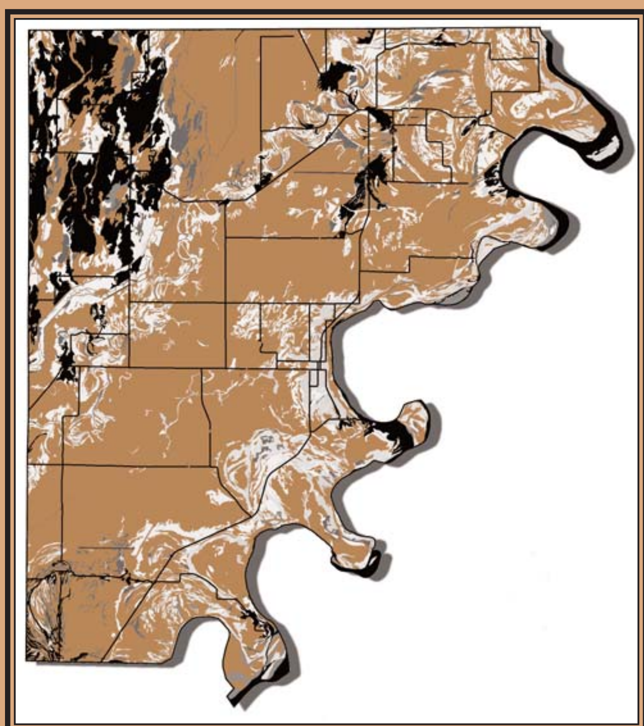
Soils of Mississippi County, Arkansas



J.M. McKimmey, B. Dixon, H.D. Scott, and C.M. Scarlat

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DIVISION OF AGRICULTURE

Soils of Mississippi County, Arkansas

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NOTE: Recent investigations indicate that some soils between Crowley's Ridge and the Mississippi River are not as wet as previously thought and as used for interpretations in this soil survey. Additional investigations are being planned to collect data that are needed to update this soil survey.

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INTRODUCTION

Along with air and water, soil contributes essential processes to the natural order of global cycles. With the exception of edibles from the sea, virtually everything we, and most other land-based animals, eat is derived from soil. Soil is a storage medium of essential minerals and nutrients for fulfilling our agricultural and nutritional needs. Humans work the soil to provide the basics of food, clothing, and shelter. We also use the soil as a medium to store and discard our waste. Virtually everything we do is in some way connected to soil.

Soil is a natural unconsolidated material that covers the earth's surface. It is a porous medium consisting of three phases solid, water, and gas. Soil is also a three-dimensional body with recognizable boundaries. The upper boundary is the soil surface and is the interface with the atmosphere. The lower limit is defined as the depth at which effects of biological, physical, and chemical weathering are not apparent. The porous material between these boundaries is the composition of an individual soil and is characterized by its uniqueness in physical, chemical, and biological properties. These characteristics are both inherited from parent material and acquired over time from chemical weathering and biological forces. Soil can be considered a sponge as it absorbs substances such as water and chemicals until it is saturated. Thus, soil is a storage medium or sink for a multitude of gases, water, chemicals, and heat.

Agriculture is not the only sector that benefits from the use of soils. Our cities, streets, houses, and businesses are constructed on soils. Therefore, knowledge of certain soil properties is essential before construction can begin. Likewise, some soil properties are used in defining environmentally sensitive areas or reclamation of damaged areas. Thus, information on soil behavior is used in agricultural, engineering and environmental applications.

The development of digital databases for natural resources, such as soils, has greatly facilitated the understanding of agricultural and environmental phenomena. Digital databases along with Geographic Information Systems (GIS) are useful in land-use planning by providing spatial information to aid decision making. They not only facilitate multiple uses, including analysis and model simulation, but they are also relatively inexpensive and easy to update. Once developed, the digital database can be used to study numerous, complex real-world problems. Digital data from various sources such as satellite imagery, radar, aerial photography, and global positioning systems can be easily added to an existing digital database to facilitate analysis, uses, and modeling.

Historically, the Natural Resources Conservation Service (NRCS) has published county soil surveys in the United States. Creating this tool is time and resource consuming, and it requires that soils in each county be surveyed, mapped, compiled, and summarized, and the information published. County soil survey publications contain aerial photographs with soil boundaries but no maps of the tabular data on soil properties. These publications are the predecessor of what is now known as the Soil Survey Geographic database (SSURGO). The surveys have been and are still used as a source of technical soil information by many individuals and organizations whose decisions are influenced by soils. A soil survey of Mississippi County was published in 1971 (USDA, 1971). The fieldwork was conducted between 1956 and 1966. Soil classifications and descriptions were approved in 1967. All work was done with cooperation between what was then the USDA Soil Conservation Service and the Arkansas Agricultural Experiment Station (USDA-SCS, 1971). The published survey contains general descriptions of the county with regard to the landform and uses but focuses on the soil descriptions, properties, and uses within the county. The maps presented herein are of the tabular data contained in the 1971 survey and these maps provide greater insight as to the true nature of the soils within the county and their characteristics that impact land use. The information presented in this document is not intended to replace but to supplement the NRCS county soil survey publications. However, neither this report nor the county soil survey publications eliminate the need for on-site soil evaluation for specific purposes. This report does provide a general guideline for county-scale management and policy formulation on soil-related issues.

This report also presents the spatial distribution of both primary and secondary attributes of the soils and other data for Mississippi County, Arkansas. Primary attributes are base data such as soils, elevation, or surficial geology. Secondary attributes are derived by manipulation of the primary attributes and are frequently more useful because they redefine the primary attributes into themes that have direct application to real-world situations. Most of the simulation models used in environmental applications frequently use secondary attributes of soils.

OBJECTIVES

The objectives of this report are to (i) present and summarize the spatial distribution of the soil resource in a digital format for Mississippi County, Arkansas, and (ii) provide information to agricultural, environmental, educational and governmental offices in order to aid understanding and management of soils.

GEOPHYSICAL DESCRIPTION

Mississippi County is located in northeastern Arkansas within the lower Mississippi River Delta region (Fig. 1). The county is bounded by the Mississippi River and the state of Tennessee to the east, the state of Missouri to the north, Crittenden County to the south, and Craighead and Poinsett counties to the west. Mississippi County covers approximately 592,349 acres (239,720 ha), most of which is alluvial and terrace deposits from the Mississippi River. Elevation within the county ranges from 194 to 262 ft. (59 to 80 m) above sea level. The county's primary weather reporting station is located in Blytheville. The long-term average monthly precipitation and air temperature are given in Fig. 2. The average annual precipitation is 48 in. (122 cm) with the highest rainfall occurring in the spring (March to May). Long-term monthly average high air temperature is 70°F (21°C) while the monthly average low air temperature is 50°F (10°C).

Before humans occupied the area, the Mississippi River flowed to the west of Mississippi County and the Ohio River flowed to the east. Upstream, the

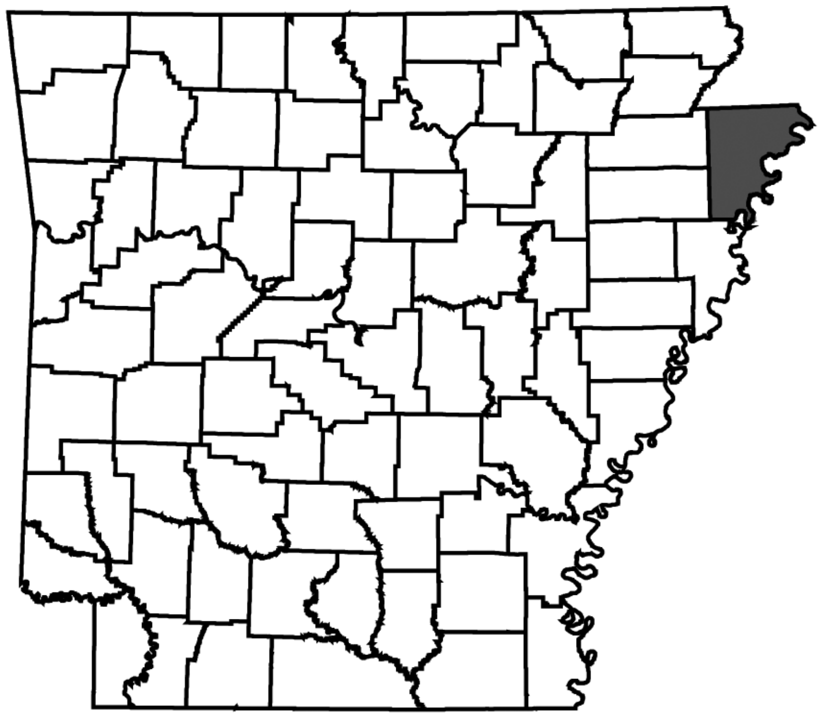

Fig. 1. Location of Mississippi County, Arkansas.

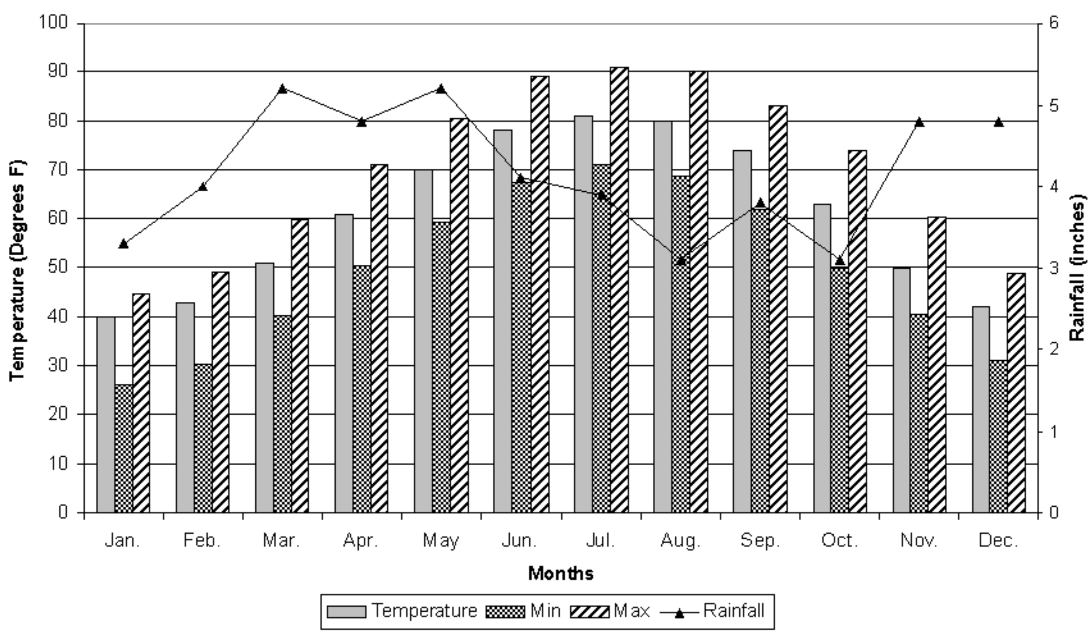

Fig. 2. Long-term annual monthly average precipitation and air temperature in Mississippi County, Arkansas (1961-1990) (NCDC TD Clim 81).

Mississippi River began to meander to the east and eventually entered a geologic feature called Thebes Gap at Cairo, IL, that merged the two rivers into what we now know as the lower Mississippi River and formed the eastern boundary of the county. The change in the river channel occurred during the late Pleistocene geological period (approximately 11,000 years ago). The county is comprised of three quaternary alluvial depositions that occurred during and immediately after the river channel change. The Late 2 Wisconsin Glaciations depositions coincide with terrace deposits away from the Mississippi River. Early and late depositions of the Wisconsin Glaciations coincide with alluvial deposits from small streams while the meander belts are more recent sedimentary depositions from the Mississippi River (Table 1; Fig. 3) (Blum et al., 2000).

Three sub-basins or 8-digit hydrologic units makeup Mississippi County drainage. These include areas that drain directly to the Mississippi River, to the Saint Francis River, and to the Little River ditches and sloughs, which are also part of the Saint Francis River drainage system (Table 2; Fig. 4). The data presented here reflect the natural surface-flow properties and do not show the influences of man-made water control structures such as levees and drainage ditches. Much of the Lower Mississippi sub-basin actually drains into the Saint Francis River sub-basin due to a system of levees along the course of the Lower Mississippi.

Table 1. Areal distribution of surface quaternary geology of Mississippi County, Arkansas.

Deposit	ac	ha	% Cover
Alluvium	86,837	35,142	14.7
Mississippi River			
Meander Belt 1	309,838	125,390	52.3
Meander Belt 3	6,534	2,644	1.1
Meander Belt 4	293	119	0.0
Wisconsin Glaciations			
Valley Trains			
Early	587	238	0.1
Late	142,654	57,731	24.1
Late 2	42,729	17,292	7.2
Back swamp	2,782	1,126	0.5
Abandoned Courses	95	38	0.0
Total	592,349	239,720	100.0

Table 2. Areal distribution of sub-basins or 8-digit hydrologic unit areas of Mississippi County, Arkansas.

Sub-Basin	Ac	ha	% Cover
Lower Mississippi Memphis (080100100)	123,590	50,016	20.9
Lower Saint Francis River (08020203)	257,243	104,105	43.4
Little River Ditches (08020204)	211,516	85,599	35.7
Total	592,349	239,720	100.0

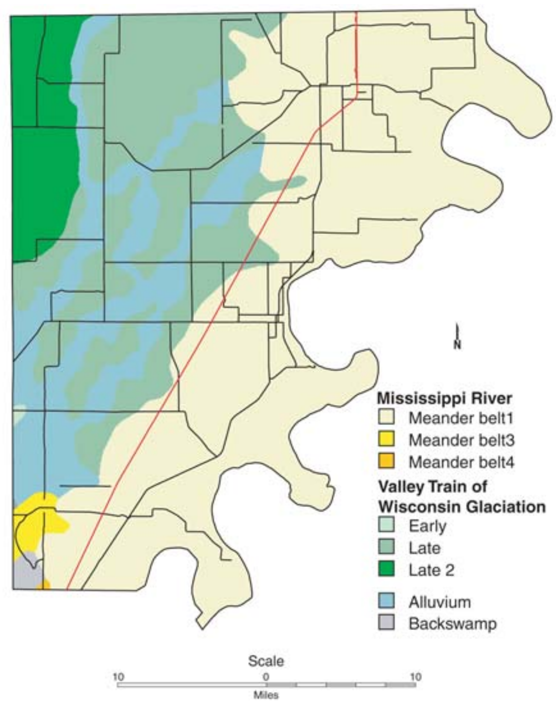

Figure 3. Quaternary geology of Mississippi County, Arkansas. Red line is Interstate 55 and black lines are highways.

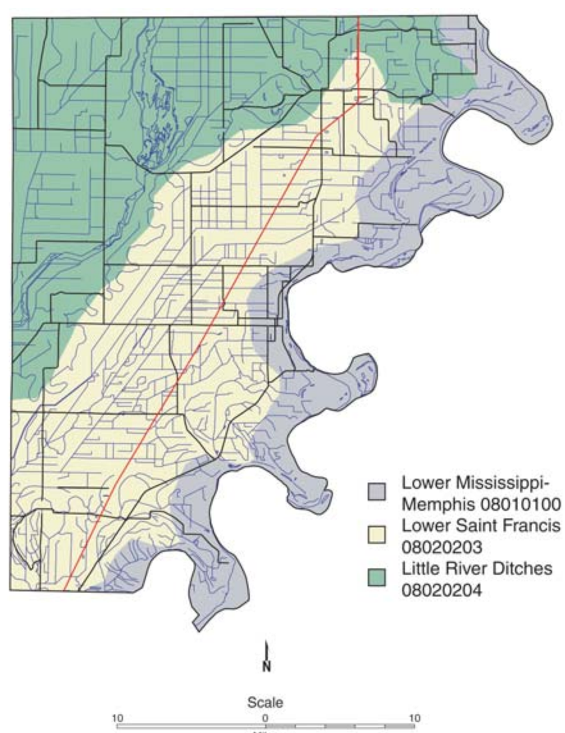

Figure 4. Areal distribution of Sub-Basins or 8-digit hydrologic unit areas in Mississippi County, Arkansas.

HISTORICAL PERSPECTIVE

The oldest indications of human habitation in the middle Mississippi River Valley occur the end of the Pleistocene Era. From 3000 B.C. to 500 B.C. human habitation increased in coverage and density. Evidence of habitation during this time includes burial mounds, pottery, and crude agricultural implements. Further artifacts have been found from the Mississippi Period (700 to 1650 A.D.) and include hoes and harpoons. Remnants of rectangular houses with cane matt walls and grain storage pits also have been found. Various tribes that occupied the county in the Mississippi Period and later included the Miami, Delaware, Shawnee, and Chickasaw (McCall, 2000).

The first European explorer to visit the area was Hernando De Soto in 1541. Evidence of De Soto's visit in Mississippi County includes Spanish trade goods found north of Blytheville. This location was used as a base for exploration of the area (McCall, 2000). De Soto was followed by the French explorers Marquette and Jolliet in 1673 and La Salle in 1682, who claimed the Mississippi River Valley for France. This area was known as Louisiana and covered nearly 900,000 square miles. This large area was bounded by the Mississippi River on the east and included all or part of the watersheds of the Red, Arkansas, and Missouri rivers and extended to lands as far north as the Canadian border and as far west as the Montana border. In 1763 partial control of the area was ceded to Spain as part of a treaty for its support in the French and Indian War. The Spanish controlled the region for 37 years denying all external trade. In 1800 the Spanish relinquished control back to France in the alliance treaty of San Ildefonso. In 1803, France sold the land to the United States to satisfy a debt accrued by the French for goods and services rendered by the citizens of the United States prior to 1800. This transaction was known as the Louisiana Purchase (NARA, 1996).

The first non-native settlers arrived in Mississippi County in 1812. The county was initially a mixture of hardwood forest and swampland, and the main forms of subsistence were hunting, trapping, and selling cordwood to steamboats on the Mississippi River. Thus began the alteration of Mississippi County. The county's earliest primary industry was timber. The demand for timber cleared the forests and drained the swamps. Much of the timber was used to rebuild Chicago after the 1871 fire (McCall, 2000).

In 1824 the United States Supreme Court decreed that the federal government had the power to regulate interstate commerce, including the power to regulate river navigation as related to commerce. This decision provided Congress the legal authority to fund river improvements and levee control districts along the river (MRC, 2002). Another major political occurrence was passage of the Swamp Acts of 1849 and 1850. These acts granted the states of the lower Mississippi River Valley the right to sell swamp lands on the condition that proceeds were used for building levees and drains for land reclamation (MRC, 2002). In 1879 The Mississippi River Commission (MRC) was created to coordinate the development and safety of the Mississippi River. This included the prevention of destructive floods and improvements in navigation. The first levee in Mississippi County was funded by the MRC and built in 1887 along a 20-mile stretch of the Mississippi River from Bear Bayou to Craighead Point. Prior to 1890, all levees built were for the improvement of navigation along the river and not for flood control. In fact, levees built strictly for flood control were prohibited. A major flood in 1890 changed the primary focus of levee construction to include flood control and in 1890 Congress appropriated monies to reflect this change in policies. These monies were responsible for many of the levees constructed along the river thereafter. In 1897 a major flood of 50 ft. at Cairo, IL, was "safely discharged to the Gulf of Mexico without a single break in the levees" (MRC, 2002).

Levee construction led to the development of the first drainage district in 1902, which constructed a drainage ditch from west of Osceola to the Tyronza River. This project led to others that eventually drained the county, creating better conditions for agriculture and roads. The land that was cleared and drained was opened to cultivated crop production. By the mid 1930's, over half of Mississippi County was in cultivation (McCall, 2000). As noted earlier, over 86% of the county is now in cultivated crop production.

Mississippi County was established in 1833 by the Arkansas territorial legislature. The first population count was taken in 1840 with an unofficial count of 1,410 residents. The first official census counted approximately 3,800 people in Mississippi County in 1860. From that time, the population increased steadily to a maximum of 82,000 in 1950. Since then the population of Mississippi County has decreased to 52,000 in 2000 although Osceola, the county seat, has shown small but steady growth since 1890 (Fig. 5). The population of the largest community, Blytheville, was first counted in 1900 with a population of just over 300. The population rose to over 24,000 in 1970 and has since decreased to over 18,000 in 2000 (US Census Bureau, 1860-2000). The latest population loss was due mostly to the closing of Eaker Air Force Base in 1992.

The recent history of Mississippi County cannot be discussed without a reference to the 1811 and 1812 earthquakes because of extreme local and worldwide impact. These three earthquakes were among the greatest known earthquakes in US history

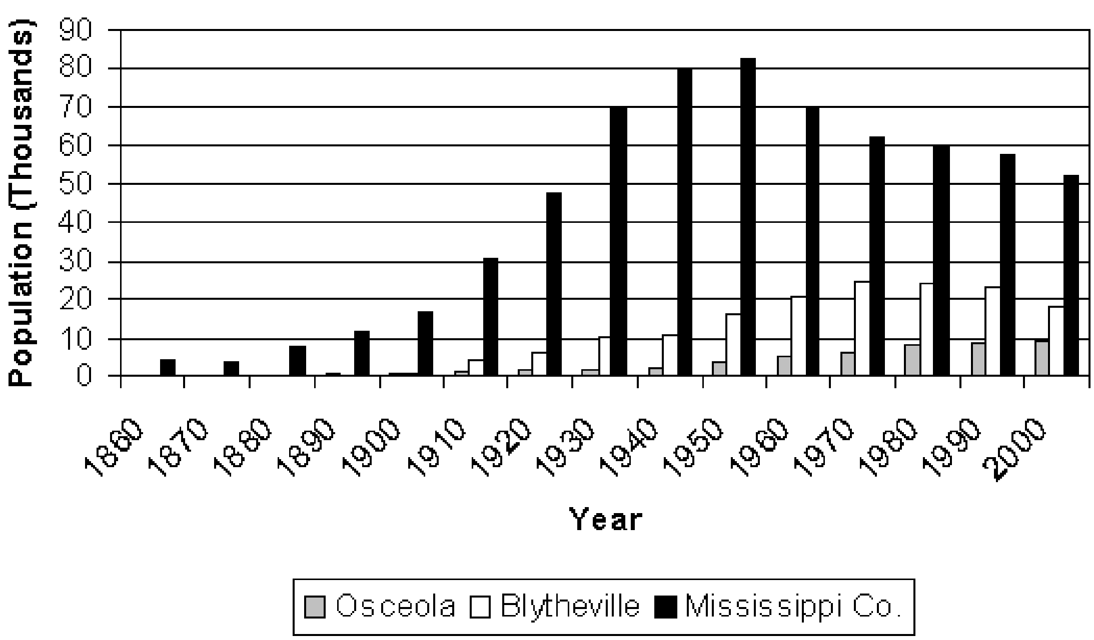

Fig. 5. Temporal distribution of populations for Osceola, Blytheville, and Mississippi County, Arkansas (US Census Bureau, 1860-2000).

because of their magnitude, estimated at greater than 8.0 on the Richter scale, and resulting changes in the local landscape (VT, 2000). The earthquakes are referred to as the New Madrid earthquakes because this was the closest town to the 1811 earthquake epicenter. However, the first earthquakes began west of Mississippi County, Arkansas, along the Saint Francis River 65 miles southwest of New Madrid, Missouri (USGS, 2001a). The areas most affected were from Cairo, Illinois, to Memphis, Tennessee, and from Crowley's Ridge in Arkansas to Chickasaw Bluff in Tennessee. This area includes all of Mississippi County. There is little written record from Mississippi County because of the low population of people at that time, but the following descriptions from New Madrid, Missouri, can be considered as a diluted description of events in Mississippi County. The first event was actually two shocks that occurred on December 16, 1811, with the first earthquake estimated at 8.4 on the Richter scale and the second just several hours later estimated at 8.0. At the onset of the earthquakes, the ground rose and fell in waves that tangled tree branches while opening great cracks in the ground. River banks collapsed while other landslides occurred on bluffs and steep hillsides. Large areas were uplifted and yet larger areas slumped and then were inundated by water and sand erupting through the fissures. Ocean-like waves destroyed many boats on the Mississippi River and washed some far inland from shore. Many believe that the river flowed backward for three days following one of the earthquakes, but the current thought is that this was an illusion caused by the opening and closing of fissures in the river bed (USGS 2001b). Sand bars and point bars were washed away while whole islands disappeared, one while the steam ship New Orleans, on its maiden voyage, was moored to it. Reelfoot Lake in far northeastern Tennessee was formed during these earthquakes as a result of a large slump. Some submerged trees are still standing in the lake to this day. There was a 3 m (10-ft.) rise of the ground where Arkansas, Tennessee, Kentucky, and Missouri meet along the Mississippi River. A lake on the Saint Francis River in Arkansas was uplifted and filled with sand leaving dead fish on the surface (USGS, 2001a). Fissures in the ground in this area were so large that they could not be crossed by horseback. Coal and sand were ejected from fissures in the swamp land adjacent to the Saint Francis River, and the water level was reported to have risen there by 8 to 9 meters. A new lake, Saint Francis Lake, was formed in eastern Arkansas (USGS 2001b), but it is unclear from historic accounts whether this was the same lake that was filled with sand. There were numerous reports of the air being filled with a "sulphurious vapor" during the earthquakes. One witness from New Madrid stated that the description of the earthquakes "would require the most sublimely fanciful imagination" (VT, 2000).

These earthquakes were an important event in the history of Mississippi County because they and other past earthquakes produced sand blows. Sand blows are a product of a process called liquefaction and occur when the pressure of water in the pores of the sand (pore pressure) is suddenly increased from the shaking by an earthquake and results in a fountain of water and sand ejecting straight out of the earth (UCBS, 2001). These eruptions in some instances are like small volcanic eruptions leaving cones or dikes of sand. These features can occur in any soil within the earthquake zone regardless of a soil's characteristics. Sand blows create discontinuities within a soil map unit that complicate soil-management situations such as estimating soil drainage for a soil map unit.

Many of the soils in Mississippi County are classified as silty clay or finer surface texture, resulting in slow drainage and permeability. These soils tend to allow ponding of water on the surface and have specific recommended irrigation practices. If a sand blow should be present in one of these soils, the fissure from which the sand erupted would transport any water from the surface deep into the soil profile at a very rapid rate. This would drastically affect irrigation recommendations for any crop. These sand filled fissures would also allow the rapid movement of dissolved substances in the water such as pesticides and fertilizers. Although many pesticides have biodegradation rates that neutralize the substance over time, rapid movement downward through a sand blow would negate the beneficial surface effects required for biodegradation over time and result in higher concentrations of the chemical inputs in subsurface waterbodies. Because of public concerns over management of agricultural soils containing sand blows and the extreme variability in soil properties within these fields, the Northeast Arkansas Agricultural Experimental Station was established at Keiser in 1925.

LAND-USE AND LAND-COVER DESCRIPTION

Land use and land cover for Mississippi County were derived from 1992 and 1999 scenes of LandSat Thematic Mapper imagery. These data were processed by the Center for Advanced Spatial Technologies (CAST) at Fayetteville. For this publication these data were simplified to show general land use and land cover according to USGS level 1 classification system (Table 3). More detailed imagery and analyses are presented later in the Land-Use Changes section.

The largest category of land use from the 1992 LandSat Thematic Mapper imagery was agriculture (> 75 %) as most open areas were used for crop production (Table 3). If bare soil areas were included as agriculture, over 85% of the county area was cultivated in 1992. The second largest category was forest at only 8% (Fig. 6). Urban areas accounted for only 3.1% of the county land area. The "other area" data were areas along the Mississippi River where the soil and land-use boundaries did not match due to the differences of the acquisition date of the data. Over half of the "other areas" coincided with water in the soil data. This land use also included miscellaneous "herbaceous" areas that could not be classified as to plant species and were most likely fallow fields.

The 1999 land-use data closely resembled the 1992 data. The single major exception was the significant reduction of the "bare soil" land use, which was reduced dramatically. This was due to differences in image acquisition date between the years (Table 4; Fig. 7). The 1992 imagery was acquired earlier in the growing season when more cropping areas were not yet planted or undergoing germination and did not provide enough vegetation to influence the imagery. There were also reductions in "forest" and "other

Table 3. 1992 land-use and land-cover distribution for Mississippi County, Arkansas, with individual crops and tree species combined into one category.

Land use/cover	ac	ha	% Cover
Urban	18,158	7,349	3.1
Perennial Water	12,218	4,944	2.1
Flooded Areas	1,397	565	0.2
Forest	46,712	18,904	7.9
Crops	447,297	181,018	75.5
Bare Soil	56,963	23,053	9.6
Other Areas	9,604	3,887	1.6
Total	592,349	239,720	100.0

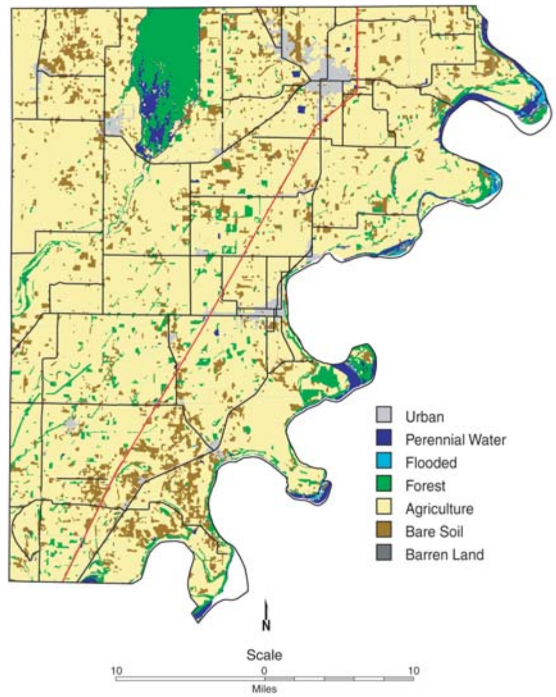

Fig. 6. 1992 land use and land cover for Mississippi County, Arkansas, with individual crops combined into one unit.

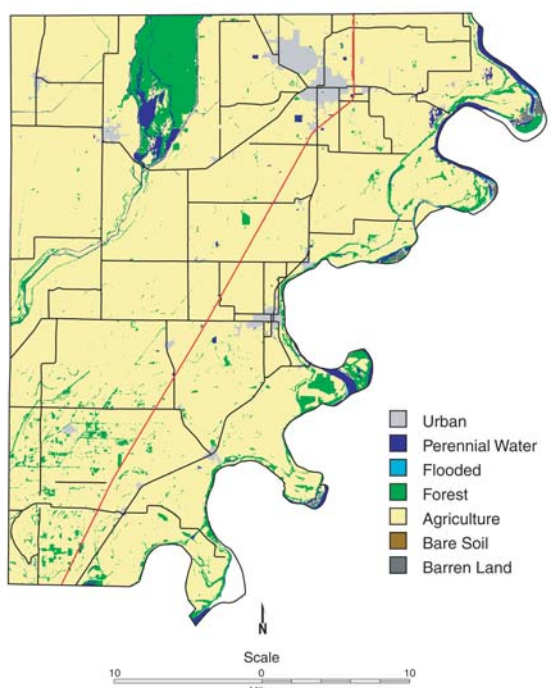

Fig. 7. 1999 land use and land cover for Mississippi County, Arkansas, with individual crops combined into one unit.

Table 4. 1999 land-use and land-cover distribution for Mississippi County, Arkansas, with individual crops and tree species combined into one category.

Land use/cover	ac	ha	% Cover
Urban	17,480	7,074	3.0
Perennial Water	12,518	5,066	2.1
Flooded Areas	531	215	0.1
Forest	45,030	18,223	7.6
Crops	510,510	206,600	86.2
Bare Soil	7	3	0.0
Other Areas	6,273	2,539	1.0
Total	592,349	239,720	100.0

areas" land uses. Some of the changes in the "other areas" land use were due to differences in the county boundary along Mississippi River between the two years. A more detailed discussion of land-use patterns and changes will be presented later.

AGRICULTURAL HISTORY

Because Mississippi County's earliest primary agricultural industry was timber harvesting, much of the land in the county was cleared. These areas were, in turn, protected from flooding while other areas were drained. This provided over half a million acres of open and drained fertile soil ready for farming. The first crop produced was cotton and was also the most planted row crop until the 1950's when soybeans displaced cotton in acreage. As noted in Fig. 8, cotton has shown a resurgence in the last two years presented (USDA-NASS, 2002). Fifty years of records show a constant growth of soybeans in both acres harvested and yield until the late 1970's. Both acres harvested and yield declined after the 1970's (Fig. 8). Until then, acres of soybeans harvested accounted for over 50% of the arable land in the county between the 1960's and the 1990's. From 1947, the beginning of soybean production records, Mississippi County consistently produced more soybeans than any other county in Arkansas until 1963. Since 1963, Mississippi County's soybean production has been near or at the top relative to other Arkansas counties (USDA-NASS, 2002).

Wheat production records begin in 1961 and include winter wheat. Production of winter wheat in Mississippi County was greater than that in any other county in Arkansas until 1985 and close to the top in the years since (Fig. 9). Rice production records began in 1950. For the first 20 years, production and acres harvested were constant (Fig. 9). Production began to increase in 1970 and continued through 2000. Although rice is an important crop in Mississippi County, it accounts for only about 10% of total acres harvested.

Grain sorghum production records begin in 1972. This crop is not a significant crop in the county although harvested acres and production did reach a significant peak in 1985. Harvested acres quickly dropped below 10% of arable land after 1985. Corn production records began in 1961. As noted by the acres harvested, it is not a significant crop for Mississippi County. However, since 1980, yields have improved and resulted in more acres in corn production.

METHODOLOGY

The data presented were developed by state and federal agencies using various methods. The following soils data were developed in the Soil Physics Laboratory of the University of Arkansas in conjunction with the Natural Resources Conservation

Services (NRCS) and the Arkansas Soil and Water Conservation Commission (ASWCC). The methods used to develop the digital soils databases can be divided into four subcategories: (i) source data development, (ii) data input techniques, (iii) data manipulation, and (iv) coincidence reports of spatial relationships between soil properties and land-use parameters.

SSURGO Definition

Soil Survey Geographic (SSURGO) database is a set of standards for the most detailed soil mapping developed by the NRCS. SSURGO digitizing duplicates or updates the original soil survey maps. This level of mapping is designed for use by landowners, townships, and county natural-resource planning and management. Any user should be knowledgeable of soils data and their characteristics.

The following is an excerpt from the NRCS SSURGO Description (USDA-NRCS, 2001). "Digitizing is done by line segment (vector) format in accordance with Natural Resources Conservation Service (NRCS) digitizing standards. The mapping bases meet national map accuracy standards and are either ortho-photoquads or 7.5-minute topographic quadrangles. SSURGO data are collected and archived in 7.5-minute quadrangle units, and distributed as complete coverage for a soil survey area. Soil boundaries ending at quad neat lines are joined by computer to adjoining maps to achieve an exact match.

"SSURGO is linked to a Map Unit Interpretations Record (MUIR) attribute database. The attribute database gives the proportionate extent

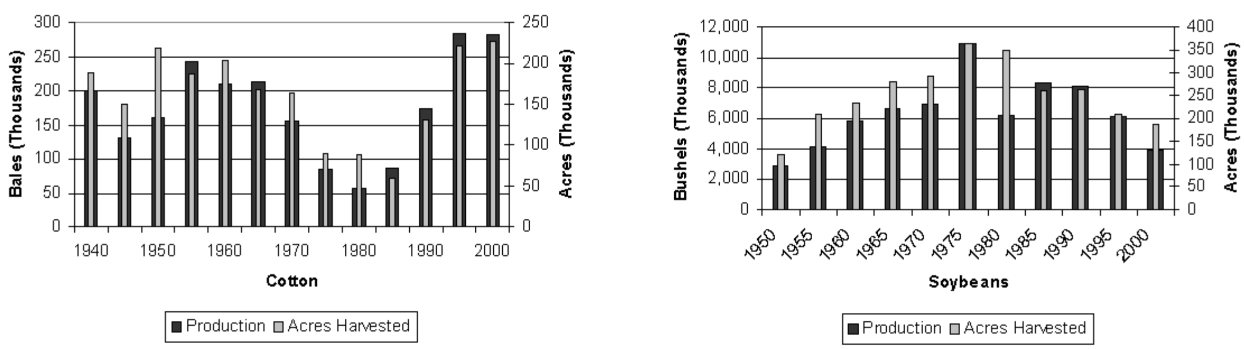

Fig. 8. History of cotton and soybean production for Mississippi County, Arkansas.

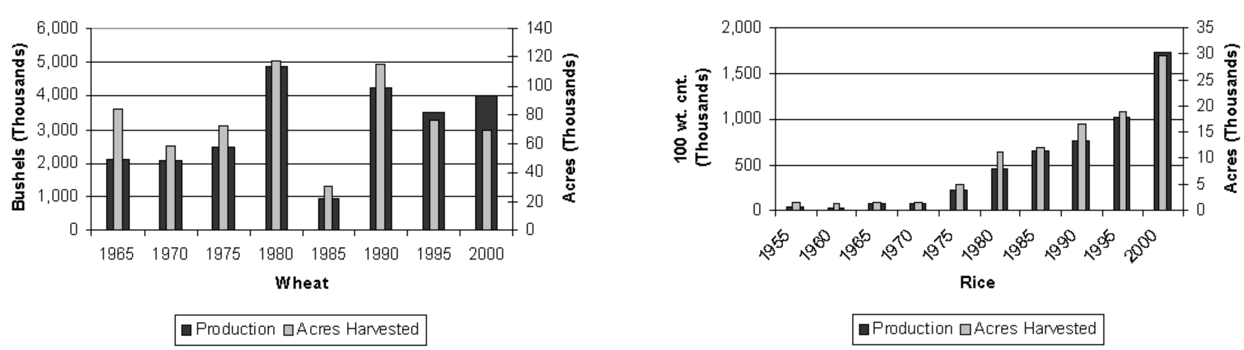

Fig. 9. History of wheat, including winter wheat, and rice production for Mississippi County, Arkansas.

of the component soils and their properties for each map unit. The SSURGO map units consist of 1 to 3 components each. The Map Unit Interpretations Record database includes over 25 physical and chemical soil properties.

"Examples of information that can be queried from the database are available water capacity, soil reaction, salinity, flooding, water table, and bedrock; building-site development and engineering uses; cropland, woodland, rangeland, pastureland, and wildlife and recreational development."

Source Data Development

Source data for this report were originally developed by the NRCS for the Mississippi County Soil Survey publication. The need to update these soils data arises from the ever-changing soil classification definitions, a greater understanding of soil properties and processes, the advent of computer technology as an analytical, presentation, and storage medium, the increasing potential audience, and the interdisciplinary uses of soils data.

Mississippi County Soil Survey is an Order II soil survey first published in June of 1971. Order II soil surveys are based on 1:24,000 scale data with the smallest mapped soil area consisting of no less than 5 acres (2.5 ha), with the exception of special features such as ponds, dams, or pits. The published soil maps and photographs were not suitable as a digital source because the map base (the photographs) had distortions inherent in photographs. The publication data were updated by NRCS personnel in Little Rock, Arkansas, from recent ortho-photographs to correct the distortion and update the soil survey. The updated data were drawn on a stable mylar medium in the USGS 7.5' 1:24,000 map scale format. Additions and corrections from the previously published survey as well as changes in surface water and levees were also applied to the new soil maps. These soil maps were sent to the Soil Physics/GIS Laboratory at the University of Arkansas in Fayetteville for digitization. These are the data used to develop this publication.

Data Input Techniques

Several methods and computer software are available to input data into a digital database. Methods and software used depend upon the user's preference and the types of source data. The most efficient method of digitization for any individual organization depends upon the source data, hardware, software, and personnel. The data used to produce this publication were developed with CAD Image Scan software with a Contex FSS8000 E size scanner, Line Trace Plus 4.0 (LT4X), and Geographical Resource Analysis Support System (GRASS). All software ran on Sun computers with a Solaris operating system.

Digitizing soil boundaries consisted of three major stages. The first stage was the creation and processing of each individual map. Stage two was the joining of the quadrangle maps to providing seamless county survey coverage. Stage three was the final checking processes and involved error-checking each individual map and a seamless patch of the maps.

Stage one of the digitizing process started with scanning the soil maps provided by the NRCS. Geodetic 7.5' USGS 1:24,000-scale frames were created for each scanned map. Each frame was registered to its proper place on the surface of the earth. The scanned raster image was loaded into the frame and geo-referenced to the corners of the frame. The new raster image was edited for errors inherent in scanned images. These errors included gaps in lines and bleeding between lines. The lines were thinned to a single pixel width and checked for errors. These errors included malformed intersections, extra polygons from text on the map, and line spurs. The neat line (map edge) was added at this time. The map was converted from a raster or bitmap format to an arc-node format and checked against the original scanned image for completeness. The map was labeled twice by two individuals. This dual-labeling process allowed comparison of the attributes for accuracy. The labeling process often revealed line errors related to missing or unnecessary lines. These were logged and sent to NRCS for correction.

Stage two involved processes that matched lines and attributes across map boundaries. Each line crossing a map boundary was inspected for a complementing line on the adjacent map. The transition from one map to the next had to be seamless; thus angle and arc of a line approaching the map edge had to be maintained when crossing the map boundary. Line intersections were moved to within a snapping threshold of the complementing line. After all crossings were inspected, a routine was run that created an exact match of all line intersections between the two maps. Attributes across the map edge were checked by copying the second attribute from the adjacent map to the second attribute of the current map. If the two attributes did not match, the area was highlighted. Errors at this stage were either simple labeling or compilation errors that did not show until the soil boundaries were patched to a single whole unit. The former errors were simply relabeled while the latter were submitted to NRCS for evaluation.

The third stage was an overall inspection of each map to insure that the USDA-NRCS specifications were met. The same error-checking methods from stage two were repeated by a different individual. Once the maps passed inspection, they were exported to a GRASS digital ASCII-vector format. These maps were imported to GRASS and patched together for a single-county coverage. The patched map was checked for open polygons, missing lines, and missing attributes. If any errors were found, the problem was fixed in the individual map in LT4X and exported to GRASS again where the patching and error-checking processes were run again. Once there were no errors in GRASS, the database was sent to NRCS offices in Little Rock.

The NRCS conducted much of the same error checking but also did limited line and attribute matching across the county boundary. Attribute tables and metadata were created and associated with the soils data. The digital database was sent to NRCS National Mapping Center in Fort Worth, Texas, where it was verified and included in the national SSURGO database.

Data Manipulation Techniques

The primary attributes of the soil database are soil map units from the Order II soil survey of Mississippi County and are represented by a symbol for each map unit. Each area defined on a map is given a tag or map symbol that denotes the soil map unit in that area. The map symbol can be used as a reference to point to other soils information commonly referred to as secondary attributes. These can be soil attributes such as textural class, drainage class, permeability, shrink-swell potential, runoff, reaction (pH), flooding frequency, soil erodibility, sustainable soil loss, or depth to bedrock. These are just a few of the possible secondary attributes.

Reports and images of soils and other data presented were derived in GRASS. All secondary soil attributes were also created in this environment. Secondary attributes were created by applying attribute classification rules from the SSURGO data to the primary soil map unit data. The result was a map for each secondary attribute previously mentioned. Not all secondary attributes mentioned may be included in this publication as some may not apply or may not have significant variability.

Coincidence Reports

A coincidence report tabulates the mutual occurrence of two or more land attributes in the same area. The tables presented are based upon the land use and a selected soil property. The land use presented is 1992 and 1999 LandSat Thematic Mapper imagery shown in Fig. 6 and Fig. 7. Coincidence report implies two different sources of data. In this case the data sources did not agree on the placement of the county boundary along the Mississippi River. This variation results in a difference in total areal coverage due to zero categories. Therefore, coincidence tables with land-use information show a "no data" category.

SPATIAL DISTRIBUTION OF PRIMARY AND SECONDARY SOIL ATTRIBUTES

A soil map unit is a collection of pedons (smallest identifiable unit of a soil) that is defined and named the same in terms of soil components or miscellaneous areas or both. A soil map unit differs from the taxonomic family name in that the map unit is simply a name, generally the nearest town of the site locale, and does not make any suggestions as to properties, potential uses, or limitations. The soil taxonomic family name is a schema of scientific terms that describes soil diagnostic features and thus makes specific references to the soil properties. We use the map unit name because it is easier to understand. Those who work with soils eventually come to associate soil map units with specific soil properties. Whether these properties are good or bad depends upon the use.

Within a soil survey, each map unit differs in some respect from all others in the same survey area and is uniquely identified on a soil map. A map unit is not a pure entity; it consists of, to varying degrees, inclusions of other map units. Inclusions are unpredictable occurrences of soil map units within another, regardless of map scale. The two are linked because of geographic association and not because of similarity of properties, as inclusions can have similar or dissimilar properties of the dominant map unit. Delineation of a map unit generally contains the dominant components but may not always contain a representative of each inclusion. In this survey there are soil complexes. Complexes are areas of two or more dissimilar soils occurring in a regular predictable pattern that cannot be mapped separately at the survey scale (1:24,000). The soils cannot be named as a single map unit because they are significantly different in morphology or behavior. All components are normally present but the proportion may vary.

Official Soil Descriptions (OSD) for the map units presented here can be found in the Soil Survey of Mississippi County, Arkansas (USDA-SCS, 1971), online at http://www.statlab.iastate.edu/soils/osd/, or at the Arkansas Soil Atlas System (ArkSAS) at http://www.cleora.uark.edu.

The following soils data reflect the natural surface properties of the soil and not the influences of humans nor the properties at depth. All soils data were taken from the data tables provided by the NRCS. Only the properties of the dominant series are displayed for complexes.

Soil Map Units

The top five map units in areal extent in Mississippi County are Sharkey-Steele complex, Sharkey clay, Tunica silty clay, Routon-Dundee-Crevasse complex, and Dundee silt loam (Table 5). These map units combined to cover 60% of the county area. These soils are given names of the location of the site where the original soil was classified. As such, the series name does not reflect the properties of the soil. The information in Table 6 gives the series name and the scientific name of a soil. Major

Table 5. Areal distribution of soil map units for Mississippi County, Arkansas.

Soil Map Unit	ac	ha	% Cover
Alligator clay	11,000	4,452	1.9
Alluvial land	1,793	726	0.3
Amagon sandy loam	12,362	5,003	2.1
Borrow Pits.	4,670	1,890	0.8
Bowdre silty clay loam	22,560	9,130	3.8
Bruno-Crevasse complex	4,869	1,970	0.8
Commerce silt loam	4,250	1,720	0.7
Convent fine sandy loam	14,217	5,754	2.4
Crevasse loamy sand.	8,752	3,542	1.5
Crowley silt loam	2,006	812	0.3
Dundee silt loam.	34,234	13,854	5.8
Dundee-Dubbs-Crevasse complex	3,973	1,608	0.7
Earle clay	5,242	2,121	0.9
Forestdale silt loam	1,335	540	0.2
Forestdale silty clay loam	2,785	1,127	0.5
Forestdale-Routon complex	1,526	617	0.3
Hayti fine sandy loam	11,435	4,628	1.9
Iberia clay.	1,239	501	0.2
Jeanerette silt loam	7,538	3,050	1.3
Levee	2,226	901	0.4
Morganfield fine sandy loam.	4,880	1,975	0.8
Routon-Dundee-Crevasse complex	50,543	20,455	8.5
Sharkey silty clay loam	3,973	1,608	0.7
Sharkey silty clay	85,486	34,596	14.4
Sharkey-Crevasse complex.	11,695	4,733	2.0
Sharkey-Steele complex	120,401	48,726	20.3
Sharkey and Steele soils.	15,991	6,472	2.7
Steele loamy sand	7,929	3,209	1.3
Steele silty clay loam	18,662	7,552	3.2
Steele and Crevasse soils	4,287	1,735	0.7
Steele and Tunica soils	19,500	7,891	3.3
Tiptonville and Dubbs silt loam	7,568	3,063	1.3
Tunica silty clay	65,424	26,477	11.0
Water	17,998	7,284	3.0
Total	592,349	239,722	100.0

properties of a soil can be interpreted from the scientific name.

The Sharkey series consists of very deep, poorly and very poorly drained, very slowly permeable soils that formed in clayey alluvium. These soils are located on flood plains and low terraces of the Mississippi River. The series is prevalent throughout the entire county but dominates the central portion of the county (Fig. 10). Sharkey soils occur as both a series and as a component of complexes.

The Steele series consists of deep, moderately well-drained soils formed in sandy and clayey river deposits on level to undulating areas of flood plains and is in narrow bands paralleling overflow channels.

Table 6. Scientific family name of soil series in Mississippi County, Arkansas.

Soil Series	Scientific family name
Alligator	Very-fine, montmorillonitic, acid, thermic Vertic Haplaquepts
Amagon	Fine-silty, mixed, active, thermic Typic Endoaqualfs
Bowdre	Clayey over loamy, montmorillonitic, thermic Fluvaquentic Hapludolls
Bruno	Sandy, mixed, thermic Typic Udifluvents
Commerce	Fine-silty, mixed, active, nonacid, thermic Aeric Fluvaquents
Convent	Coarse-silty, mixed, active, nonacid, thermic Aeric Fluvaquents
Crevasse	Mixed, thermic Typic Udipsamments
Crowley	Fine, montmorillonitic, thermic Typic Albaqualfs
Dubbs	Fine-silty, mixed, active, thermic Typic Hapludalfs
Dundee	Fine-silty, mixed, active, thermic Typic Endoaqualfs
Earle	Clayey over loamy, montmorillonitic, acid, thermic Vertic Haplaquepts
Forestdale	Fine, smectitic, thermic Typic Endoaqualfs
Hayti	Fine-silty, mixed, active, nonacid, thermic Mollic Fluvaquents
Iberia	Fine, montmorillonitic, thermic Vertic Haplaquolls
Jeanerette	Fine-silty, mixed, active, thermic Typic Argiaquolls
Morganfield	Coarse-silty, mixed, active, nonacid, thermic Typic Udifluvents
Routon	Fine-silty, mixed, active, thermic Typic Ochraqualfs
Sharkey	Very-fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts
Steele	Sandy over clayey, mixed, active, nonacid, thermic Aquic Udifluvents
Tiptonville	Fine-silty, mixed, active, thermic Typic Argiudolls
Tunica	Clayey over loamy, montmorillonitic, nonacid, thermic Vertic Haplaquepts

Steele soils are also prevalent throughout the county as an individual series and as a component of complexes.

The Tunica series consists of deep, poorly drained, very slowly permeable soils that formed in clayey alluvium and the underlying loamy alluvium. These soils are on the flood plains of the Mississippi and Saint Francis Rivers as a single series and as a component of a complex.

The Routon series consists of very deep, poorly drained, slowly permeable soils that formed in loess and silty alluvium. Routon soils are located on low stream terraces and in depressions on uplands.

The Crevasse series consists of very deep, excessively drained, rapidly permeable soils that formed in sandy alluvium. These soils are level to gently sloping and located on splays and recent, sparsely vegetated point bar deposits on the flood plain of the Mississippi River.

The Dundee series consists of very deep, somewhat poorly drained soils that formed in loamy alluvium. These soils are level to gently sloping and are located on natural levees and low terraces along former channels of the Mississippi River and its tributaries. The Routon-Dundee-Crevasse complex and the Dundee series dominate the northwest portion of the county and areas adjacent to the Saint Francis River. The complex also occurs in the areas adjacent to abandoned stream channels of the Mississippi River.

Most of these soils are poorly drained but are chemically fertile and excellent for agricultural uses

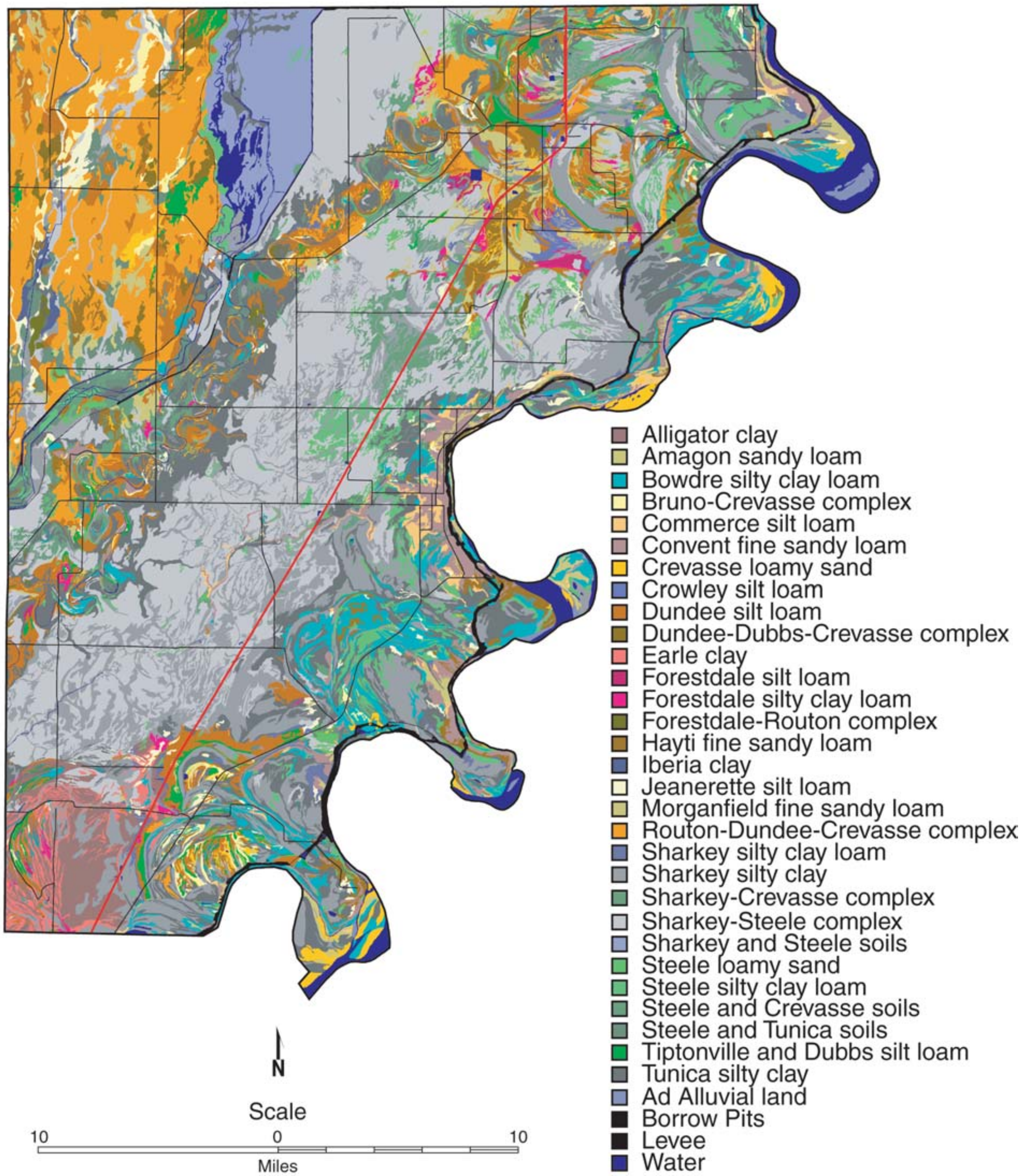

Fig. 10. Spatial distribution of the soil map units in Mississippi County, Arkansas.

as long as the soils are drained. Crevasse and Steele soils are the exceptions to the drainage classifications due to these soils' close proximity to river channels.

Surface Textural Class

Surface textural class indicates the relative weight proportions of sand, silt, and clay particles in a given mass of dry soil at the soil-surface horizon. Numerous soil properties are dependent upon soil texture. The largest soil textural class in Mississippi County is silty clay and comprises over 50% of the total area (Table 7) due to the extensive areas of Sharkey soils and similar complexes (Fig. 11). The next largest class is silt loam covering nearly 20% of the county and consists mostly of the Routon-Crevasse-Dundee complex and the Dundee series. Soils with this textural class are distributed in the northwest portion of the county and in the meander belts of the Mississippi and Saint Francis Rivers. The third largest textural class is sandy loam covering nearly 10% of the county followed by loamy sand with coverage of nearly 8% of the county. Soils with sandy textures tend to occur near streams and old abandoned stream channels. The remaining textural classes account for less than 12% of the county area. The "other" category in the following tables groups Alluvial Land, Borrow Pit, Levees, and Water.

Soil Drainage Class

The natural soil drainage class refers to the frequency and duration of wet periods when the soil is not saturated. This class denotes the ability of water to move through unsaturated soil, thus indicating the natural retention or loss of water from the profile. Practically the effects range from persistent ponding on poorly drained clay soils to rapid water loss on sandy soils at the time of the survey. Modifications by humans such as land leveling, artificial tiles, or irrigation were not considered unless the modifications significantly changed the morphology of the soil.

Nearly 68% of Mississippi County is poorly drained (Table 8). These areas coincide with the extensive areas of Sharkey, Dundee, and Routon soil series. Somewhat poorly drained areas cover 15% of the county area and are adjacent to flood plains of the major rivers (Fig. 12). The moderately well to excessively drained areas combined do not cover a significant area in the county, but these areas coincide with the coarser-textured soils that are located in the flood plains adjacent to the major streams.

Soil Reaction (pH)

Soil reaction is an indicator of natural soil hydrogen-ion content expressed as pH with a neutral of pH 7. A pH value of less than 7 indicate acidity; whereas, pH values greater than 7 indicate alkalinity. Reaction can be divided into descriptive classes although many soil pH ranges include multiple classes due to variability of this soil property. The degree of acidity and alkalinity affects the nutrient availability as well as crop yield. The reaction of a soil can change due to fertilization or long-term irrigation where the water and soil pH differ.

Forty percent of the county is dominated by soils having pH's within the 5.1 to 8.4 pH ranges (Table 9). This broad range covers several pH classes from strongly acidic to moderately alkaline. These areas coincide mostly with Sharkey and Steele complexes and series (Fig. 13). The next largest category in a pH range of 5.6 to 7.8 covers 13% of the county and coincides mostly with the Tunica series and is located close to streams and abandoned stream channels. The third largest category is the pH range of 6.1 to 7.3 and covers slightly over 10% of the county. These areas are along abandoned stream channels and coincide with Steele and Hayti Series. The two pH ranges 5.1 to 6.0 and 5.1 to 6.5 together cover nearly 20% of the total area of the county. These ranges coincide

Table 7. Areal distribution of soil textural class in Mississippi County.

Textural class	ac	ha	% Cover
Clay	17,481	7,074	2.9
Silty Clay	298,998	121,003	50.5
Silty Clay Loam	29,317	11,864	4.9
Loam	4,880	1,975	0.8
Silt Loam	112,974	45,719	19.1
Sandy Loam	56,676	22,937	9.6
Loamy Sand	45,336	18,347	7.7
Other	26,687	10,801	4.5
Total	592,349	239,720	100.0

Table 8. Areal distribution of soil drainage class in Mississippi County, Arkansas.

Drainage class	ac	ha	% Cover
Poorly	400,437	162,054	67.6
Somewhat Poorly	88,778	35,928	15.0
Moderately Well	57,945	23,450	9.8
Well Drained	4,881	1975	0.8
Somewhat Excessively	4,869	1970	0.8
Excessively	8,752	3,542	1.5
Other	26,687	10,801	4.5
Total	592,349	239,720	100.0

Table 9. Areal distribution of soil reaction (pH) in Mississippi County, Arkansas.

PH	ac	ha	% Cover
4.5-6.5	12,362	5,003	2.1
5.1-6.0	54,853	22,198	9.3
5.1-6.5	55,785	22,576	9.4
5.1-7.0	2,006	812	0.3
5.1-8.4	242,416	98,104	40.9
5.6-7.3	30,128	12,193	5.1
5.6-7.8	79,081	32,004	13.4
5.6-8.4	27,219	11,015	4.6
6.1-7.3	61,812	25,014	10.4
Other	26,687	10,801	4.5
Total	592,349	239,720	100.0

Table 10. Areal distribution of soil permeability in Mississippi County, Arkansas.

Permeability Rate	ac	ha	% Cover
0.00-0.06	309,998	125,454	52.3
0.06-0.2	29,040	11,752	4.9
0.2-0.6	11,624	4,704	2.0
0.6-2.0	139,566	56,482	23.6
2.0-6.0	30,097	12,180	5.1
6.0-20	45,336	18,347	7.6
Other	26,688	10,801	4.5
Total	592,348	239,720	100.0

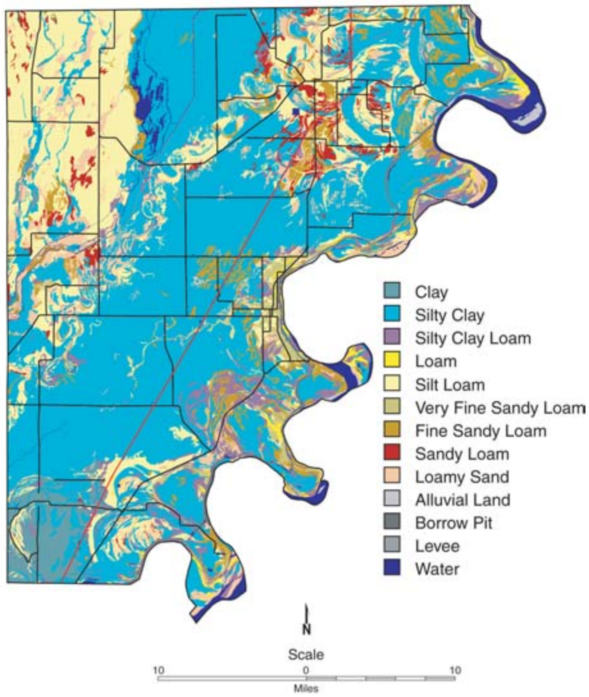

Fig. 11. Soil surface textural class of Mississippi County, Arkansas.

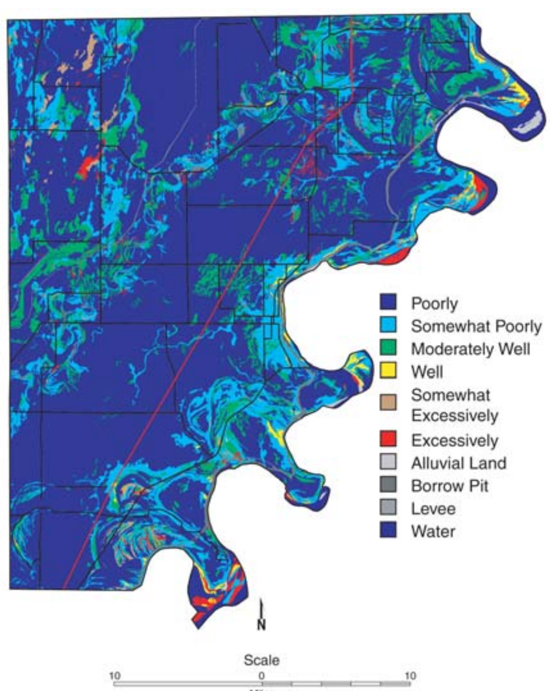

Fig. 12. Soil drainage class of Mississippi County, Arkansas.

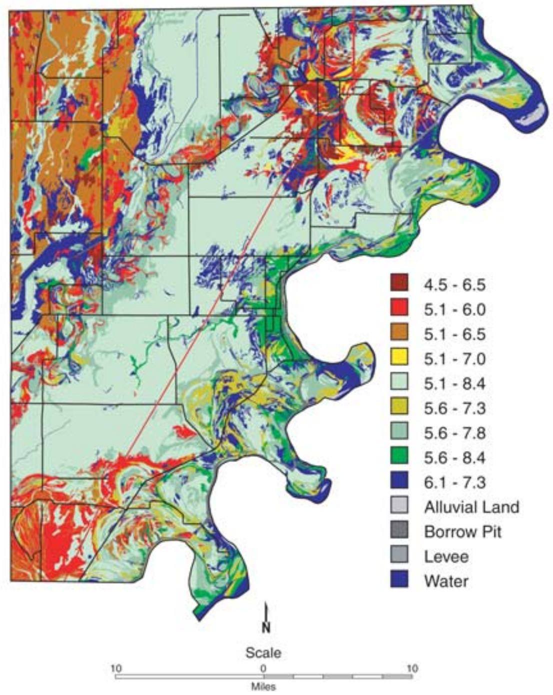

Fig. 13. Soil reaction (pH) of Mississippi County, Arkansas.

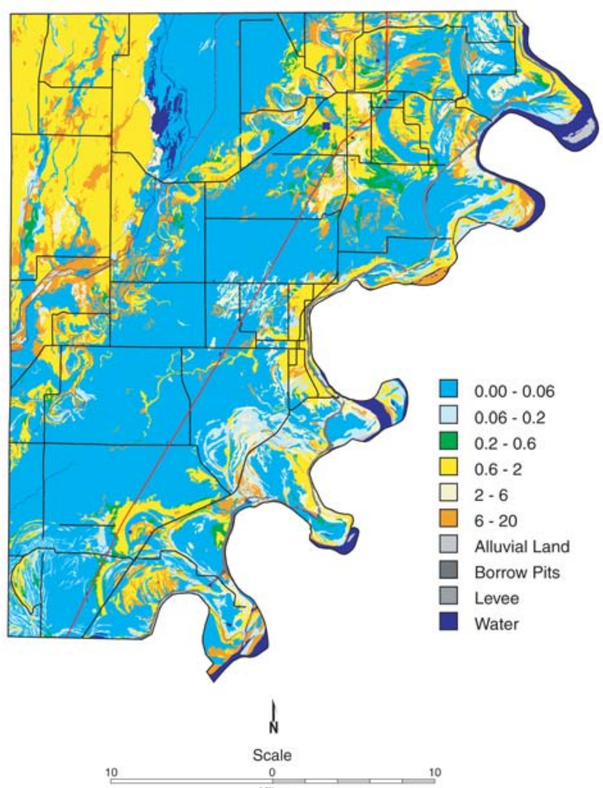

Fig. 14. Soil permeability for Mississippi County, Arkansas, in inches per hour.

with the Routon-Crevasse-Dundee complex and the Dundee Series.

Soil Permeability

Soil permeability refers to the rate of downward movement of water under saturated conditions where ponded water is at the surface creating a hydraulic gradient. The units of permeability are inches per hour. The rate of downward movement of water is controlled by both the hydraulic gradient, the height (weight) of the ponded water at the surface, and the soil matrix and pore size. Permeability differs from drainage in that drainage also occurs during unsaturated conditions. The estimates of permeability are based upon soil structure and porosity. Soil permeability in conjunction with other properties is used to predict soil suitability for numerous uses such as rice production, wetlands, ponds, and sewage lagoons.

The class of permeability occupying the largest areal extent is very slowly permeable, 0 to 0.06 inches per hour, and covers over 52% of the county (Table 10). These areas coincide with most of the clayey-textured soils such as the Alligator, Sharkey, and Tunica series (Fig. 14). The second largest category is 0.6 to 2.0 inches per hour and coincides with the Routon-Crevasse-Dundee complex and the Dundee Series. The third largest category is in the 6.0 to 20.0 inches per hour range at over 7% and is made up of Steele, Crevasse, and Bruno Series; these are rapidly permeable soils along river banks and abandoned stream channels. Permeability range of 2 to 6 inches per hour is mostly comprised of the Steele series. Permeability range of 0.06 to 0.2 inches per hour covers nearly 5% of the county and coincides mostly with the Bowdre Series.

Hydric Soil Potential

Hydric soil potential is a measure of the probability that a soil has hydric characteristics. Hydric soils are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper layer of the soil and to support the growth and regeneration of hydrophytic vegetation. These characteristics are some that are used as criteria for the identification of wetlands. These data are divided into classes that portray only the potential of occurrence. Due to scale limitations and inclusions, an on-site inspection is necessary to determine the actual hydric condition. Table 11 and Fig. 15 show the distribution of the potential hydric soils in Mississippi County.

Annual Flooding

Annual flooding potential, duration, and months when flooding occurs are terms used to describe the likelihood of flooding and duration during a year. Table 12 shows the descriptive terms for the potential of inundation and duration for Mississippi County.

There are only two classifications for annual flooding in Mississippi County, None and Rare. The Rare occurrence is brief in duration and occurs between the months of December and April. The area of rare flooding is 119,517 acres, (48,368 ha) or 20.2% of the total county area (Fig. 16).

Soil Erodibility

Soil erodibility or k factor is the relative index of susceptibility of bare cultivated soil to particle detachment and transport by rainfall. The value of k is used in the Universal Soil Loss Equation to estimate annual loss of soil due to erosion. Measurements are made on plots of standard dimensions and adjusted to a 9% slope. Currently, k is computed by simulated rainfall on freshly tilled plots. Early measurements integrated erosion for the year under natural rainfall. Erodibility can also be calculated from the composition of the soil, saturated hydrologic conductivity, and soil structure.

Table 11. Distribution of potential for hydric soils in Mississippi County, Arkansas.

Potential	ac	ha	% Cover
Medium	335,013	135,577	56.6
High	230,648	93,342	38.9
Other	26,688	10,801	4.5
Total	592,349	239,721	100.0

Table 12. Descriptive terms for potential of inundation and duration in Mississippi County, Arkansas.

Classes	Criteria
(Frequency)	*(Within a 100 year period)*
None	No reasonable possibility
Rare	1-5 times
Occasional	5-50 times
Frequent	≥ 50 times
Common	Occasional and frequent can be grouped for certain purposes
(Duration)	
Extremely Brief	< 4 hours (flooding only)
Very Brief	4-48 hours
Brief	2-7 days
Long	7 days-1month
Very Long	≥ 1month

Table 13. Soil erodibility for Mississippi County, Arkansas.

k Factor	ac	ha	% Cover
0.10	8,752	3,541	1.5
0.15	4,869	1,970	0.8
0.17	50,377	20,387	8.5
0.24	11,435	4,628	1.9
0.32	328,840	133,080	55.5
0.37	39,746	16,085	6.7
0.43	61,555	24,911	10.4
0.49	60,087	24,317	10.2
Other	26,688	10,801	4.5
Total	592,349	239,720	100.0

Table 14. Percentage organic matter by weight of the soils in Mississippi County, Arkansas.

% OM	ac	ha	% Cover
0.5-1.0	50,377	20,387	8.5
0.5-2.0	111,946	45,304	18.9
0.5-3.0	14,217	5,753	2.4
0.5-4.0	249,334	100,904	42.1
1.0-2.0	12,362	5,003	2.1
1.0-3.0	115,186	46,615	19.4
1.0-4.0	11,000	4,452	1.9
2.0-5.0	1,239	501	0.2
Other	26,688	10,801	4.5
Total	592,349	239,720	100.0

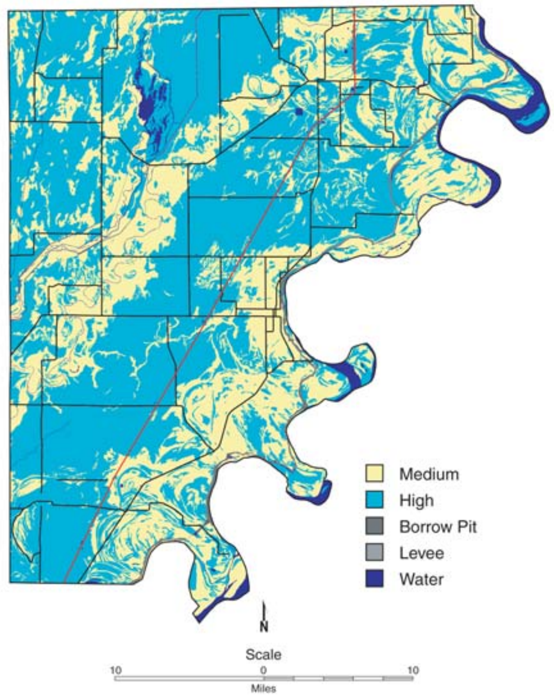

Fig. 15. Spatial distribution of potential for hydric soils in Mississippi County, Arkansas.

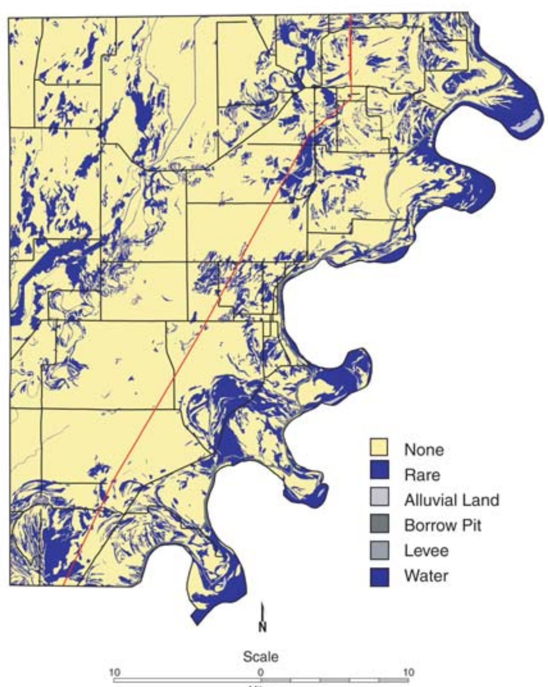

Fig. 16. Flooding occurrence in Mississippi County, Arkansas.

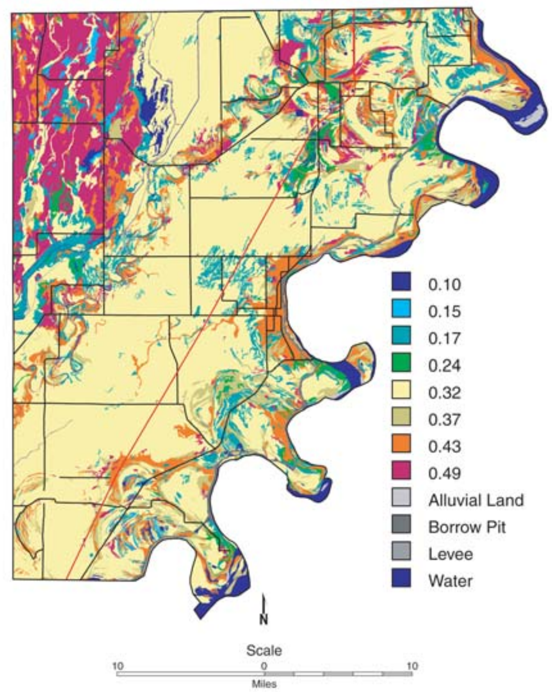

Fig. 17. Soil erodibility or k factor of Mississippi County.

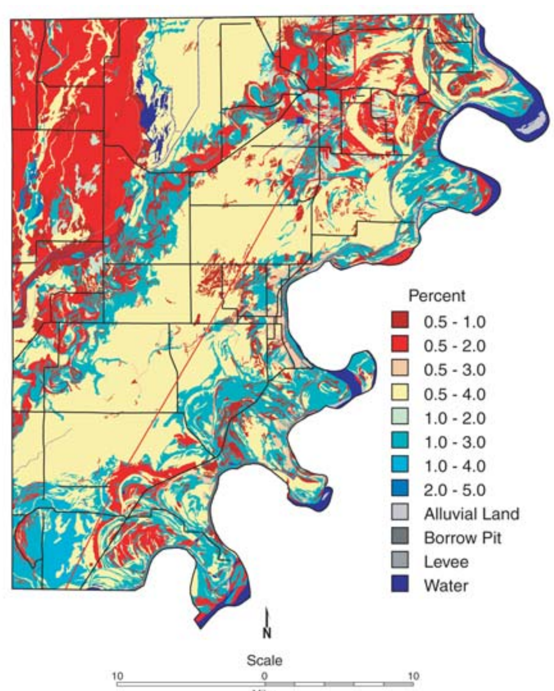

Fig. 18. Percentage organic matter for the soils of Mississippi County, Arkansas.

Mississippi County is dominated by the moderate erosion k value of 0.32 (Table 13). These areas primarily coincide with Sharkey, Steele, Alligator, and Tunica soils (Fig. 17). The next two largest are areas of even higher erodibility. The k value of 0.43 is mostly Commerce and Dundee soils while the higher k factor 0.49 is mostly Routon-Crevasse-Dundee complex. The lower k values and smaller areas coincide with Steele, Hayti, Bruno, and Crevasse soils.

Soil Organic Matter

Organic matter content is expressed as a range of the percentage of total soil by weight. The presence of organic materials affects the soil structure, color, water retention, water infiltration, and retention of inorganic and organic materials such as fertilizers and pesticides. An increase of organic matter at the soil surface increases infiltration and decreases runoff. In cultivated fields, organic matter content at the soil surface is strongly affected by soil management.

The largest organic matter range is the 0.5% to 4.0% range. This range covers over 42% of the central portion of the county (Table 14) and coincides with the Sharkey and Steele soils (Fig. 18). The second largest category of the 1.0% to 3.0% range covers over 19% and includes the Bowdre and Tunica soils. The 0.5% to 2.0 % range covers nearly 19% of the county. These areas are on the Routon, Crevasse, Dundee soils and are adjacent to rivers and abandoned stream channels.

Available Soil Water Capacity

Available soil water is the volume of water that should be available to plants if the soil were at field capacity. Field capacity is the water remaining in soil after drainage due to gravity. Available water capacity is expressed as inches of water per inch of soil and is a better measure of required irrigation. Available water capacity is a better measure of required irrigation than field capacity. Clayey soils may hold more water than others, but crops may require more frequent irrigation because a greater volume of water is held in the soil so tightly that many crops cannot extract it from the small pore spaces.

In Mississippi County over 41% of the area has an available water capacity (AWC) of less than 0.14 inches (Table 15). These areas are dominated by Sharkey Series soil (Fig. 19). Other clayey soils such as Alligator, Tunica, and Bowdre soils account for most of the 0.15 to 0.20 AWC range. The silt loam soils account for most of the higher AWC ranges and occupy the northwest region of the county.

Soil Bulk Density

Moist bulk density is a measure of the weight of oven-dry soil per unit volume of soil at or near field capacity, expressed as grams per cubic centimeter. It is a measure of compaction and is one of the most important soil properties. Bulk density values range from 1.2 to 1.8 g cm-3 with clayey-textured soils having lower bulk densities than sandy soils.

In Mississippi County over 43% of the area is covered by soils with a bulk density of 1.2 to 1.5 (Table 16) and is occupied by Sharkey soils and complexes (Fig. 20). The next largest area is bulk density ranges of 1.4 to 1.5 covering 15% of the county. These areas coincide with the Routon-Crevasse-Dundee complex and the Dundee Series. The third largest area is the 1.45 to 1.55 covering over 12% of the county. These areas are made up of mostly Tunica Series and occur along areas adjacent to streams and abandoned stream channels.

Table 15. Available soil water capacity in inches of water per inch of soil.

AWC	ac	ha	% Cover
0.05-0.10	4,869	1,970	0.8
0.06-0.10	8,752	3,542	1.5
0.07-0.14	233,574	94,526	39.4
0.10-0.12	31,715	12,834	5.4
1.10-0.15	12,362	5,003	2.1
0.10-0.20	11,000	4,452	1.9
0.12-0.18	5,241	2,121	0.9
0.13-0.18	30,097	12,180	5.1
0.15-0.19	1,239	501	0.2
0.15-1.20	126,192	51,069	21.3
0.18-1.23	14,217	5,754	2.4
0.20-0.22	9,618	3,892	1.6
0.20-0.23	14,455	5,850	2.4
0.20-0.24	50,543	20,455	8.5
0.21-0.23	11,787	4,770	2.0
Other	26,688	10,801	4.5
Total	592,349	239,720	100.0

Table 16. Soil bulk density of Mississippi County, Arkansas in mass per unit volume.

Bulk Density (g cm-3)	ac	ha	% Cover
1.20-1.35	1,239	501	0.2
1.20-1.50	257,819	104,338	43.5
1.30-1.60	12,362	5,003	2.1
1.30-1.65	16,223	6,565	2.7
1.30-1.70	38,208	15,462	6.5
1.35-1.65	15,760	6,378	2.7
1.40-1.50	88,816	35,944	15.0
1.40-1.55	50,543	20,455	8.5
1.40-1.60	4,869	1,970	0.8
1.45-1.55	74,177	30,019	12.5
1.50-1.55	5,645	2,284	1.0
Other	26,688	10,801	4.5
Total	592,350	239,720	100.0

Table 17. Water table duration in months for Mississippi County, Arkansas.

Months	ac	ha	% Cover
Nov.-Mar.	8,752	3,542	1.5
Dec.-Mar.	50,544	20,454	8.5
Dec.-Apr.	300,703	121,693	50.8
Jan.-Apr.	147,717	59,780	24.9
Jan.-May	57,945	23,450	9.8
Other	26,688	10,801	4.5
Total	592,349	239,721	100.0

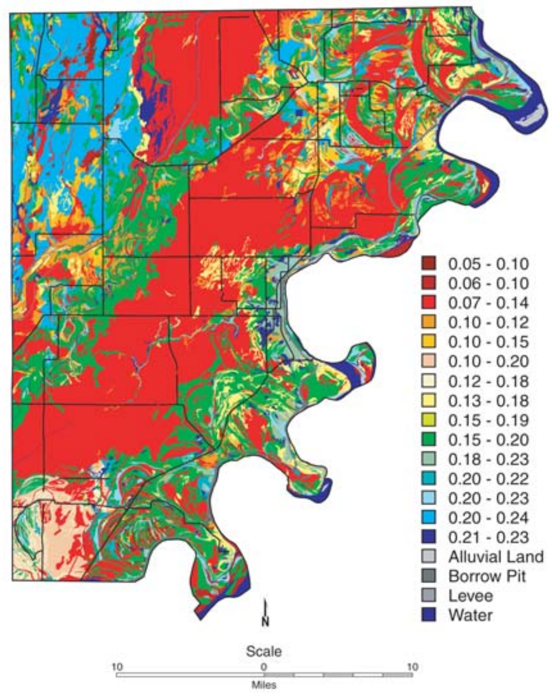

Fig. 19. Available soil water capacity in inches of water per inch of soil in Mississippi County, Arkansas.

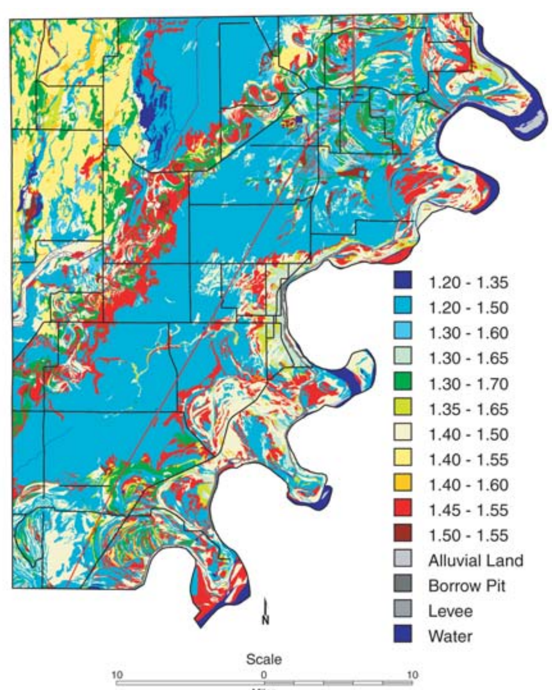

Fig. 20. Soil bulk density expressed as weight per unit volume of soil in Mississippi County, Arkansas.

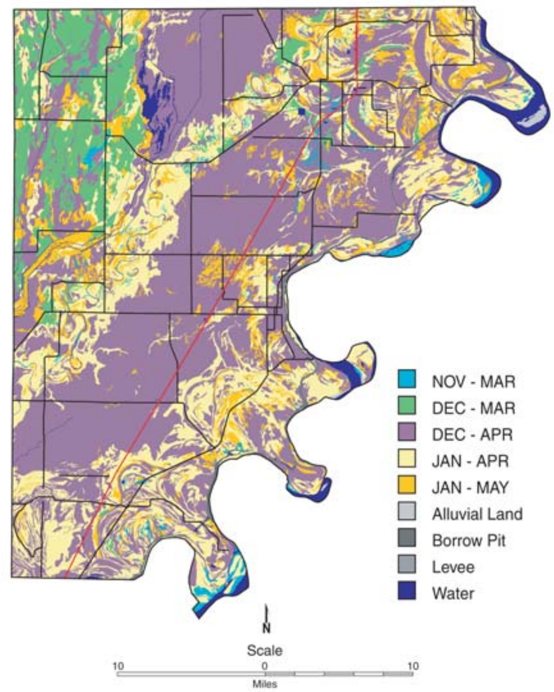

Fig. 21. Water table duration in months for Mississippi County, Arkansas.

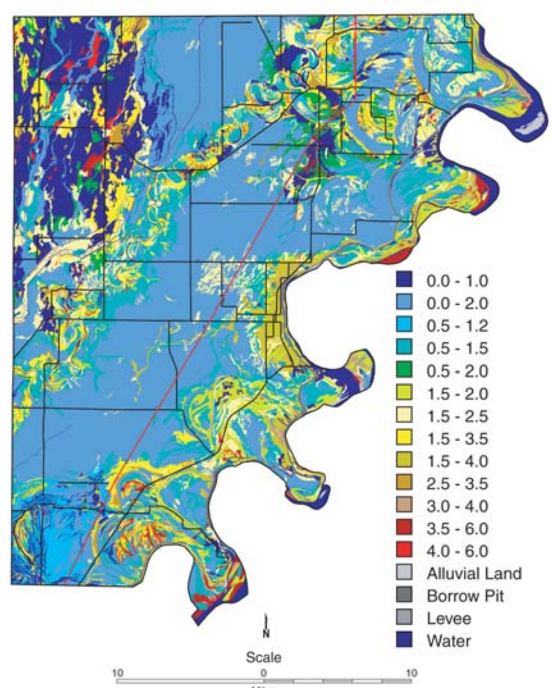

Fig. 22. Water table depth intervals (in feet) for Mississippi County, Arkansas.

Depth to Water Table

Water table properties are a set of data that describes the nature of a seasonal water table. There are three aspects to water table: months of occurrence, depth, and type of water table. The two types of water tables are perched and apparent. Perched water tables are sub-surface saturated layers that are separated from deeper aquifers by an unsaturated layer. Apparent water tables are continuously saturated layers from lower aquifers to the top of the water table.

In Mississippi County nearly 87% of the area is apparent water while nearly 9% is perched. The most common duration of the water table is between December and April (Table 17). Most of these areas are on the Sharkey, Alligator, and Tunica soils. The later durations occur near the stream channels while the earlier durations occur in the northwest portion of the county on the coarser textured soils (Fig. 21). The most common depth interval to water is the 0 to 2-ft category covering over 40% of the county (Table 18). These are areas coinciding with the Sharkey, Alligator, and Tunica soils (Fig. 22). The second largest category is the 0.5 to 1.5-ft depth interval that covers over 13% of the county. These are areas along stream channels. The third largest category is the 0 to 1.0-ft depth interval covering over 11% of the county. These areas are in the northwest portion of Mississippi County.

Prime Farmland

Prime farmland is one of a series of technical soil groupings used to manage the environment and agricultural production. This interpretation is based upon several soil environmental, physical and chemical properties contained within a SSURGO database. Criteria for prime farmland are adequate and dependable water supply, favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. All areas considered must also be available for use as farmland.

No areas in Mississippi County are classified outright as prime farmland. All prime farmland areas in the county are classified as such under certain conditions (Table 19). In the county, 40% of the area is prime farmland provided that the areas are protected from flooding (Fig. 23). Over 58% of the county can

Table 18. Water table depth for Mississippi County, Arkansas.

Depth (ft.)	ac	ha	% Cover
0.0-1.0	67,220	27,204	11.4
0.0-2.0	238,786	96,635	40.3
0.5-1.2	11,000	4,451	1.9
0.5-1.5	80,613	32,624	13.6
0.5-2.0	12,362	5,003	2.0
1.5-2.0	22,560	9,130	3.8
1.5-2.5	50,377	20,387	8.5
1.5-3.5	38,208	15,462	6.5
1.5-4.0	18,467	7,473	3.1
2.5-3.5	7,568	3,063	1.3
3.0-4.0	4,880	1,975	0.8
3.5-6.0	8,752	3,542	1.5
4.0-6.0	4,868	1,970	0.8
Other	26,688	10,801	4.5
Total	592,349	239,720	100.0

Table 19. Areal distribution of prime farmland locations in Mississippi County, Arkansas.

Description	ac	ha	% Cover
Not Prime Farmland	25,836	10,456	4.3
Protected rom flooding	195,173	78,985	33.0
Drained and protected from flooding	344,652	139,478	58.2
Other	26,688	10,801	4.5
Table	592,349	239,720	100.0

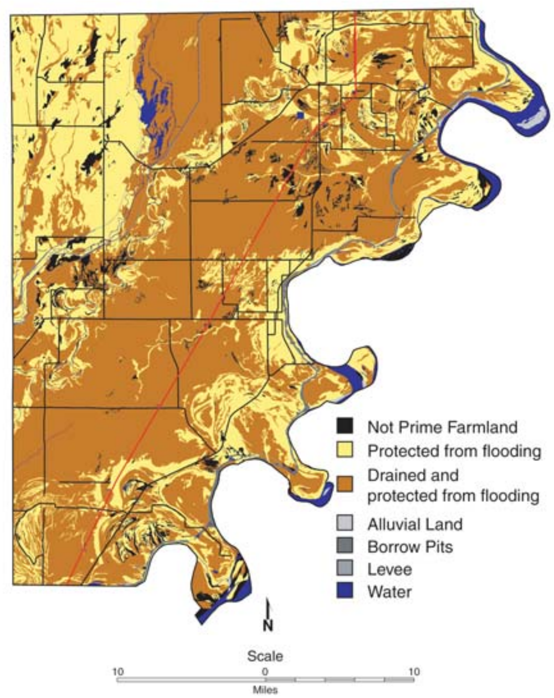

Fig. 23. Prime farmland potential for Mississippi County, Arkansas.

be considered prime farmland provided that the areas are protected from flooding and are drained. These areas coincide with the same areas where the depth to the water table is less than 1.0 ft (Fig. 22). This classification is also inconsistent with the flooding frequency, which is either “none” or “rare” for the county, but is consistent with the predominant drainage properties. In this one instance, the effect of human intervention has influenced the soils data in that much of the county is protected from flooding by levees. Without these levees, the flooding frequency would dramatically change upward. Although the database reflects the changes in flooding due to levees, it does not reflect the influence of past drainage projects. The drainage projects removed the surface water but did not change the drainage property of the soil. Only a change in soil texture could affect soil drainage.

Over 4% of the area in Mississippi County is not considered as prime farmland. These areas coincide with water table depths greater than 3 ft which are the sandy soils of Bruno, Crevasse and Steele. These areas would not be suitable for irrigation due to lack of water held within the soil matrix and because of rapid drainage through the soil profile and low available water capacity.

Land-Use Changes

The USGS level 1 land-use classification system reflects a general classification scheme such as urban, transportation, forest, and agriculture. Figures 6 and 7 are approximations of this scheme. Interpretation of the satellite imagery has provided an ability to create a classification finer than level 1, which allowed the identification of individual plant species. This precision also has permitted investigations of not only land use and land cover between 1992 and 1999, but also changes in crop production during these years. Cross tabulating the 1992 and 1999 crops pointed out absolute changes in land use with some degree of accuracy and included evidence of crop rotation. Time issues such as the 7-year gap between imagery and the time of season the imagery was taken limited the conclusions that could be drawn from the imagery. Investigations into the changes in the forest land-use category were not possible due to inconsistencies in this land-use category for 1992 and 1999. To reduce confusion, areas that were classified as forest in either imagery were omitted from further analyses. As a result, total areas of specific crops changed; however, the relationship between years and crops remained consistent due to the relatively small coverage of the forest land-use category.

There are many different manners in which to analyze the cropping changes between the 2 years. For simplicity purposes only the major changes will be discussed. As noted, the changes in land use between the 2 years (1992 and 1999) were minimal and were marked by the change of "bare soil" to "crops" (Table 20; Table 21). Over 94% of the "bare soil" changed to crop production while nearly 5% went to the urban category. Of the portion that went to crops, over 59% was converted to soybean production, over 27% was converted to cotton, and over 8% was converted to rice, corn, or grain sorghum. The "other crop" land-use category from 1992 was deleted in the 1999 and classified as soybeans (49%), cotton (43%), or corn and grain sorghum (7%). The deletion of these two categories accounts for the gain of over 100,000 cropland acres in the county.

Because of the 7-year span between the two images, a complete analysis of crop rotation is not possible. However, inferences can be made. Of areas that were planted with soybeans in 1992, 53% of these areas were again planted with soybeans in 1999; cotton was planted in nearly 36% of the 1992

Table 20. 1992 crop production for Mississippi County, Arkansas.

Land-cover	ac	ha	% Cover
Urban	18,158	7,349	3.1
Forest	46,712	18,904	7.9
Soybeans	224,593	90,892	37.9
Rice	26,702	10,806	4.5
Cotton	132,864	53,769	22.4
Grain Sorghum/Corn	10,784	4,364	1.8
Herbaceous/Pasture	1	0	0.0
Other crop	52,353	21,187	8.8
Bare Soil	56,963	23,053	9.6
Barren land	289	117	0.1
Flooded areas	1,397	565	0.2
Water	12,218	4,944	2.1
Other	9,315	3,770	1.6
Total	592,349	239,720	100.0

Table 21. 1999 crop production for Mississippi County, Arkansas.

Land cover	ac	ha	% Cover
Urban	17,480	7,074	3.0
Forest	45,030	18,223	7.6
Soybeans	267,650	108,317	45.2
Rice	27,460	11,113	4.6
Cotton	196,364	79,467	33.2
Grain Sorghum/Corn	18,015	7,291	3.0
Herbaceous/Pasture	1,021	413	0.2
Bare Soil	7	3	0.0
Barren Land	1,434	580	0.2
Flooded Areas	531	215	0.1
Water	12,518	5,066	2.1
Other	4,839	1,958	0.8
Total	592,349	239,720	100.0

soybean areas; and rice was planted in nearly 7% of the 1992 soybean areas. Of areas that were planted with cotton in 1992, 51% of the same area was also planted with cotton in 1999, soybeans were planted in 42% of the 1992 cotton areas, and rice, grain sorghum, and corn were planted in 6% of the 1992 cotton area. Soybean and cotton account for 78% of the total county area in 1999. Rice production covered much less area in Mississippi County at approximately 4.5%. Unlike cotton and soybeans, less than 10% of the area planted with rice in 1992 was again planted with rice in 1999. Soybeans were planted in 55% of the previous rice areas while cotton was planted in 27% of the previous rice areas.

Wheat and oat production were combined in the satellite imagery due to similarities in their spectral signatures. Statistics for crop production for Mississippi County showed little if any oat production. Therefore, it was assumed that the numbers presented pertain to wheat production. In Mississippi County most wheat is produced as winter wheat and visible only in the spring satellite imagery. Land use from the spring 1992 satellite imagery showed nearly 10% (57,268 acres and 23,176 hectares) of Mississippi County, under wheat production. In 1999 wheat production dropped to 9% (53,688 acres and 21,727 hectares) of Mississippi County a reduction of 0.6% (3,580 acres and 1,449 hectares). Comparison of the spring imageries with the summer imageries showed areas where the wheat was double-cropped with other crops. In 1992, 60% of the wheat production area was double-cropped with soybeans, 14% was bare soil, and 11% planted with cotton. The remaining 15% was divided between other crops. In 1999, 92% of the wheat production area was double-cropped with soybeans, 4% with cotton, and the remaining 4% with other crops.

CONCLUSIONS

Mississippi County is unique in that it is uniform in many respects. This uniformity negated some of the normal measures of land use and soil properties for this report. Normally, an analysis of soil properties with other geographic themes such as land use or geology would show differences based upon specific soil properties. Because agricultural land uses dominate the land area of the county, any analyses based upon soil properties and individual agricultural crops would show the same percentage distribution as the whole county. The opposite conclusion is that any statement that could be drawn from the county distribution would describe the county with more accuracy.

The following illustrates this point. The elevation range, 58 ft, is narrower than in the adjacent counties. The entire region is within Major Land Resource Area 131 or the Mississippi Valley Silty Alluvium. Over 57% of the soils in the county have a texture of silty clay loam or finer. Over 82% of the county is either poorly or somewhat poorly drained. Soil permeability rates of less than 0.06 in h-1 occupy over 52% of the county. Over 95% of the county has a greater than medium potential for hydric soils with no low potential areas. Over 82% of the soil is moderately to highly erodible (k factor greater than 0.24). Nearly 54% of the soils in the county had a low bulk-density range of 1.3 g cm-3 or less, reflecting the higher clay contents of the soils. Over 63% of the soils have a water table within 2-ft of the soil surface that is persistent in the winter and spring. None of the land in the county is classed prime farmland without drainage improvements or preventative measures against flooding. When these measures of improvement are taken, over 91% of Mississippi County could be considered as prime farmland. This is reflected by the land use where agriculture covered over 85% of the county area.

Soils naturally vary across landscapes. They are mapped according to several soil and environmental factors including landscape position and vegetation. Soil mapping results in a product that shows the distribution of soils across a landscape, which is referred to as spatial distribution. Most soil properties are presented here as groups or ranges of values and not as discrete numbers or characteristics. This variance with area is referred to as spatial variation and is considered intrinsic because the variation occurs within a map unit. The spatial distribution of soils in Mississippi County is based on the intrinsic variability of soil properties. A soil map unit is not a pure entity and contains inclusions of other soils that may or may not have similar properties. Soil variability complicated by influences of humans can be considered as extrinsic variability. Therefore, soils have different types of variability 1) the spatial distribution based upon landscape position, 2) intrinsic variability based upon the properties of the soil, 3) inclusions of other map units with different soil properties, and 4) extrinsic variability based upon influences from outside the soil environment. In addition, there are also factors from the actual soil survey. The degree of variability added depends upon the level or intensity of the soil survey. All of this variability indicates that the material presented here and in NRCS soil survey publications should not be used as a basis for a site-specific evaluation. An on-site survey is the only manner in which the true nature of the soil and associated environment can be determined. However, this report and the associated NRCS soil survey publication can assist land management planning.

County soil surveys published by NRCS provide maps for soil map units and tabular data associated with soil map units. The tabular data provide information on various soil physical and chemical properties, and on soil usage interpretations. This document supplements the information available in the soil survey report by providing maps of secondary soil attributes and their real extents. The purpose of this report is to facilitate soil and land resource inventory and management by making tabular data available in a spatial format. The readers will learn, however, in reading this report and comparing its contents to one’s own experiences and observations, that the inventory of the county soil survey and this resulting report are not perfect. Soil survey reports tend to be both accurate and imprecise. Intricate details of the land cannot be completely depicted and described on maps of this scale or in a text of this length. Specific soil use or management continues to require site-specific information.

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