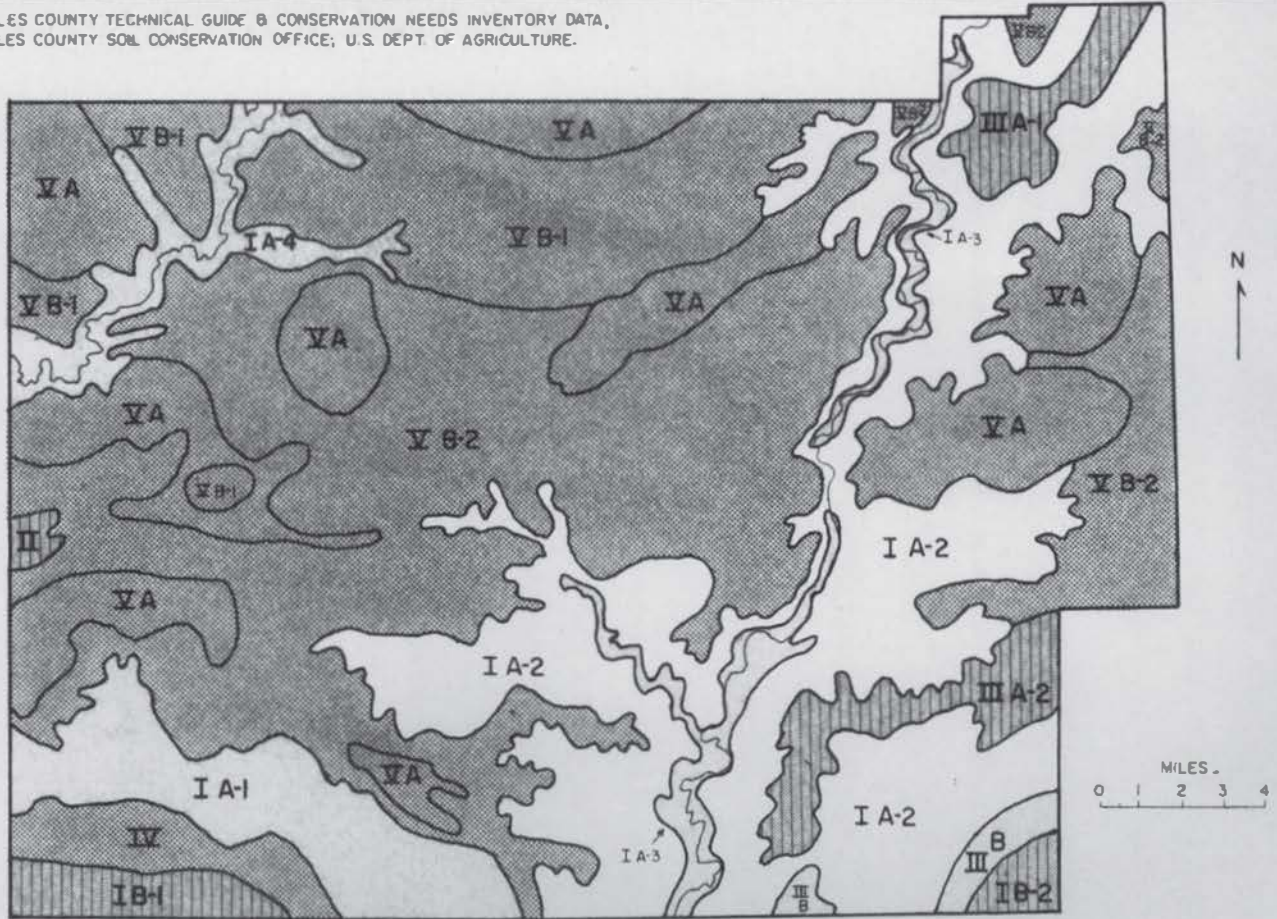
BUSHEL/ACRE

(under a high level management)



(The numbers of Fig. 5-1 denote the subgroups of Fig. 4-7.)

SOURCE: COLES COUNTY TECHNICAL GUIDE & CONSERVATION NEEDS INVENTORY DATA,
COLES COUNTY SOIL CONSERVATION OFFICE; U.S. DEPT. OF AGRICULTURE.



SOYBEAN YIELD REGIONS IN COLES COUNTY

J.K. 8/67

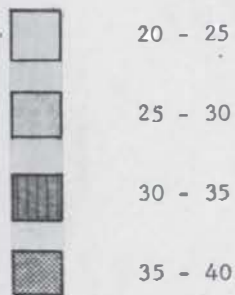
Fig. 5-2

-123-

Fig. 5-2 LEGEND

BUSHELS/ACRE

(under a high level management)



(The numbers of Fig. 5-2 denote the subgroups of Fig. 4-7.)

Thus, the yield regions that are constructed by use of weighted average yield/acre figures for subgroups are a reasonably accurate representation of the average yields/acre that can be computed for each plot area by using soil series data. This is very important because it provides the geographer with a method for developing reliable theoretical yield regions from the subgroup categories without consuming the time necessary for working extensively with soil series data.

The apparent accuracy and validity of the yield regions in Figures 5-1 and 5-2 may also enable the geographer to use the yield regions for a great deal of further analysis. Both yield region maps in Figures 5-1 and 5-2 are constructed by using average yield/acre figures for the subgroup when used under a high level of management. Two additional yield region maps of corn and soybeans can be constructed using low level management figures. By comparative analysis, it is possible to point out: (1) the naturally fertile and productive areas of Coles County, (2) the areas which respond well to good management, and (3) the potential yields for the soil regions as well as the entire county.

Yield regions for other crops, such as wheat, oats, and hay, can also be constructed. A comparative analysis of the yield regions within the study area would point out the areas most adaptable and most productive for all major crops of Coles County. This analysis would permit an evaluation of the agricultural importance of areas within the county. Agricultural

geographers have emphasized crop production when doing intensive field studies of small areas. Thus, the yield regions are of particular interest to this subfield of geography.

Agricultural geographers have also concerned themselves with explaining how the human and natural resources of an area have combined to produce the agricultural products of the area. The use of yield regions in Figures 5-1 and 5-2 could facilitate this type of study. Actual yield figures can be gathered for each of the yield regions in Coles County. A comparison of actual yields versus theoretical yields under a high or a low level of management can be conducted. The results would help the agricultural geographer to determine the level of management under which the soils are being used for agriculture. This, in turn, could lead to further study of the agricultural characteristics of Coles County. For example, the Cash Grain region of Illinois is located north of the Shelbyville Moraine while the General Farming region is located south of the Shelbyville Moraine in Coles County.¹ Ross and Case describe the soils and agricultural practices of the two regions in very general terms. An analysis of the yield regions constructed in this study versus actual productivity figures for the regions may point out which of the farmers of the two regions generally uses better

¹R.C. Ross and H.C.M. Case, Types of Farming in Illinois, Bulletin 601 (Urbana: University of Illinois Agricultural Experiment Station, April, 1956), p. 32.

agricultural practices to get maximum yields. The geographer may then seek the answer as to why this is true. A comparison of actual yield figures to theoretical yield figures might also point out that yields in the Amish community of North Okaw Township are significantly higher than the theoretical yields for soils in the area. It may also be found that actual yields from soils in the Amish community are higher than from soils with similar theoretical yields that are found in other portions of Coles County. Thus, through using the yield regions derived from soil regions, anomalous regions or areas within regions that require further geographic study may be pointed out. Research by geographers using soil regions can take many other forms and directions after an exploratory study such as the one presented. It is possible, for example, that regions using characteristics of Coles County soils such as soil permeability and erodability can be delimited. A geographer can devise regions using soil characteristics that are the most important to his particular study. The urban geographer needs to know something of soil permeability, ability of the soil to withstand structures, and soil wetness in order to interpret the existing urban patterns of Coles County. A knowledge of the areal patterns of pertinent soil characteristics will help the geographer to determine where future urban development or development along the new Interstate Highway 57 in Coles County is the most suitable and desirable.

The recreation geographer can use maps of soil erodability, soil drainage, danger of flooding, and the ability of soil to withstand trails, roads, campgrounds, etc.. Such maps would help the recreation geographer to assess present as well as future sites for recreational facilities.

A geographer interested in the land-use of Coles County can devise regions using soil characteristics that are most essential for a particular land-use or group of land-uses. By comparison of the present land-use or uses in a region or regions based on soil characteristics, a geographer can determine how well suited the present land uses are for the region in which they are located. A study of the future land-use needs of Coles County would point out the areas that have a potential use conflict. Further study and analysis of the selected soil characteristic regions in the conflict areas would help the geographer to determine the best land-use for the soils of that region and suggest alternatives that could be used to resolve the conflict.

Many maps that are required to meet a variety of the geographer's needs can be constructed from the soil region maps. In addition, the hierarchy of soil regions may make it possible to use the degree of generalization which is most suitable to the geographer's need.

There is little doubt that geographers interested in various subfields of geography can make use of soil regions for

studies of Coles County. It is important that studies of other areas are made in order to further test the application of soil regions using the 7th Approximation categories. Studies similar to the one presented here should be made in other counties in Illinois. This would serve several purposes. First, it would further test the suitability of the subgroup level of the 7th Approximation for use on an area of similar size to that of Coles County. Secondly, differences and similarities in the categories at similar levels of the two soil classification systems might be more strongly established. Thirdly, it would further test the validity of the 7th Approximation as a tool for geographic research. If similar soil regions were found in different counties, they could be compared to each other with respect to chemical, morphological, and agricultural characteristics in order to better understand the variable character of the regions.

Crop yield regions could very well be useful to the agricultural geographer in a comparative analysis of the Illinois counties with respect to natural soil fertility and potential yields. This may also be a valuable tool for evaluation of the agricultural potential of the counties with respect to one another. Also, if the counties selected are located in different agricultural regions of Illinois, as set up by Ross and Case, analysis of yield regions could lead to: (1) a better understanding of the interrelationships that exist within each agricultural region, and (2) similarities and differences of the agricultural regions.

Soil regions should also be constructed for the entire state of Illinois, a group of 10 to 20 counties, or a township. Evaluation of the resulting maps would ascertain the degree of validity of the various levels of the 7th Approximation for use in studies of different scale. Studies that are concerned with devising experimental 7th Approximation soil regions will provide the basis for more widespread and useful geographical applications of these soil regions.

Construction of a hierarchy of soil regions may prove to be a way of relating large scale studies to the more generalized small scale studies. Such a tool is especially valuable in the subfields of geography, such as agricultural geography, in which there still exists a major problem of relating various scale studies to each other.

Summary

Coles County will apparently undergo significant growth and change in the near future. Much of the change will directly or indirectly involve the soils of Coles County. There is, however, little or no up-to-date information about Coles County soils in their areal setting.

Soils geography, as a subfield of geography, is concerned with areal relationships as they seek to interpret the arrangement and character of soils from place to place on the earth's surface. As it is true of other geographic phenomena, soils differ greatly

from place to place and they cannot all be studied individually. Generalizations must be used to group soils so they may be effectively studied. Yet, when generalizations are used, they should group soils as homogeneously as possible so the maximum meaning and significance of the grouping may be attained when interrelationships are interpreted. Thus, this study is focused upon a determination of a method for constructing soil regions that are the most realistic and useful in providing information about regional interrelationships.

Soil series data for Coles County are taken from the Conservation Needs Inventory and other selected 160 acre plot areas. The areally most significant soil series are grouped into the categories at the various levels of both the U.S.D.A. 1949 soils classification system and the 7th Approximation. The categories are used as the criteria for delimiting soil regions at various levels of both systems.

The resulting soil region maps are evaluated in terms of: (1) the quantity of information and degree of accuracy of chemical and morphological characteristics given about the soils in each region, and (2) the accuracy of information about other phenomena related to the soils in each region. Evaluation of the maps in this manner required a discussion of the formation and characteristics of the major soil series in the study area. Natural vegetation, slope, topographic feature, and parent material maps constructed for the discussion were used to help develop and analyze the viability of the soil regions developed

at the various levels of the two systems. Of all the soil region maps constructed, the subgroup level of the 7th Approximation is most realistic and useful concerning soils and their interrelationships within the study area.

Conclusions

The two main objectives of this study - (1) to analyze selected geographical aspects of Coles County soils which will serve as a basis (2) to test the validity of the use of the 7th Approximation in a soils geography study - have been fulfilled. It is apparent that Coles County soils have distinct characteristics and areal differences that provide a good laboratory for soils geography studies. Within Coles County, the subgroup level of the 7th Approximation presents the most realistic and potentially useful soil regions for detailed geographical analyses. The subgroup category is nearly as accurate as soil series data when it is used to define regions of agricultural productivity. The viable soil regions developed in this study not only facilitates the geographer's task of defining agricultural yield regions, but it also enables the geographer to use these regions to help identify geographical problems. The quantity and reliability of soil information that may be obtained from the subgroup and other 7th Approximation categories theoretically makes possible a wide variety of geographic analyses in Coles County.

The study illustrates that a geographer can use the 7th Approximation to develop useful soil data at all scales of study while use of the U.S.D.A. 1949 soils classification system is very limited in this aspect. Thus, the 7th Approximation provides soil regions with the greatest potential for most future geographic studies of soils. Several additional studies applying the 7th Approximation soil regions are needed to further test the viability of the 7th Approximation as a tool for geographic research.

Areal differentiation of soils at various levels of the two classification systems and analyzing the interrelationships within the study area do constitute a geographical study of the soils. However, the main value of the study is that it provides a methodological foundation from which other geographers can investigate physical, cultural, and economic aspects of geography that have close interrelationships with soil.

GLOSSARY

1. Calcareous - anything containing sufficient calcium carbonate (often with magnesium carbonate) to effervesce visibly to the naked eye when treated with hydrochloric acid.

2. Eluviation - the movement of soil material from one place to another within the soil, in solution or suspension, where there is an excess of rainfall over evaporation. Horizons that have lost material through eluviation are referred to as eluvial, and those that have received material are illuvial.

3. Gley - a soil horizon in which the material is usually bluish gray or olive gray, more or less sticky, compact, frequently without definite structure; developed under the influence of excessive moisture.

4. Illuviation - the process of deposition of soil material removed from one horizon to another horizon of the soil, usually from an upper horizon to a lower horizon in the profile.

5. Land-capability classes -
 - ^a

Land suitable for regular cultivation:

Class I. Soils that have few or no conditions that limit their use. They can be safely cultivated without special conservation treatment.

Soils in this class are suited to a wide range of plants and may be used safely for cultivated crops, pasture, range, woodland, and wildlife. They are nearly level and erosion hazard (wind or water) is low; they are deep, generally well drained, and easily worked; they hold water well and are either fairly well supplied with plant nutrients or highly responsive to inputs of fertilizer.

The soils in class I are not subject to damaging overflow. They are productive and suited for intensive cropping. The local climate is favorable for growing many of the common field crops. Soils in class I that are used for crops need ordinary management practices to maintain productivity—both soil fertility and soil structure.

Class II. Soils that have some natural condition that limits the kinds of plants they can produce or that calls for some easily applied conservation practice when they are cultivated.

Soils in this class require careful soil management, including conservation practices, to prevent deterioration or to improve air and water relations when the soils are cultivated; the limitations are few and the practices are easy to apply.

These soils may be used for cultivated crops, pasture, range, woodland, or for wildlife food and cover but they provide the farm operator less latitude in the choice of either crops or management practices than soils in class I. They may also require special soil-conserving cropping systems, soil conservation practices, water-control devices, or tillage methods when used for cultivated crops.

Class III. Soils that have more serious or more numerous limitations than those in class II and are more restricted in the crops they can produce or, when cultivated, call for conservation practices more difficult to install or keep working efficiently.

These soils may be used for cultivated crops, pasture, woodland, range, or for wildlife food and cover.

Their limitations restrict the amount of clean cultivation; timing of planting, tillage, and harvesting; choice of crops; or a combination of these. The limitation may be natural—such as steep slope, sandy or shallow soil, or too little or too much water. Or the limitation may be erosion brought on by the way the land has been used.

Land suitable for limited cultivation:

Class IV. Soils that have very severe limitations that restrict the kinds of plants they can grow. When cultivated, they require very careful management and conservation practices are more difficult to apply and maintain than on soils of class III.

These soils may be used for crops, pasture, woodland, range, or for wildlife food and cover.

Many sloping soils in class IV in humid regions are suited for occasional but not regular cultivation. In subhumid and semiarid regions soils in class IV may produce good yields of adapted cultivated crops in years of above average rainfall; low yields in years of average rainfall; and failures in years of below average rainfall. In the low-rainfall years the land must be protected even though there can be little or no expectance of a marketable crop.

Land generally not suitable for cultivation:

Class V. Soils that have little or no erosion hazard but have some condition impractical to remove that limits their use largely to pasture, range, woodland, recreation, water supply, or wildlife food and cover. They have limitations that restrict the kind of plants that can be grown and that prevent normal tillage of cultivated crops.

These soils are nearly level but are wet, are frequently overflowed by streams, are stony, have climatic limitations, or have some combination of these limitations.

in cover crops or soil-improving crops not harvested or pastured, rotation pasture, and cropland being prepared for crops or newly seeded. Cropland also includes land in vegetables, fruits, and nuts including those grown on farms for home use. All tame hay (and also wild hay harvested east of the Mississippi and that from irrigated land west of the Mississippi) was included as cropland. Meadowland was considered as cropland when it had soil and water conditions capable of producing a hay crop in normal years, was used primarily for the production of hay harvested nearly every year, and was locally considered as cropland rather than as pasture or range. The hay could consist of either native or introduced species.

Irrigated cropland. Cropland to which water is usually applied by artificial means.

The 1958 acreage includes only cropland which was irrigated in 1957. Irrigated cropland was recorded in the 17 western mainland States.

Pasture and range. Land in grass or other long-term forage growth used primarily for grazing. Pasture and range includes grassland, nonforested pasture, and nonirrigated wild hay harvested west of the Mississippi and other grazing land with the exception of pasture in the crop rotation. It may contain shade trees or scattered timber trees with less than 10 percent canopy, but the principal plant cover is such as to identify its use primarily as permanent grazing land. It does not include extensive acreages in the following categories which are grazed but are included in forest and woodland: Chaparral, pinon-juniper woodlands of the West, and grassy forested areas with more than 10 percent tree canopy.

Forest and woodland. (a) Land which has at least 10 percent canopy of forest trees of any size and capable of producing timber or other wood products or capable of exerting an influence on the water regime; (b) land from which the trees described in (a) have been removed to less than 10 percent canopy and which has not been developed for other uses; (c) afforested (planted) areas; and (d) chaparral areas.

Other land. All agricultural land not classified as cropland.

6. Percent slope - the vertical change in feet for each 100

feet of horizontal distance. For example, a 15 percent slope means 15 feet of vertical change in 100 feet of distance.

^b
7. Permeability rates -

<u>Permeability</u>	<u>Soil Infiltration Rate (in/hr)</u>
Rapid	1.5-4.0"
Mod. rapid	.8-1.5"
Moderate	.5-8 "
Mod. slow	.3-5 "
Slow	.1-3 "
Very slow	.02-0.1"

8.^c pH values - used for the following terms:

	pH		pH
Extremely acid.....	Below 4.5	Neutral.....	6.6-7.3
Very strongly acid...	4.5-5.0	Mildly alkaline.....	7.4-7.8
Strongly acid.....	5.1-5.5	Moderately alkaline..	7.9-8.4
Medium acid.....	5.6-6.0	Strongly alkaline....	8.5-9.0
Slightly acid.....	6.1-6.5	Very strongly alkaline	9.1 and higher

9. Soil structure - the morphological aggregates in which the individual soil particles are arranged.
10. Soil texture - the relative proportion of the various size groups of individual soil grains. The coarseness or fineness of the soil.
- 11.^d Textural classes -

-basic definitions in graphic form

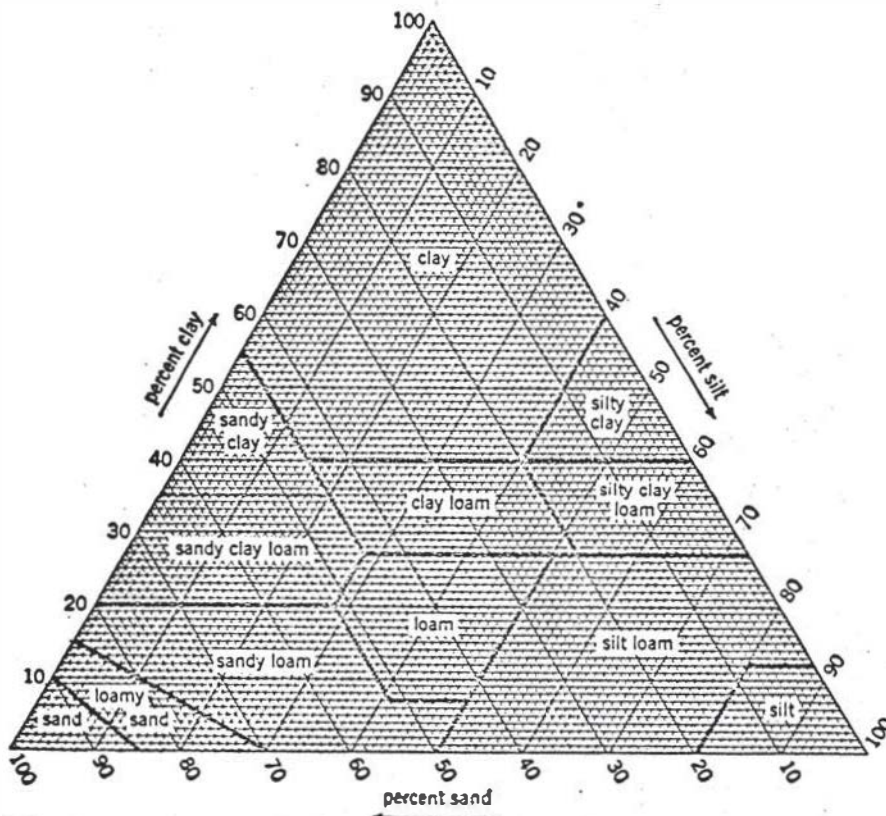


Chart showing the percentages of clay (below 0.002 mm.), silt (0.002 to 0.05 mm.), and sand (0.05 to 2.0 mm.) in the basic soil textural classes.

-general grouping

General terms:	<i>Basic soil textural class names</i>		
Sandy soils.— <i>Coarse-textured soils</i>	Sands. Loamy sands.		
Loamy soils.—	<i>Moderately coarse-textured soils</i> } <i>Medium-textured soils</i> } <i>Moderately fine-textured soils</i> }	Sandy loam. Fine sandy loam. Very fine sandy loam. Loam. Silt loam. Silt. Clay-loam. Sandy clay loam. Silty clay loam.	
		Clayey soils.— <i>Fine-textured soils</i>	Sandy clay. Silty clay. Clay.

^a U.S. Department of Agriculture, Soil and Water Conservation Needs - A National Inventory, Miscellaneous Publication No. 971, A Report Prepared by the Conservation Needs Inventory Committee (Washington, D.C., 1965), p. 91.

^b U.S. Soil Conservation Service, Coles County Work Unit Handbook, Sec. V, Part 4.

^c Soil Survey Staff, Soil Survey Manual (Washington, D.C.: U.S. Department of Agriculture, U.S. Government Printing Office 1st ed., August, 1951), p. 235.

^d Ibid., pp. 209-213.

A P P E N D I X B

SOIL SERIES - COLES COUNTY

Number	Series	Type	Area (acres)	Percent of Total Sample Area
24		silt loam	7.5	.07
25	Hennepin	loam	108.0	1.02
27	Miami	loam-silt loam	270.5	2.56
48	Ebbert	silt loam	73.5	.70
55	Sidell	silt loam	111.5	1.05
56	Dana	silt loam	213.0	2.02
60	La Rose	silt loam	12.0	.11
67	Harpster	silty clay loam	15.0	.14
73	Huntsville	loam	68.5	.65
87	Summer	silt loam	.5	.01
107	Sawmill	silty clay loam	48.0	.45
112	Cowden	silt loam	188.0	1.78
113	Oconee	silt loam	15.0	.14
131	Alvin	fine sandy loam	.5	.01
132	Starks	silt loam	20.0	.19
134	Camden	silt loam	21.0	.20
137	Ellison	silt loam	1.0	.01
138	Shiloh	silty clay loam	56.0	.53
145	Saybrook	silt loam	81.5	.77

SOIL SERIES - COLES COUNTY--Continued

Number	Series	Type	Area (acres)	Percent of Total Sample Area
148	Proctor	silt loam	16.0	.15
149	Brenton	silt loam	165.5	1.57
151	Ridgeville	fine sandy loam	5.5	.05
152	Drummer	silty clay loam	3116.5	29.52
153	Pella	silty clay loam	5.0	.05
154	Flanagan	silt loam	1351.5	12.80
164	Bluford	silt loam	4.0	.04
165	Wynoose	silt loam	94.0	.89
171	Catlin	silt loam	161.5	1.53
175	Unity	loamy sand- sandy loam	5.5	.05
206	Thorp	silt loam	6.0	.06
207	Ward	silt loam	32.0	.51
219	Millbrook	silt loam	33.5	.32
221		silt loam	3.0	.03
224	Strawn	silt loam	505.5	4.79
226	Capron	silt loam	8.0	.07
233	Birbeck	silt loam	77.0	.73
234	Sunbury	silt loam	88.0	.83
236	Reesville	silt loam	445.0	4.22

SOIL SERIES - COLES COUNTY--Continued

Number	Series	Type	Area (acres)	Percent of Total Sample Area
291	Yenia	silt loam	595.5	5.64
322	Russell	silt loam	428.5	4.06
328	Cullo	silt loam	2.5	.02
330	Peotone	silty clay loam	77.0	.73
333	Wakeland	silt loam	33.0	.31
348	Wingate	silt loam	65.5	.62
353	Toronto	silt loam	170.5	1.61
376	Leonore	silt loam	31.0	.29
381		silt loam	3.0	.03
385	Atlanta	silt loam	60.0	.57
428	Coffeen	silt loam	110.5	1.05
451	Lawson	silt loam	283.0	2.68
474	Piasa	silt loam	23.5	.22
481	Raub	silt loam	672.0	6.37
490	Odell	silt loam	8.5	.08
495		silt loam - loam	9.0	.08
496	Fincastle	silt loam	527.5	5.00
497	Mellott	silt loam	<u>2.5</u>	<u>.02</u>
			10,559.0	100.00

Source: U.S. Department of Agriculture, Conservation Needs Inventory data.

PROFILE CHARACTERISTICS OF THE 7TH APPROXIMATION

SUBGROUPS IN COLES COUNTY

No. In Subgroup	Subgroup	Profile Characteristics	
4	Typic NormudalFs	A ₁	- Ochric epipedon
		B ₂	- Argillic horizon
		C	- Parent material or Bedrock
2	Aquic NormudalFs	A ₁	- Ochric epipedon
		B ₂	- Light colored argillic horizon with mottles in upper 10"
		C	- Parent material or rock
2	Aquollic AlbaqualFs	A ₁	- Ochric epipedon
		B	- Dark colored argillic horizon with mottles in upper 10"
		C	- Parent material or rock
1	Mollic AlbaqualFs	A ₁	- Thick, dark ochric epipedon
		A ₂	- Light colored albic horizon
		B ₂	- Dark argillic horizon very high in organic matter (like epipedon)

PROFILE CHARACTERISTICS- - Continued

No. In Subgroup	Subgroup		Profile Characteristics
2	Typic Haplaquolls	A ₁	- Mollic epipedon 6-24" thick
		B ₂	- May have cambic horizon
		C	- Parent material or rock
4	Typic Argiudolls	A ₁ and part of B ₂	- Mollic epipedon
		B ₂	- Brownish argillic horizon (often has mottling)
		C	- Parent material
3	Aquic Argiudolls	A ₁ and part of B ₂	- Mollic epipedon
		B ₂	- Brownish argillic horizon with very dark mottling
		C	- Parent material
1	Cumulic Hapludolls	A ₁ and part of B ₂	- Mollic Epipedon over 20" thick
		B ₂	- Possible cambic horizon
		C	- Parent material

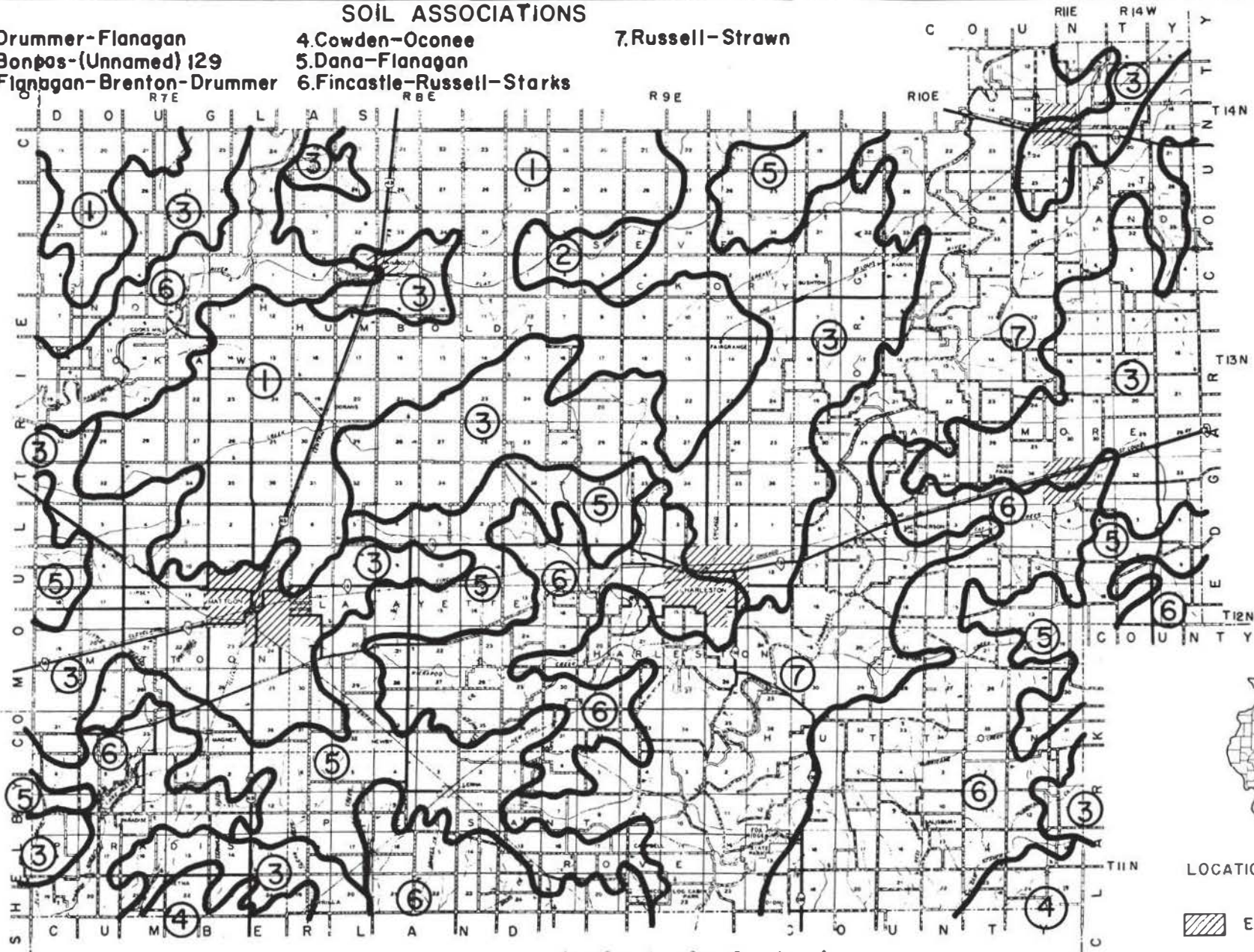
PROFILE CHARACTERISTICS- - Continued

No. In Subgroup	Subgroup	Profile Characteristics	
2	Cumulic Acquic Hapludolls	-no description available-	
1	Typic Haplorthents	-no description available-	
2	Typic Ochraqualfs	A ₁	- Thick, dark ochric epipedon
		A ₂	- Albic horizon
		B ₂	- Argillic horizon (rests on C)
		C	- Parent material
1	Mollic Natraqualfs	A ₁ and upper portion of B ₂	- Mollic epipedon
		B ₂	- Contains a natric horizon
1	Haplaquic Argialbolls	-no description available-	

Source: Soil Survey Staff, Soil Classification, A Comprehensive System, 7th Approximation.

SOIL ASSOCIATIONS

- 1. Drummer-Flanagan
- 2. Bonpas-(Unnamed) 129
- 3. Flanagan-Brenton-Drummer
- 4. Cowden-Oconee
- 5. Dana-Flanagan
- 6. Fincastle-Russell-Starks
- 7. Russell-Strawn



LOCATION IN ILLINOIS

EXCLUDED AREA

0 1 2 3 4 5
SCALE IN MILES

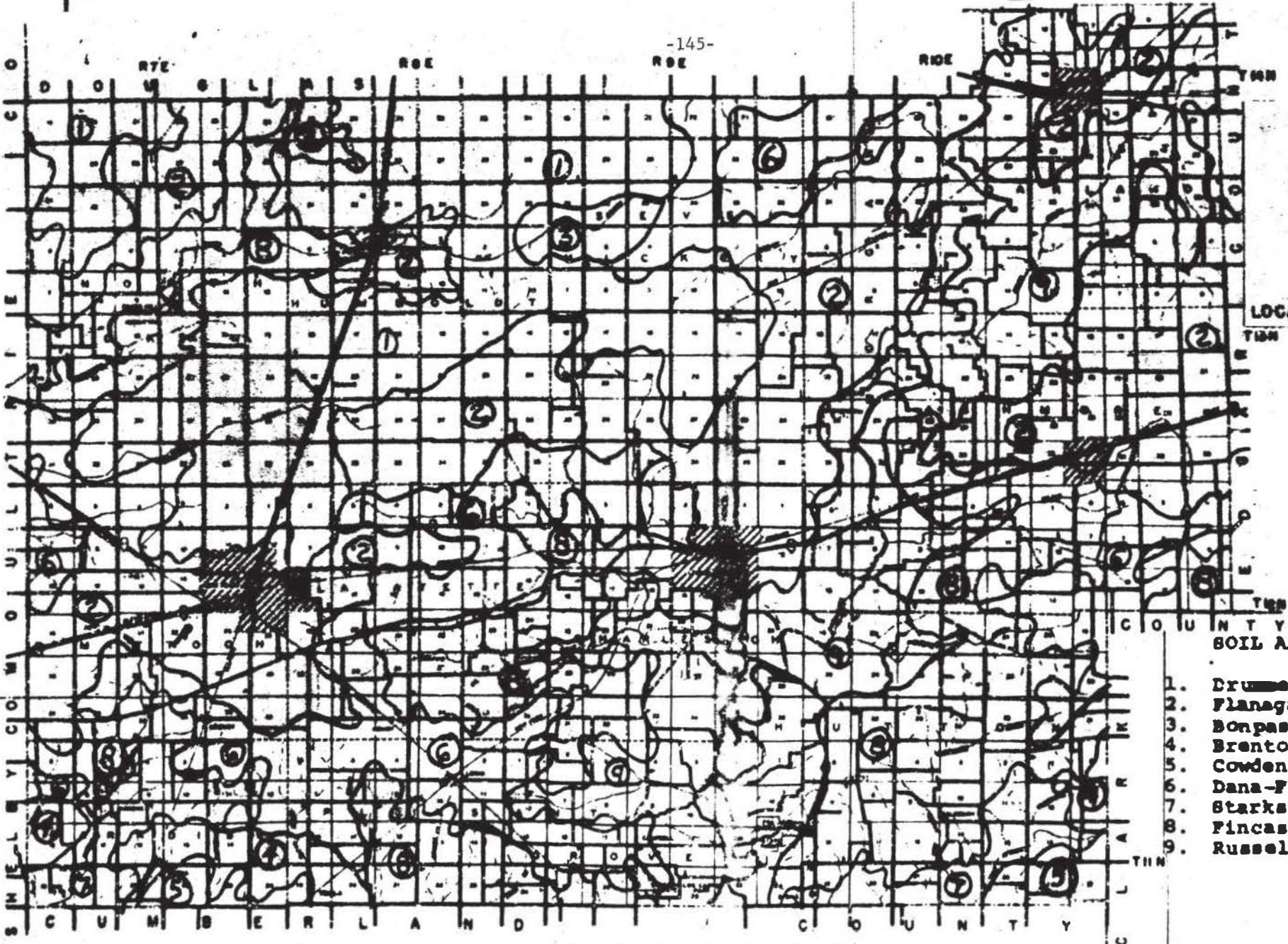
LAND RESOURCE IAP COLES COUNTY SOIL CONSERVATION DISTRICT

Total acreage approximate 318,380
Acreage in farms 310,101

The District includes all of Coles County
exclusive of cities, towns, and villages,
and cemeteries

Prepared by the Cartographic Division, Soil Conservation Service, operating with the District Governing Body

January 1963



LOCATION IN ILLINOIS

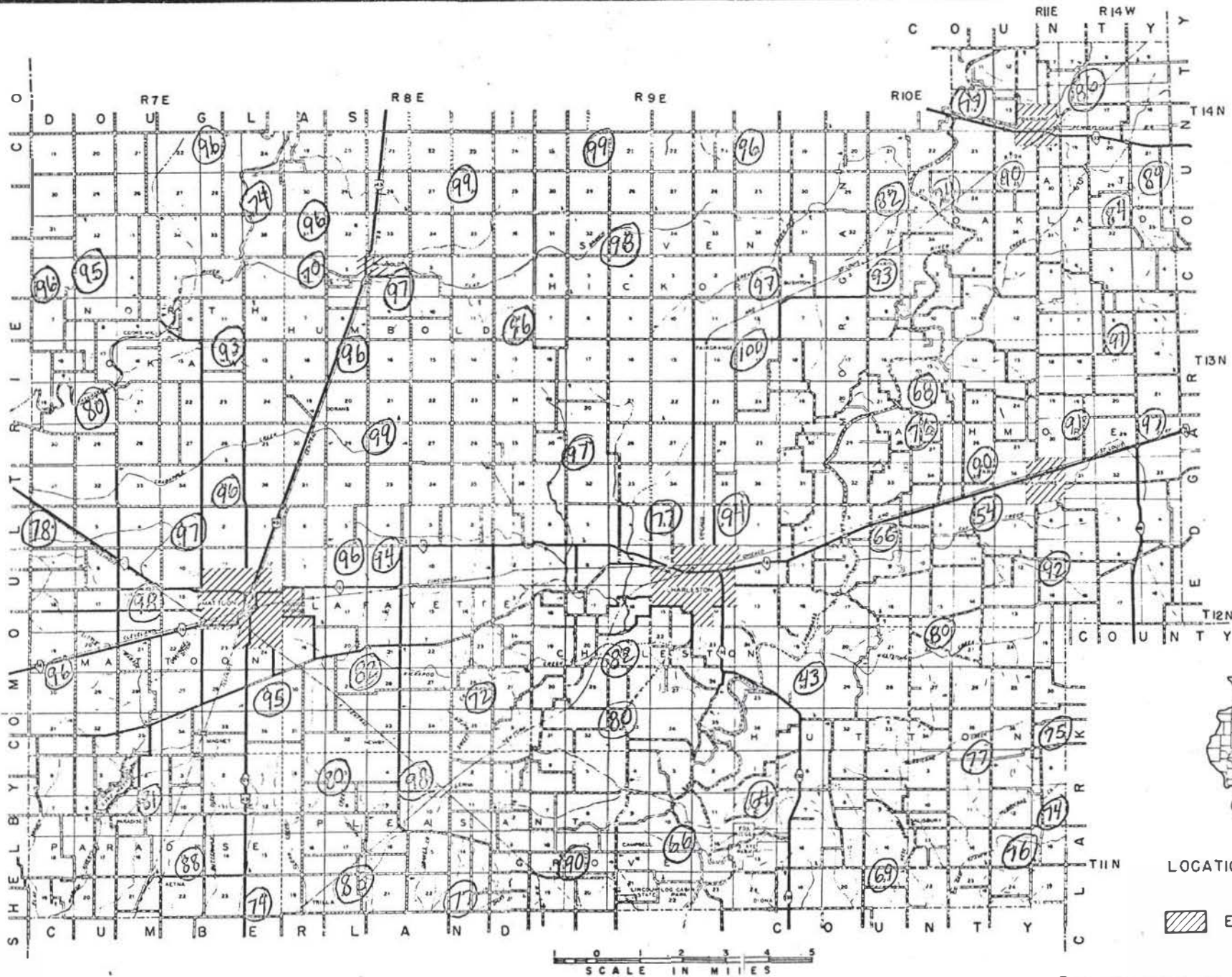
SOIL ASSOCIATIONS

- 1. Drummer-Flanagan
- 2. Flanagan-Drummer
- 3. Bonpas-(Unnamed) 129
- 4. Brenton-Drummer
- 5. Cowden-Oconee
- 6. Dana-Flanagan
- 7. Starks-Camden
- 8. Fincastle-Russell
- 9. Russell-Strawn

GENERAL SOIL MAP

COLES COUNTY





LOCATION IN ILLINOIS

 EXCLUDED AREA



The District includes all of Coles County exclusive of cities, towns, and villages, and cemeteries

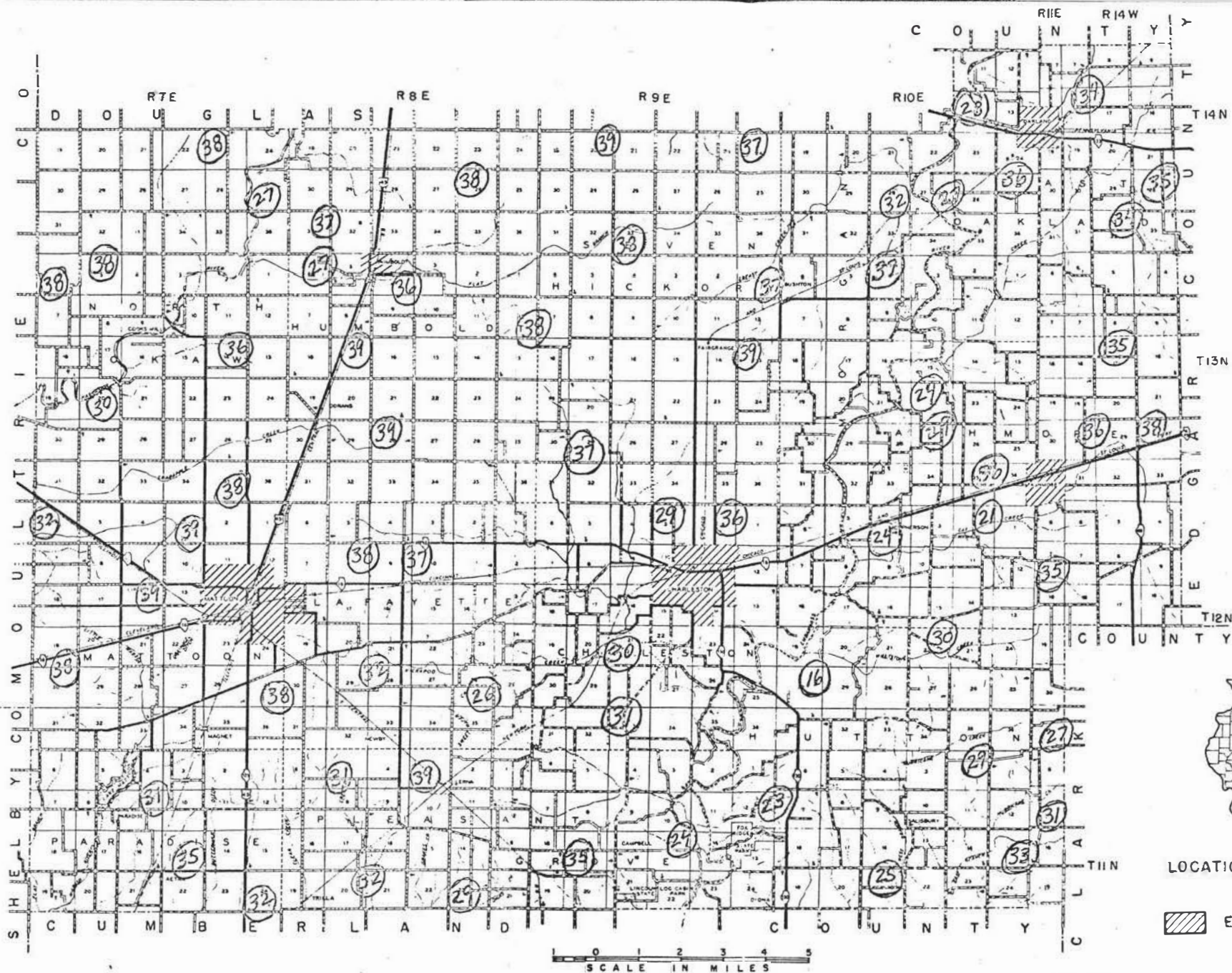
Total acreage approximate 318,380
Acreage in farms 310,101

COLES COUNTY SOIL CONSERVATION DISTRICT

Prepared by the Cartographic Division, Soil Conservation Service,

Cooperating with the District Governing Body

1-27-50
3-N-22,294



Total acreage approximate 318,380
 Acreage in farms 310,101

COLES COUNTY SOIL CONSERVATION DISTRICT

The District includes all of Coles County
 exclusive of cities, towns, and villages,
 and cemeteries

B I B L I O G R A P H Y

Books

- Bartelli, L. J., Klingebiel, A.A., Baird, J.V., and Heddleston, M.R. (ed.). Soil Surveys and Land Use Planning. Soil Science Society of America and American Society of Agronomy: 1966.
- Buckman, Harry D. and Brady, Nyle C. The Nature and Properties of Soils. New York: MacMillan Co., 1964.
- Fenneman, Nevin M. Physiography of Eastern United States. New York: McGraw-Hill Book Co., Inc., 1938.
- James, Preston E. and Jones, Clarence F. (ed.). American Geography - Inventory and Prospect. New York: Syracuse University Press, 1st ed., 1954.
- Kellogg, Charles E. The Soils That Support Us. New York: The MacMillan Co., 12th ed., 1961.
- Leverett, Frank. The Illinois Glacial Globe, Monograph No. 38. Washington, D.C.: U.S. Geological Survey, U.S. Government Printing Office (1899).
- Millar, C.E., Turk, L.M., and Foth, H.D. Fundamentals of Soil Science. New York: John Wiley and Sons, Inc., 1958.
- Soil Survey Staff. Soil Classification, A Comprehensive System, 7th Approximation. Washington, D.C.: U.S.D.A. Soil Conservation Service, U.S. Government Printing Office, 1st ed., 1960.
- Soil Survey Staff. Soil Survey Manual. Washington, D.C.: United States Department of Agriculture, U.S. Government Printing Office, 1st ed., August, 1951.
- Thornbury, William D. Principles of Geomorphology. New York: John Wiley and Sons, Inc., 1954.

Trewartha, Glen T., Robinson, Arthur A., and Hammond, Edwin A.
Physical Elements of Geography. St. Louis, Missouri:
McGraw-Hill Book Co.: 5th ed., 1967.

Articles and Periodicals

- Baldwin M., Kellogg, Charles E., and Thorp, J. "Soil Classification," Soils and Men. Washington, D.C.: U.S. Department of Agriculture Yearbook, 1938, U.S. Government Printing Office.
- Bidwell, O.W. and Hole, F.D. "Man as a Factor of Soil Formation," Soil Science, IC, No. 1 (January, 1965).
- Borchert, John R. "The Climate of the Central North American Grassland," Annals of the Association of American Geographers, XL, No. 1 (March, 1950).
- Ekblaw, W. Elmer. "The Role of Soils in Geographic Interpretation," Annals of the Association of American Geographers, XXVIII, No. 3 (September, 1937).
- Kellogg, Charles E. "Why A New System of Soil Classification?" Soil Science, XCVI, No. 1 (July, 1963).
- Sauer, C.D. "Notes on the Geographic Significance of Soils," Journal of Geography, XXI, No. V (May, 1922).
- Smith, Guy D. "Objectives and Basic Assumptions of the New Soil Classification System," Soil Science, XCVI, No. 1 (July, 1963).
- Thorp, J. and Smith, Guy D. "Higher Categories of Soil Classifications: Order, Suborder, and Great Soil Groups," Soil Science, LXVII.
- Vestal, Arthur G. "A Preliminary Vegetation Map of Illinois," Transactions of the Illinois State Academy of Science, XXIII, No. 3. (March, 1931).

Reports and Bulletins

- College of Agriculture. Illinois Soil and Water Conservation Needs Inventory. A Report Prepared by the Illinois Soil and Water Conservation Needs Committee. Urbana: University of Illinois, 1st ed. (August, 1962).
- Department of Registration and Education. Local Climatological Data 1901 - 1962 Charleston. A Report Prepared by the Illinois State Water Survey Division. Urbana: State of Illinois, 1964.
- Frye, John C., Glass, H.D., Willman, H.B. Stratigraphy and Mineralogy of the Wisconsin Loesses of Illinois, Circular 344. Urbana: Illinois State Geological Survey (1962).
- Horberg, Leland. Bedrock Topography of Illinois, Bulletin No. 73. Urbana: Illinois State Geological Survey (1950).
- Leighton, M.M., Ekblaw, George, and Horberg, Leland. Physiographic Divisions of Illinois, Report of Investigations No. 129. Urbana: Illinois State Geological Survey (1948).
- Leighton, M.M. and MacClintock, Paul. Weathered Zones of the Drift-Sheets of Illinois, Report of Investigations No. 20. Urbana: Illinois State Geological Survey (1930).
- Page, John L. Climate of Illinois, Bulletin 532. Urbana: University of Illinois Agricultural Experiment Station (April, 1949).
- Ross, R.C. and Case, H.C.M. Types of Farming in Illinois, Bulletin 601. Urbana: University of Illinois Agricultural Experiment Station (April, 1956).
- Runge, E.C.A., Carmer, S.G., and Tyler, L.E. "Slope of the Illinois Landscape," Illinois Research, IX, No. 3. Urbana: University of Illinois Agricultural Experiment Station (Summer, 1967).
- Sampson, Homer C. An Ecological Survey of the Prairie Vegetation of Illinois, Bulletin XIII, Art. XVI. Urbana: Illinois State Natural History Survey (August, 1921).

- Smith, Guy D. Illinois Loess - Variation In Its Properties And Distribution: A Pedological Interpretation, Bulletin 490. Urbana: University of Illinois Agricultural Station (July, 1942).
- Smith, R.S., DeTurk, E.E., Bauer, F.C., and Smith, L.H. Coles County Soils, Soil Report No. 44. Urbana: University of Illinois Agricultural Experiment Station (August, 1929).
- Telford, Clarence J. Third Report On A Forest Survey Of Illinois, Bulletin XVI, Art. I. Urbana: Illinois State Natural History Survey (March, 1926).
- U.S. Department of Agriculture. National Handbook for Updating the Conservation Needs Inventory. A Report Prepared by the Department Conservation Needs Inventory Committee. Washington, D.C.: U.S. Government Printing Office (August, 1966).
- U.S. Department of Agriculture. Soil and Water Conservation Needs - A National Inventory, Miscellaneous Publication No. 971. A Report Prepared by the Conservation Needs Inventory Committee. Washington, D.C., 1965.
- U.S. Soil Conservation Service. Soil Surveys - Review of February, 1963, Soil Family Groups. Champaign, Ill.: U.S. Soil Conservation Service Office (January 27, 1964).
- Wascher, H.L., Alexander, John D., Ray, B.W., Beavers, A.H., and Odell, R.T. Characteristics of Soils Associated with Glacial Till in Northeastern Illinois, Bulletin 665. Urbana: University of Illinois Agricultural Experiment Station (November, 1960).
- Wascher, H.L., Fehrenbacher, J.B., Odell, R.T., Veale, P.T. Illinois Soil Type Descriptions, No. AG-1443. Urbana: University of Illinois Agricultural Experiment Station (1950).
- Willman, H.B., Glass, H.D., and Frye, John C. Mineralogy of Glacial Till and Their Weathering Profiles in Illinois, Circular 400. Urbana: Illinois State Geological Survey (1966).

Other Sources

- Coles County Conservation Service. Soil Series Sheets. Charleston, Illinois.
- Coles County Conservation Service. Telephone interview with J.K. Johnson, Work Unit Conservationist. Charleston, Illinois: July 24, 1967.
- Jones, R.L. and Hinesly, T.D. "Illinois' Pleistocene Heritage," Agronomy Facts, No. SP-31. Urbana: University of Illinois College of Agriculture (July 9, 1965).
- U.S. Department of Agriculture. Conservation Needs Inventory data.
- U.S. Soil Conservation Service, "Acidity," Coles County Work Unit Handbook, Sec. V, Part 8b. Charleston, Illinois: Soil Conservation Office.
- U.S. Soil Conservation Service, "Permeability," Coles County Work Unit Handbook, Sec. V, Part 4. Charleston, Illinois: Soil Conservation Office.
- U.S. Soil Conservation Service, "Taxonomic Key," Coles County Work Unit Handbook, Sec. I, Part 3. Charleston, Illinois: Soil Conservation Office.
- U.S. Soil Conservation Service. "Land Capability," Coles County Technical Guide, Sec. II, A-1. Charleston, Ill.: Soil Conservation Office.
- U.S. Soil Conservation Service. "Yields," Coles County Technical Guide, Sec. III. Charleston, Ill.: Soil Conservation Office.
- Wascher, H.L. "Glacial Tillis of Wisconsin Age in Illinois," Agronomy Facts, No. SP-7. Urbana: University of Illinois College of Agriculture (May 2, 1955).