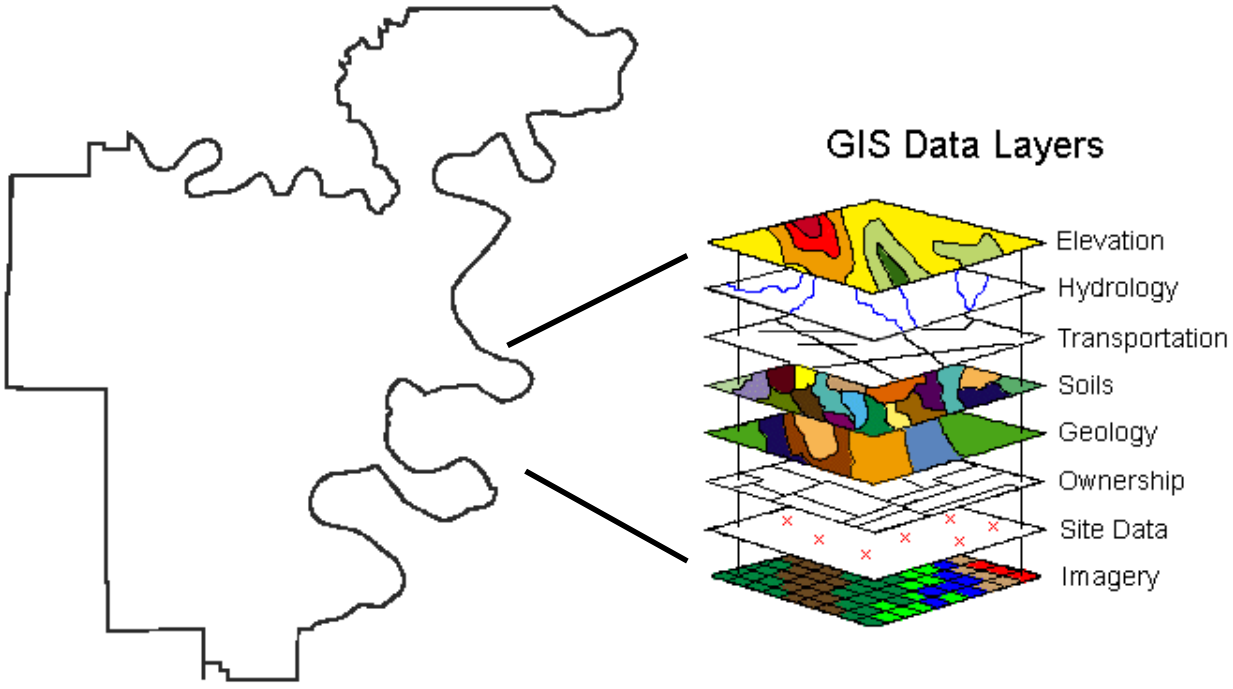
Soils of Desha County, Arkansas



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ARKANSAS AGRICULTURAL EXPERIMENT STATION

Division of Agriculture University of Arkansas

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Disclaimer: The soils in these GRASS mapsets were digitized by the Soil Physics Laboratory, Agronomy Department, University of Arkansas. These data have not been certified by the Natural Resources Conservation Service (NRCS) for SSURGO standards. As a result the NRCS and the Soil Physics Laboratory are not responsible for any loss or damage directly or indirectly related to these data.

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INTRODUCTION

Soil is one of the most important natural resources of Arkansas. Information on soil behavior is used in agriculture, engineering and environmental applications. Soil is a vital resource for sustaining two basic human needs, a quality food supply and a livable environment. Along with air and water, soil contributes essential processes to the natural order of global cycles. Soils are products of both inherited and acquired properties. Their current characteristics reflect an integration of original features with accumulated influences of subsequent environments.

Soil refers to the unconsolidated natural material on the earth's surface that supports plant growth and provides a storage medium for water, gases, chemicals and heat. An individual soil is a three-dimensional body with recognizable boundaries. The interface with the atmosphere is the soil's upper boundary; the depth to which biological, physical and chemical weathering occurs approximates the lower boundary. Internally, soil bodies differ in their physical, chemical and biological properties. Soils in an area occur in patterns related to five soil-forming factors: geology, landscape features, climate, native vegetation and time. Soils occupy definite positions on the landscape; therefore, individual soils can be mapped and named.

The development of digital databases of natural resources such as soils has greatly facilitated understanding of agricultural and environmental phenomena. Digital databases along with Geographic Information Systems are useful in planning and providing spatial information to aid decision making processes. 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 different sources such as satellite imagery, radar, air photographs and global positioning systems can be easily added to an existing digital database to facilitate analysis, use and modeling.

This report presents the spatial distribution of both primary and secondary attributes of the soils of Desha County, Arkansas. Secondary attributes of the soils were derived from the primary attributes and are frequently more useful because they redefine the primary attributes into forms that have direct application to real-world situations. In addition, most of the simulation models used in environmental applications frequently use secondary attributes of soils.

OBJECTIVES

The main objectives of this report are to (i) present and summarize the spatial distribution of the soil resource in a digital format for Desha County, Arkansas, and (ii) provide information to local, county and governmental offices in order to aid management of soils. Both scanning and digitizing techniques were used to convert primary attributes of soils from hardcopy maps to the digital format. Secondary attributes of the soils are also available in a tabular format. Various manipulation techniques were used to convert tabular data of secondary attributes into digital format. This report does not eliminate the need for on-site soil evaluation for specific purposes. However, this report provides a general guideline for macro-/meso-level management and policy formulation.

LOCATION AND DESCRIPTION OF DESHA COUNTY

Desha County is located in southeastern Arkansas, in the lower Mississippi Delta region (Figure 1). The county is bounded by the Mississippi River on the east, Lincoln and Drew Counties on the west, Phillips and Arkansas Counties on the north and Chicot County on the south.

Desha County is comprised of 516,236 acres (212,355 ha) and has 30 soil mapping units. The dominant soil mapping unit is Sharkey and Desha clays and in the 0 – 1% slope class. In 1992, agriculture was the main economic activity of Desha County and involved approximately 60% of the land area (Table 1).

The central and west-central part of the county has agriculture as the predominant landuse whereas the northeastern part of the county is dominated by deciduous forests (Figure 2). Primary and secondary roads of Desha County are presented in Figure 3, and the spatial distribution of water bodies is presented in Figure 4.

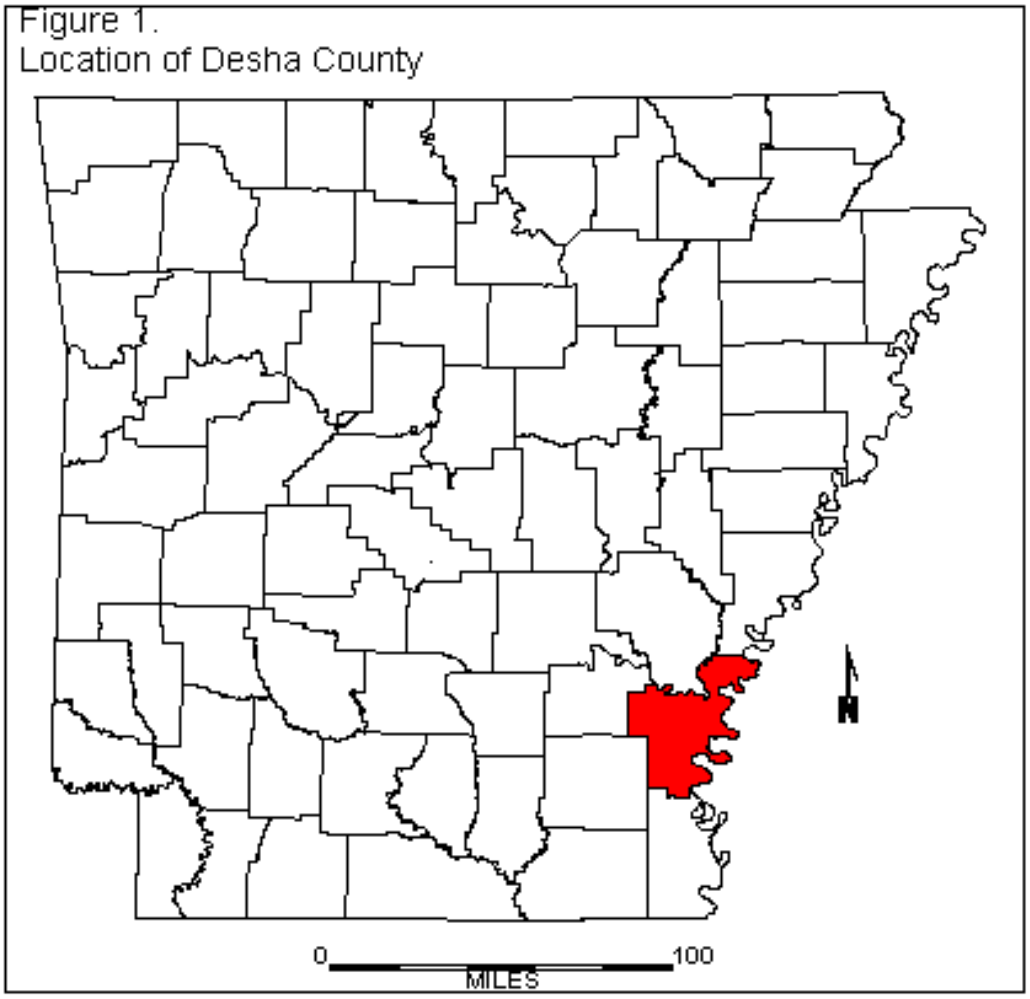
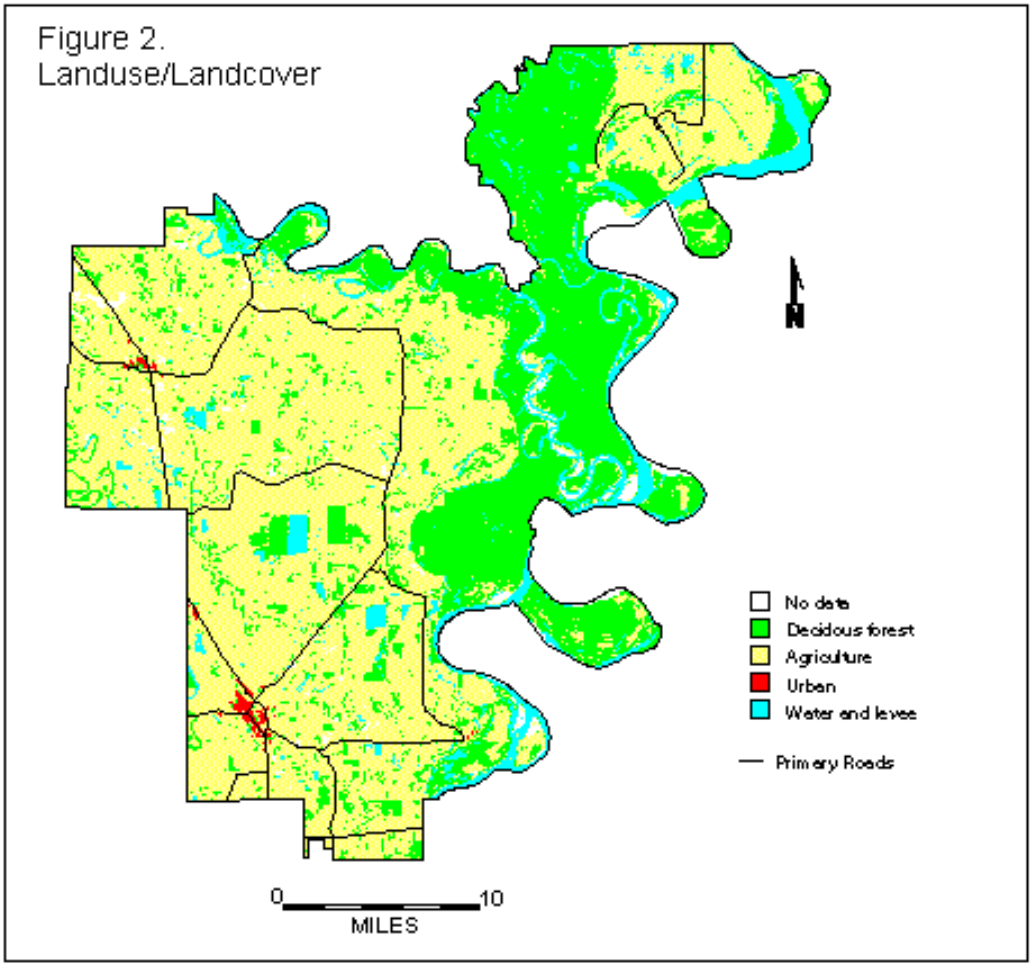


Table 1. Areal distribution of landuse and landcover in Desha County.

Landuse and landcover class	acres	hectares	% cover
Deciduous forest	159,798	64,669	31.54
Agriculture	305,542	123,651	60.30
Urban	1,888	764	0.37
Water and levee	39,498	15,985	7.79
TOTAL	506,726	205,069	100.00



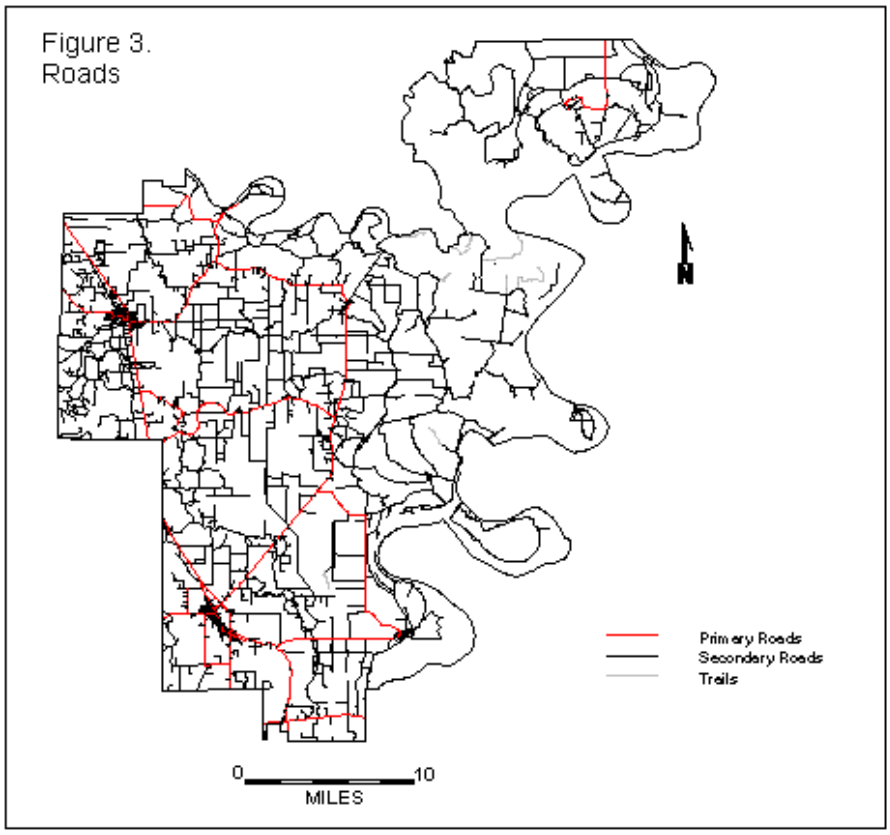


Figure 3.
Roads
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Primary Roads
Secondary Roads
Trails
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10
MILES

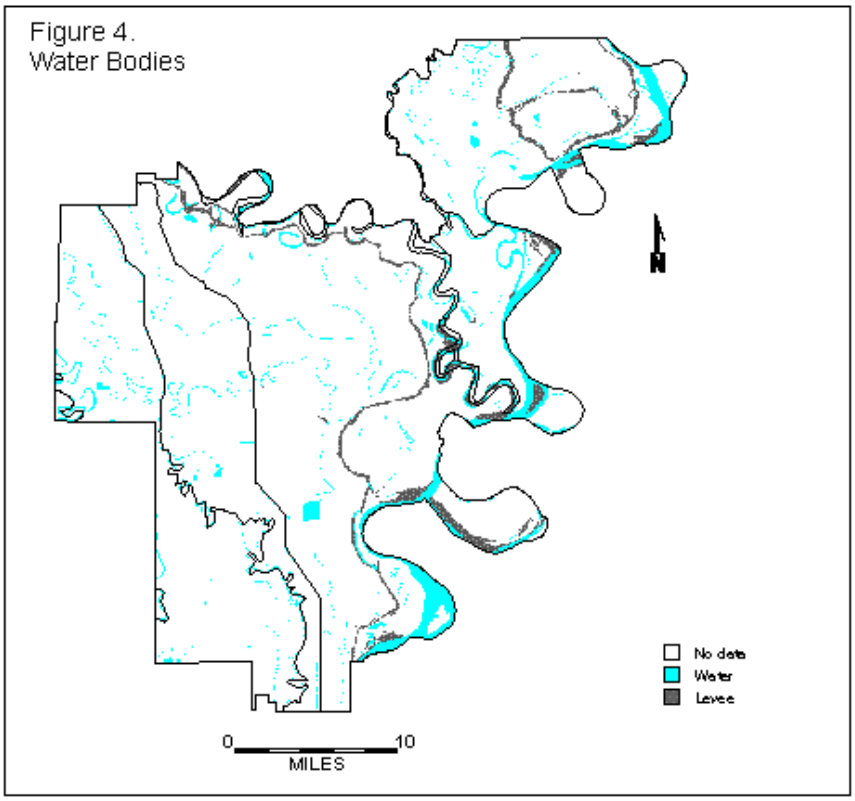


Figure 4.
Water Bodies
N
No data
Water
Levee
0
10
MILES

This county has seven eight-digit watersheds defined by the USGS classification scheme (Table 2). The major, or largest, of these watersheds is Bayou Macon, which covers about 35% of the total land area in Desha County. Bayou Macon extends from north to south in the central part of county (Figure 5).

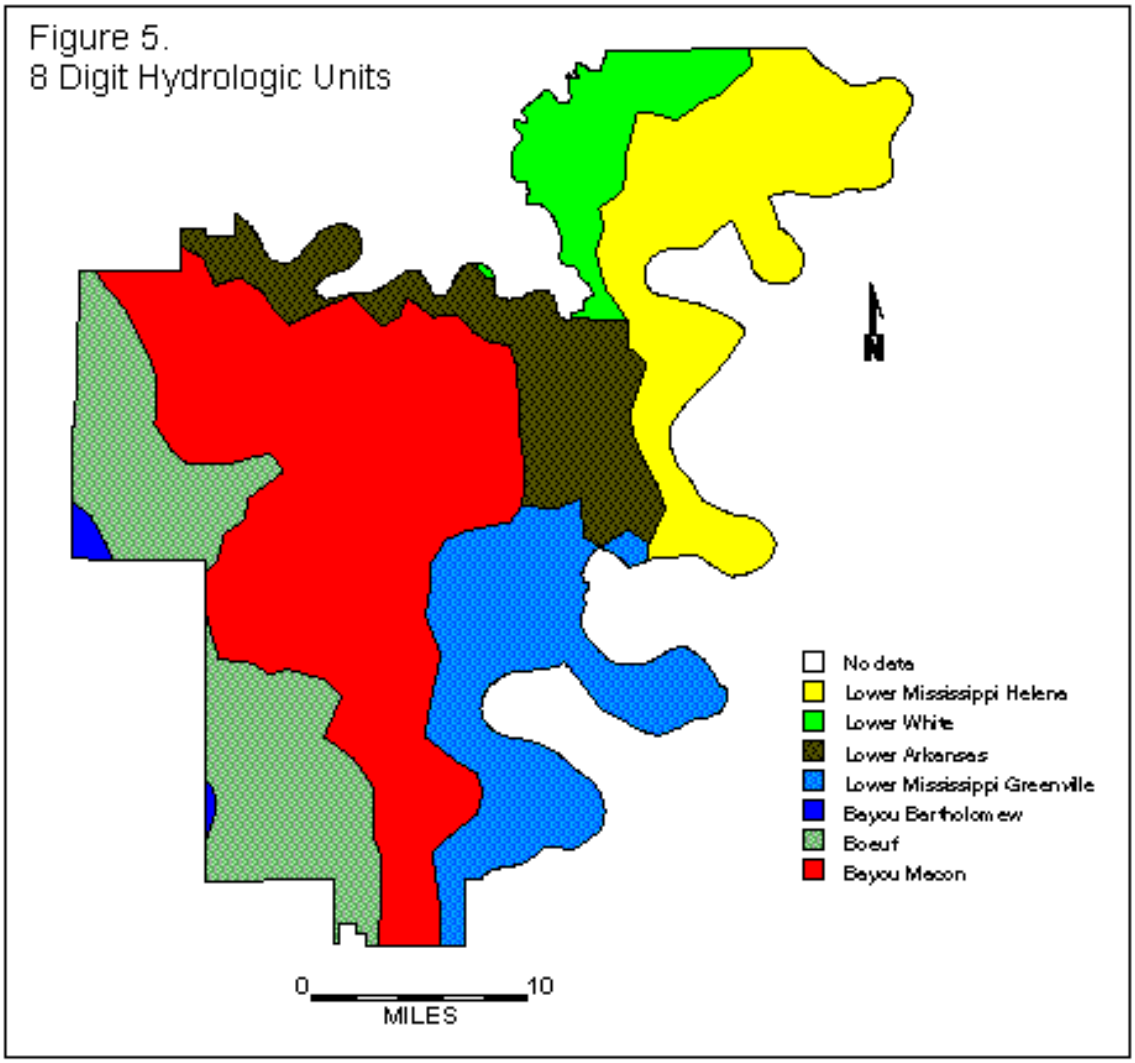


Table 2. Areal distribution of eight-digit hydrologic units in Desha County.

Hydrologic units	acres	hectares	% cover
Lower Mississippi Helena	83,639	33,848	16.20
Lower White	33,424	13,526	6.47
Lower Arkansas	52,584	21,282	10.19
Lower Mississippi Greenville	75,009	30,356	14.53
Bayou Bartholomew	2,544	1,029	0.49
Boeuf	87,588	35,446	16.97
Bayou Macon	181,448	73,431	35.15
TOTAL	516,236	208,918	100.00

Desha County is dominated by backswamps, which occur primarily in the central part of the county (Table 3). The Arkansas River Valley meander belt 1 covers about 10% of the land area, and the Mississippi River meander belt 1 covers about 18% of the area in Desha county (Figure 6). Different sources of information used in this study have varying regional definition and masks, resulting in different total areal coverage between the maps, as seen in Tables 1 - 19. For example, landuse data were classified from Thematic Mapper (TM) satellite imagery by the Center for Advanced Spatial Technologies (CAST), and the Hydrologic Units were obtained from the U.S. Geological Survey, Water Resource Division. Moreover, for certain maps, borrow pit, levee and intermittently flooded areas are not used in calculating the total areal coverage; in these cases areal coverage may differ from those where borrow pit, levee and intermittently flooded areas were used in the calculation of areal coverage.

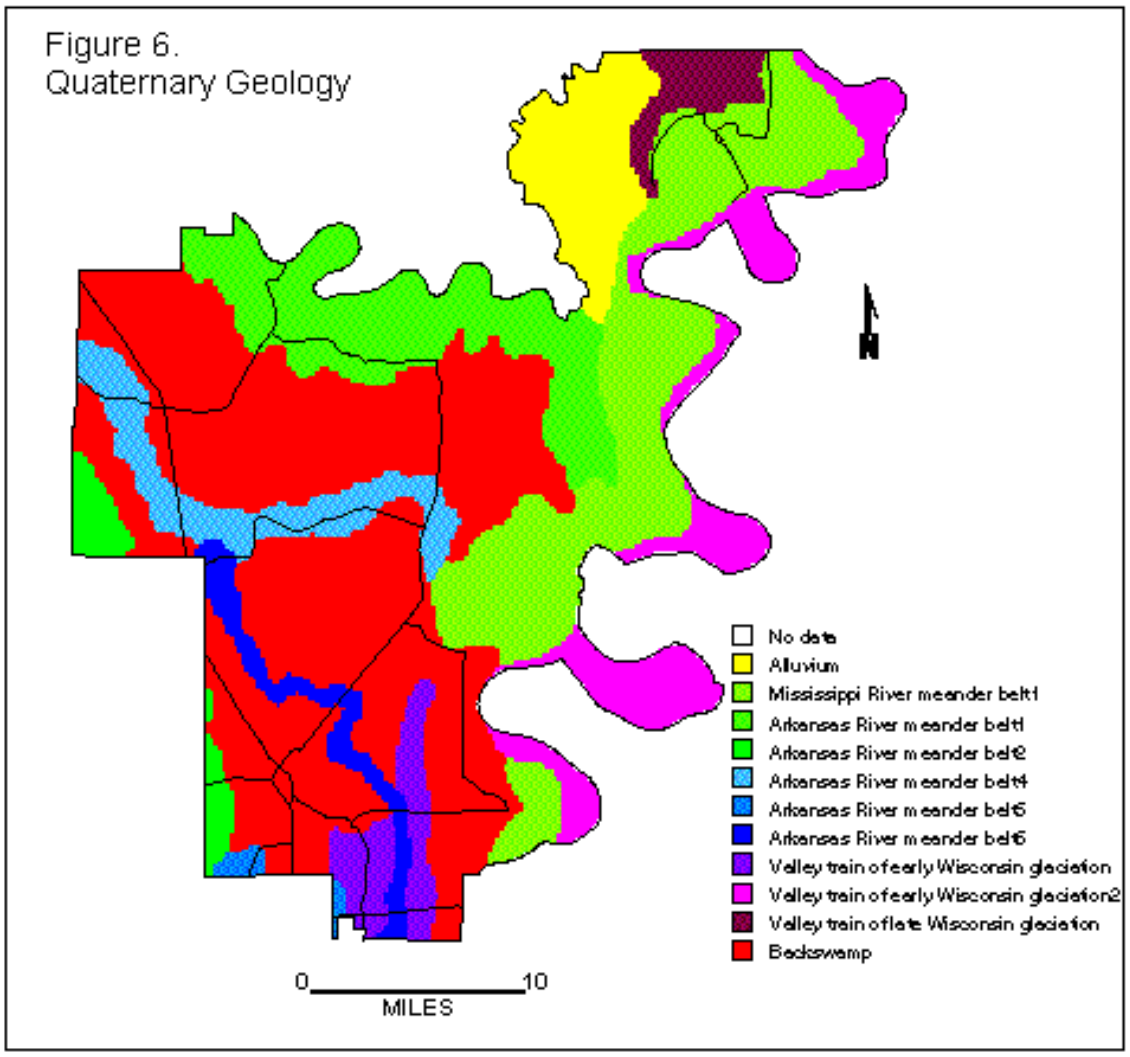


Table 3. Areal distribution of Quaternary geology in Desha County.

Geology	acres	hectares	% cover
Alluvium	31,494	12,746	6.12
Mississippi River meander belt1	92,922	37,605	18.04
Arkansas River meander belt1	53,358	21,594	10.36
Arkansas River meander belt2	10,648	4,309	2.07
Arkansas River meander belt4	26,745	10,824	5.19
Arkansas River meander belt5	2,393	968	0.46
Arkansas River meander belt6	14,500	5,868	2.82
Valley train of early Wisconsin glaciation	16,643	6,735	3.23
Valley train of early Wisconsin glaciation2	44,397	17,967	8.62
Valley train of late Wisconsin glaciation	11,877	4,806	2.31
Backswamp	209,990	84,982	40.78
TOTAL	514,967	208,404	100.00

METHODOLOGY

The methods used to develop the digital databases of the soils of Desha County can be divided into three sub categories: (i) hardware and software used, (ii) data input techniques used to develop primary soil attribute layers and (iii) manipulation techniques used to create the secondary soil attributes.

Hardware and Software

The hardware used in this project included Sun SPARC stations, a Context FSS8000 size E scanner and an Altek AC-30 digitizer. The computer software known as CAD/Scan was used for scanning the soil quadrangles. The software Line Trace Plus (LT4x) was used to edit, label and develop the primary digital database of soils. The GIS software Geographical Resource Analysis Support System (GRASS 4.1) was used to manipulate the primary data layers into secondary data layers and to paint the maps.

Data Input Techniques

There are two ways to convert hardcopy maps into a digital database: (i) scanning and (ii) digitizing. The soil boundary lines were drawn on mylar by Natural Resource Conservation Service (NRCS) personnel in Little Rock and were scanned using Scan/CAD software in the University of Arkansas' Soil Physics laboratory. The county boundaries were digitized from topographic maps using an Altek digitizer. The resulting scanned images went through several processes of editing in order to be imported into a GIS database. The scanned image of soil boundaries is a raster image, unless the scanner is operating in vector mode. The scanned image appears to be rather crude when compared to the original soils map. This crudeness is the result of lines bleeding together. The scanned boundaries contained multiple and variable pixel widths. Scanned images required more editing than digitizing techniques. Although digitizing involves less editing, the process of digitizing soil lines is time consuming. Compared to digitizing, scanning, which sometimes involves extensive editing, is still considered a time-saving technique. Therefore, most of the soil quadrangles

for Desha County were scanned. The county boundaries were digitized due to simplicity of the line work.

All soil boundaries were inspected before scanning. The errors or flaws in the source maps, which included matching soil boundaries between the maps, were corrected before scanning. Some soil boundary lines were not complete. Incomplete soil boundaries create open polygons. Open polygons cannot be used to build topology because they are not considered as a map type object. Also, thin or dim portions of soil boundary lines were identified. These types of lines may not scan successfully, causing yet more open polygons. The major corrections were done by NRCS personnel. Minor corrections such as editing a dim line were completed in the Soil Physics Laboratory of the Department of Agronomy.

The county boundaries were digitized from the 7.5-minute USGS topographic quadrangles. Digitizing was chosen over scanning, since selective relevant features can be digitized. The county lines were digitized directly in a vector format. This step resulted in fewer errors induced by raster to vector conversion processes. There was no need for editing the images, which involves thinning the lines or fixing the problems related to intersection. Thus, considerable time for editing was saved.

After the soil quadangles were scanned and edited, they were converted into the vector format and labeled. Before labeling, the county boundaries were imported. Each soil polygon was labeled twice to avoid mislabeling due to human errors. After labeling was completed, the images were exported to GRASS in vector format.

Manipulation Techniques

The primary attributes of the soil quadangles are soil mapping units from the Order II soil survey of Desha County. The Order II soil survey was published at a scale of 1:24000. The smallest mapped land area was no less than 5 acres with the exception of special features such as ponds, dams or pits. Soil mapping units were reclassed to the soil series level since some of the tabular data were available at this level. Tabular data for Desha County were used to create secondary attributes from soil mapping units.

Secondary soil attributes such as textural class, drainage class, permeability, shrink-swell potential, runoff and reaction (pH) were obtained from the Soil Survey of Desha County (1972), published by USDA Soil Conservation Service in cooperation with the Arkansas Agricultural Experiment Station. A map of the potential hydric soils was created by soil series, which was obtained from Hydric Soils of the United States (1991), published by USDA Soil Conservation Service in cooperation with The National Technical Committee for Hydric Soils. Secondary attributes such as annual flood, flood duration, soil K factor, soil T factor, depth to bedrock and soil slope were generated from tabular data associated with soil mapping units provided by NRCS. These data are of pre-SSURGO standards and are waiting to be certified.

Digital data of soil quadrangles with primary attributes were imported to GRASS in

vector format. The vector data were subsequently converted to raster format in GRASS. Since most environmental applications require raster analysis, conversion of the data from a vector format into the raster format is the first step. The manipulation technique, such as reclassification, can be done in either vector or raster domain. Since almost all of the analyses were done in raster domain, it is a common practice to convert vectors to a raster format, then use manipulation techniques to create secondary attribute layers for soils.

The manipulation technique used to create secondary attribute data for soils of Desha County was reclassification. The GRASS command r.reclass was used to create secondary attributes from primary soil attributes. The command r.reclass requires a set of rules that defines new classes from the old class.

SPATIAL DISTRIBUTION OF PRIMARY AND SECONDARY ATTRIBUTES

The primary attribute of soil is the soil mapping unit (Table 4). Soil mapping units can be reclassed to create maps of soil series (Table 5). This report also includes secondary attributes and classifications such as textural class, drainage class, reaction (pH), permeability, runoff, hydric soils, shrink-swell potential, annual flooding, flood duration, soil erodibility (K) factor, soil T factor, organic matter content, depth to bedrock and soil slope.

Table 4. Areal distribution of soil mapping units in Desha County.

Mapping units	acres	hectares	% cover
Bowdre, Desha, and Robinsonville Soils, gently undulating	1,423	576	0.28
Bruno loamy sand, gently undulating	2,148	869	0.42
Commerce silt loam, 0 to 1 percent slopes	4,800	1,942	0.93
Commerce silt loam, gently undulating	957	387	0.19
Coushatta complex, 0 to 1 percent slopes	3,941	1,595	0.76
Desha silt loam	2,986	1,208	0.58
Desha clay	30,327	12,273	5.87
Herbert silt loam	38,778	15,693	7.51
McGhee silt loam	14,431	5,840	2.80
Newellton clay, 0 to 1 percent slopes	4,406	1,783	0.85
Newellton clay, gently undulating	3,122	1,263	0.60
Perry silt loam	359	145	0.07
Perry clay	21,277	8,611	4.12
Portland silt loam	2,209	894	0.43
Portland clay	3,525	1,427	0.68
Rilla silt loam, 0 to 1 percent slopes	21,553	8,723	4.18
Rilla silt loam, 1 to 3 percent slopes	7,426	3,005	1.44
Sharkey clay	59,699	24,160	11.56
Sharkey-Commerce-Coushatta association, frequently flooded	78,632	31,822	15.23
Sharkey and Desha silt loams	4,268	1,727	0.83
Sharkey and Desha clays, 0 to 1 percent slopes	129,196	52,285	25.03
Sharkey and Desha clays, gently undulating	9,288	3,759	1.80
Tunica clay, 0 to 1 percent slopes	1,843	746	0.36
Tunica clay, 1 to 3 percent slopes	1,923	778	0.37
Tunica clay, frequently flooded	5,119	2,071	0.99
Tutwiler silt loam	6,500	2,630	1.26
Borrow Pit	5,635	2,280	1.09
Levee	3,827	1,552	0.74
Water	36,979	14,965	7.16
Intermittently flooded areas	9,659	3,909	1.87
TOTAL	516,236	208,918	100.00

Table 5. Scientific names of the major soil series found in Desha County.

Soil series	Scientific family name
Bowdre	Clayey over loamy, montmorillonitic, thermic Fluvaquentic Hapudolls
Bruno	Sandy, mixed, thermic Typic Udifluvents
Commerce	Fine silty, mixed nonacid, thermic Aeric Fluvaquents
Coushatta	Fine silty, mixed, thermic Fluventic Eutrochrepts
Desha	Very fine, montmorillonitic, thermic Vertic Hapludolls
Hebert	Fine silty, mixed, thermic Aeric Ochraqualfs
McGehee	Fine silty, mixed, thermic Aeric Ochraqalfs
Newellton	Clayey over loamy, montmorillonitic, nonacid, thermic Aeric Fluvaquents
Perry	Very fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts
Portland	Very fine, mixed, nonacid, thermic Vertic Haplaquepts
Rilla	Fine silty, mixed , thermic Typic Hapludalfs
Robinsonville	Coarse loamy, mixed, nonacid, thermic Typic Udifluvents
Sharkey	Very fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts
Tunica	Clayey over loamy, montmorillonitic, nonacid, thermic Vertic Haplaquepts
Tutwiller	Coarse silty, mixed, thermic Typic Hapludalfs

Soil Mapping Units

A soil mapping unit is a collection of pedons (smallest identifiable unit of a soil) defined and named the same in terms of their soil components or miscellaneous areas or both. Each map unit differs in some respect from all others in a survey area and is uniquely identified on a soil map. A delineation of a map unit generally contains the dominant components in the map unit name, but it may not always contain a representative of each kind of inclusion. The different kinds of soil used to name soil mapping units have sets of interrelated properties that are characteristic of soil as a natural body. However, the term *soil mapping unit* is intended to exclude maps showing the distribution of a single property such as texture, slope, permeability, shrink-swell potential or depth, alone or in limited combinations; maps that show the distribution of soil qualities such as productivity or erodibility; maps of soil forming factors, such as topography, vegetation or geology (USDA, 1993).

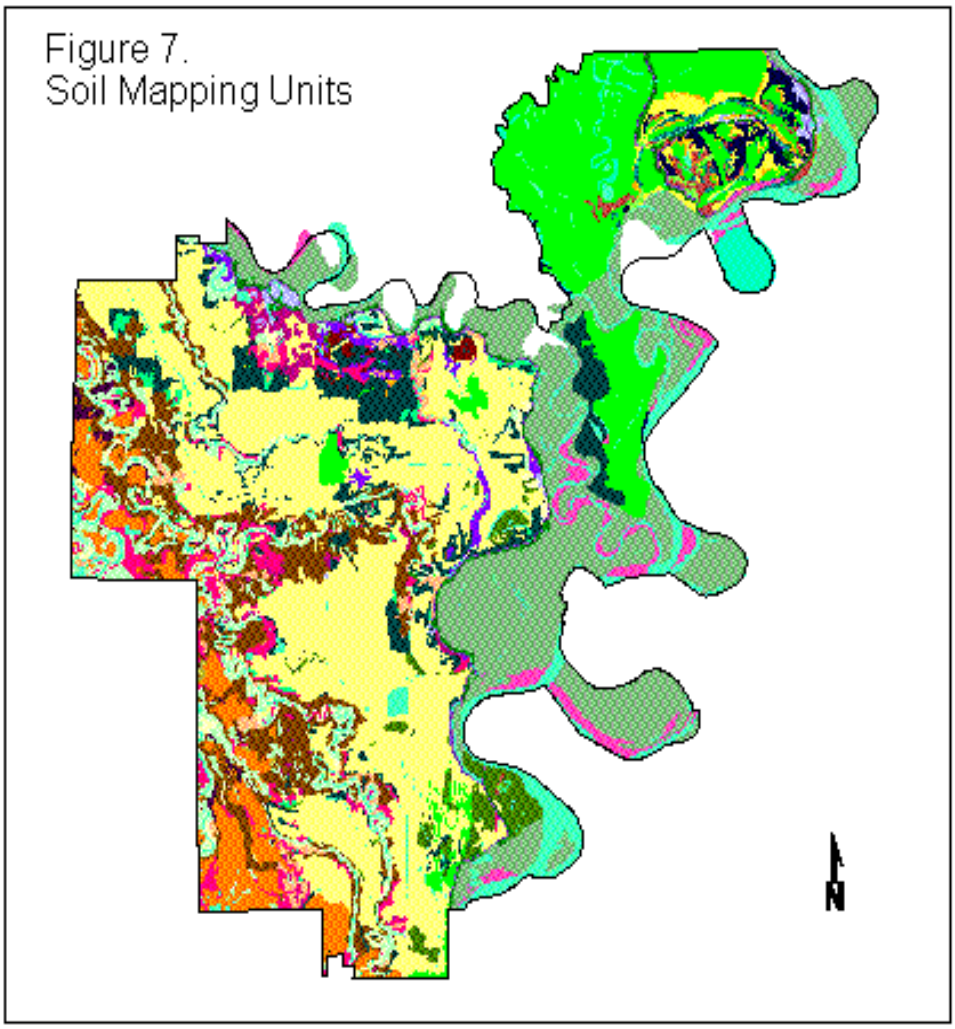
Four mapping units occupy almost 60% of the land area in Desha County (Table 4). The most extensive soil mapping unit is the Sharkey and Desha clay with 0 - 1% slopes. This mapping unit occupies 25% of the land area and is mostly found in the central part of the county (Figure 7). The Sharkey soil is poorly drained, and the Desha soil is somewhat poorly drained. When dry, these soils contract and crack, and when wet, they expand and seal over. Runoff is very slow, and wetness is a severe hazard. Natural chemical fertility is high. These soils can be cultivated within a narrow range of water content, and in areas not drained, farming operations are delayed for several days after rain. Seedbed preparation is difficult, and tilth is hard to maintain.

The Sharkey-Commerce-Coushatta association frequently flooded is the second most

extensive mapping unit, comprising about 15% of the total area, and occurs in the eastern part of the county. This soil association is found in areas not protected by levees. It is well suited to hardwood and wildlife habitat and is not suitable for cultivation. The soil is used at low intensity because it is frequently flooded and inaccessible.

Sharkey clay, which occupies 11.6% of the land area, occurs primarily in the northern part of Desha County. One of the major soil mapping units found in the western part of the county is Perry clay. Sharkey clay and Perry clay have high shrink-swell potential, and permeability is very slow except when the soil is cracked. The other major soil mapping units found in the western part of the county include Herbert silt loam followed by Sharkey and Desha silt loam. Desha clay is found in the north-central part of the area; Tunica clay, which occupies about 2% of the county, is found in the eastern part of the county, and Sharkey and Desha clays are found in patches all over the county. Hebert soils have slow runoff and moderately low permeability. This soil is well suited to crops, but excess water is a moderate hazard. Tilth is easy to maintain. Sharkey clay and Desha silt loam have very slow permeability. Except when the soil is cracked, runoff is very slow, and wetness is a severe hazard. Tilth is easy to maintain and natural fertility is high.

Figure 7.
Soil Mapping Units



- No data
- Bruno loamy sand, gently undulating
- Commerce silt loam, gently undulating
- Desha silt loam
- Herbert silt loam
- Newellton clay, 0 to 1 percent slopes
- Perry silt loam
- Portland silt loam
- Rilla silt loam, 0 to 1 percent slopes
- Sharkey clay
- Sharkey and Desha silt loams
- Sharkey and Desha clays, gently undulating
- Tunica clay, 1 to 3 percent slopes
- Tutwiler silt loam
- Levee
- Out of Survey
- Bowdre, Desha, and Robinsonville soils, gently undulating
- Commerce silt loam, 0 to 1 percent slopes
- Coushatta complex, 0 to 1 percent slopes
- Desha clay
- McGehee silt loam
- Newellton clay, gently undulating
- Perry clay
- Portland clay
- Rilla silt loam, 1 to 3 percent slopes
- Sharkey-Commerce-Coushatta association, frequently flooded
- Sharkey and Desha clays, 0 to 1 percent slopes
- Tunica clay, 0 to 1 pecent slopes
- Tunica clay, frequently flooded
- Borrow Pit
- Water
- Intermittently flooded areas

Surface Textures

Surface textural class indicates the relative proportion of sand, silt and clay particles in a given mass of soil. Numerous properties and behaviors of soils are dependent on soil texture. The tabular data of soil texture were obtained from NRCS. The majority of the soils of Desha County have clay texture at the surface, which comprises 67% of the total area of the county and is found in all areas of the county (Table 6 and Figure 8). Soils with a silt loam texture in the surface occupies about 21% of the county and are found primarily in the western part and also in small patches in the eastern part of the county. Soils with silty clay texture in the surface are found mainly in the northern part of the county, whereas soils with silty clay loam are found in the north-central part of the county, comprising only 0.83% of the area. Small patches of loamy sand are mainly found in the northern part of the county.

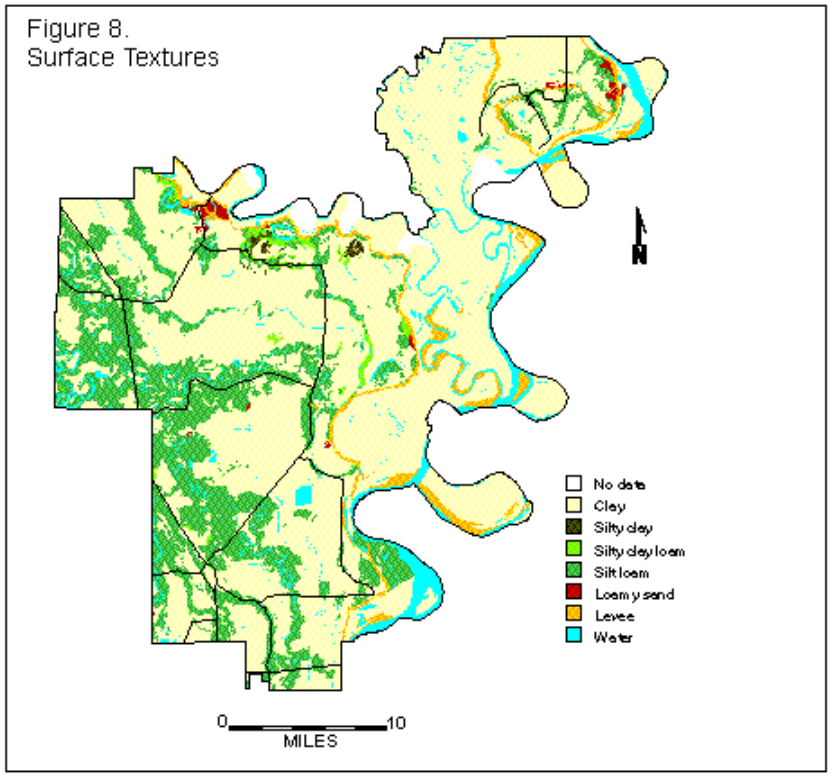


Table 6. Areal distribution of surface textures in Desha County.

Texture	acres	hectares	% cover
Clay	343,337	138,947	66.51
Silty clay	1,423	576	0.28
Silty clay loam	4,300	1,740	0.83
Silt loam	108,928	44,083	21.10
Loamy sand	2,148	869	0.42
Levee	19,121	7,738	3.70
Water	36,979	14,965	7.16
TOTAL	516,236	208,918	100.00

Soil Drainage Classes

The drainage classes of the soils of Desha County vary from poorly drained to excessively drained (Figure 9). Poorly drained soils occupy about 68% or 350,382 acres (141,798 ha) of the total area and are found all over the county (Table 7). Most of the soils that are classified as somewhat poorly drained are found in the northern part of the county. There is a relatively higher distribution of somewhat poorly drained soils in the western and central part of the county than in the eastern part. Somewhat poorly drained soils account for 14% of the total area. Well drained soils account for only 7% of the county and are found mainly in the central and western part of Desha county. Patches of excessively drained soils are found mostly in the northern part of the county and comprise only 0.4% of the total area.

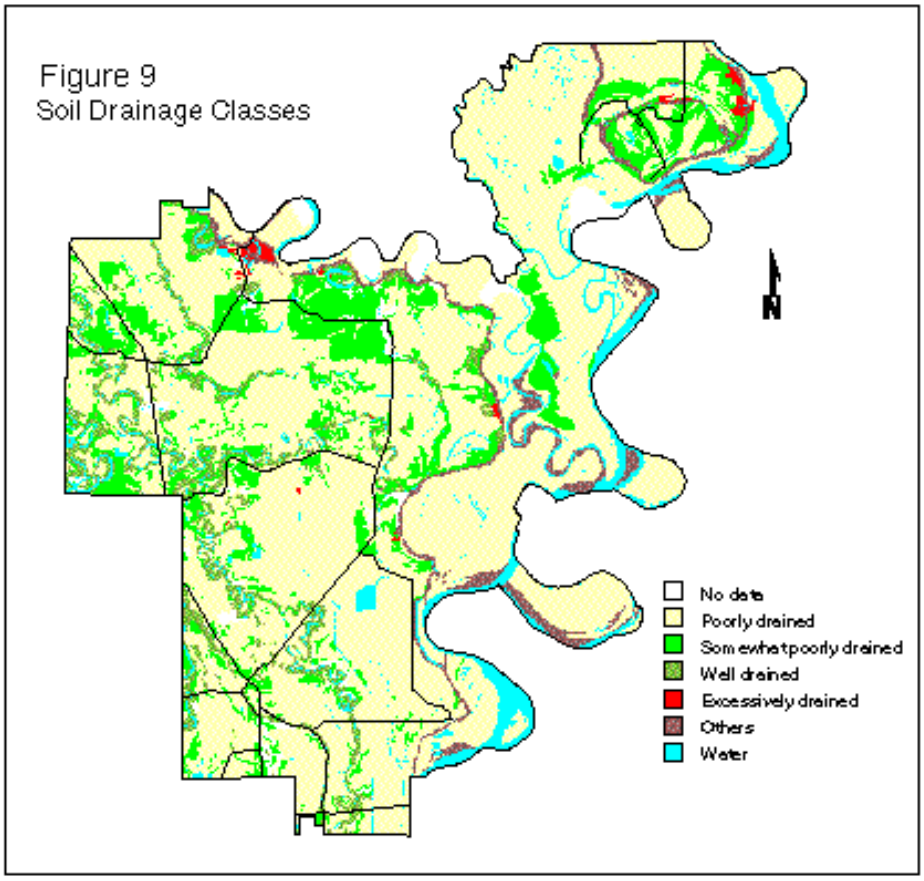


Table 7. Areal distribution of soil drainage classes in Desha County.

Drainage class	acres	hectares	% cover
Poorly drained	350,382	141,798	67.87
Somewhat poorly drained	72,126	29,189	13.97
Well drained	35,480	14,358	6.87
Excessively drained	2,148	869	0.42
Others	19,121	7,738	3.70
Water	36,979	14,966	7.17
TOTAL	512,236	208,918	100.00

Reaction (pH)

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The degree of acidity and alkalinity affects nutrient availability as well as crop yield. A soil pH value of less than 7.0 is considered as acidic soil, whereas pH values greater than 7.0 are alkaline soils. The tabular data for soil reaction were obtained from the NRCS. Almost two-thirds of Desha County has soils having neutral pH. The exception occurs in the western part of the county (Figure 10). Slightly acidic soils occur in the northeastern part of Desha County but comprise only 2% of the land area within the county. Moderately acidic soils comprise 17% of the county and are found in central and the west-central part of the county. Strongly acidic soils comprise only 4% of the area and are mainly found in the western part of the county (Table 8).

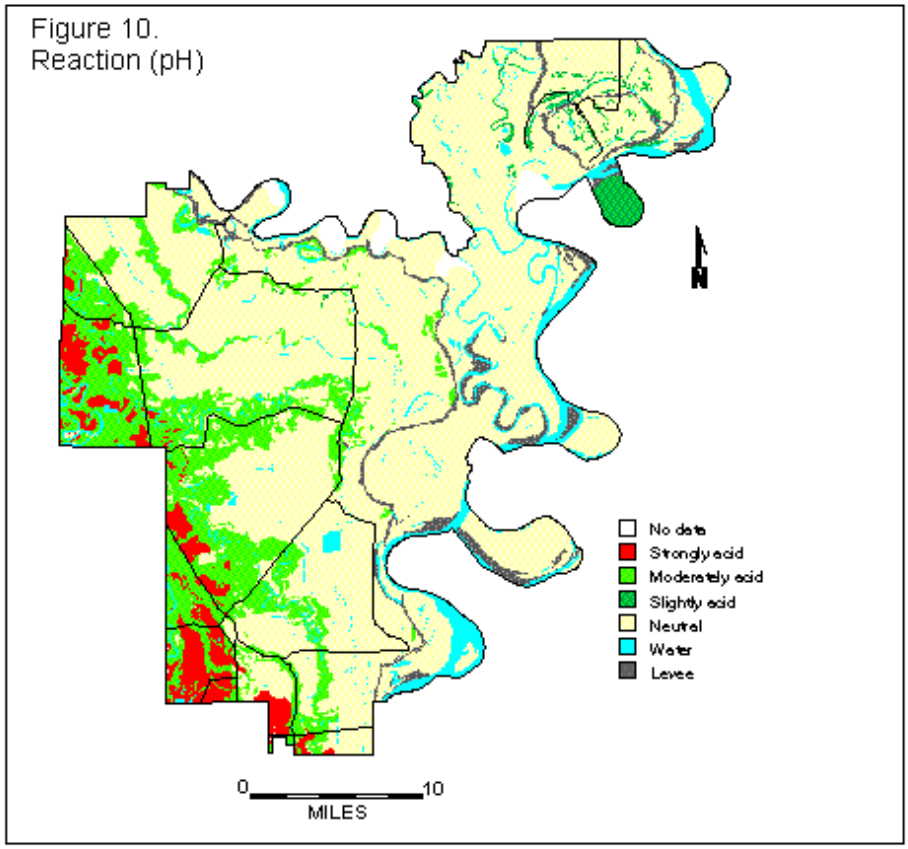


Table 8. Areal distribution of reaction (pH) in Desha County.

Soil reaction	acres	hectares	% cover
Strongly acid (5.1- 5.5)	21,636	8,756	4.19
Moderately acid (5.6 - 6.0)	87,923	35,582	17.03
Slightly acid (6.1 - 6.5)	8,885	3,596	1.72
Neutral (6.6 - 7.3)	341,692	138,281	66.19
Water	36,979	14,965	7.16
Other	19,121	7,738	3.71
TOTAL	516,236	208,918	100.00

Soil Permeability

Soil permeability in this context refers only to the movement of water downward through undisturbed and uncompacted saturated soils. This does not include lateral seepage. The estimates of permeability are based on structure and porosity of the soils. Basically, soil permeability along with the slope and the hazard of flooding influence suitability of soils for use as rice fields, wetlands, ponds, sewage lagoons, etc.

About 59% of the total land area in Desha County has very low permeability, i.e., 0.0 - 0.06 in./hr, and found all over the county (Table 9). Soils with low permeability (0.0 – 0.2 in./hr) cover 6% of the total area and are found in patches mainly in the north and central part of the county. Soils with moderately low permeability of 0.06 – 2.0 in./hr occur in the northeastern part of the county. The north-central part of the county has soils with moderately high permeability of 0.2 – 2.0 in./hr and covers only 1.01% of the county. About 21% of Desha County has soils with high permeability of 0.6-2.0 in./hr. These soils are mainly found in the western part of the county. Soils with very high permeability of 6.0 – 20 in./hr are mainly found in patches in the northern part of the county (Figure 11). Small patches of soils with very high permeability are also found in the central part of Desha County.

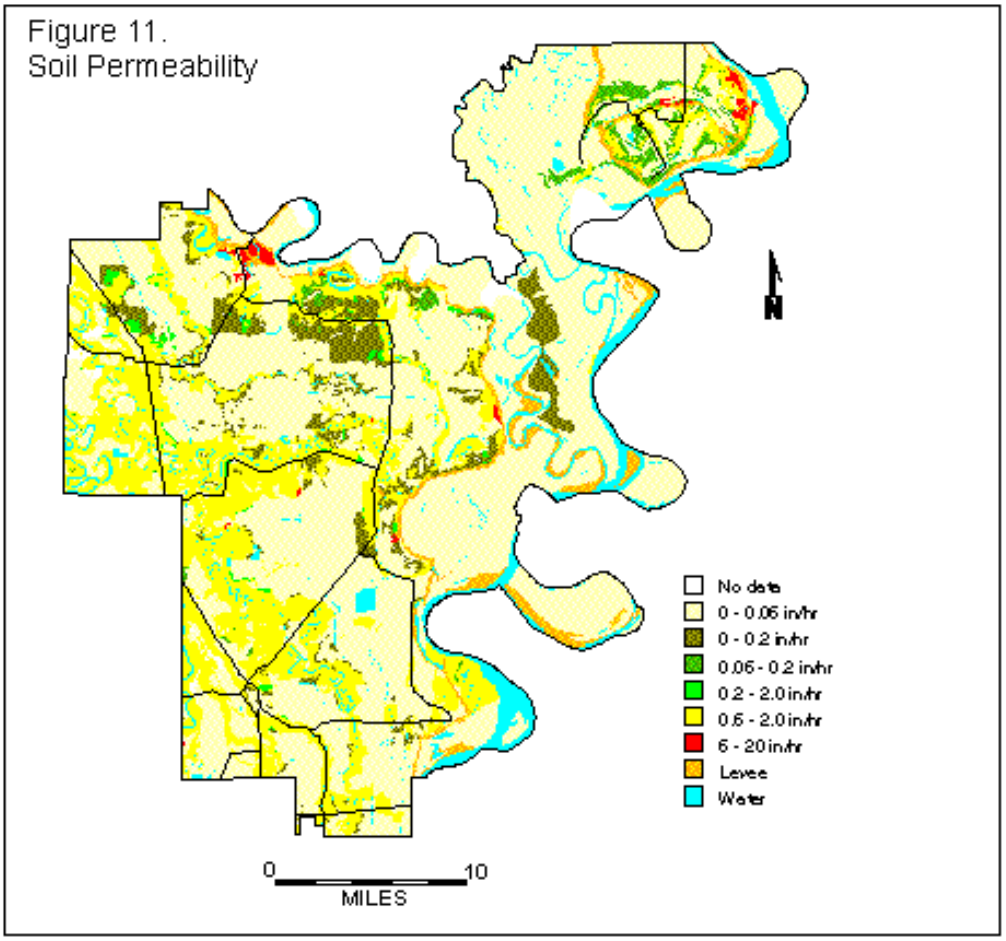


Table 9. Areal distribution of soil permeability in Desha County.

Permeability	acres	hectares	% cover
0 – 0.06 in./hr	305,482	123,627	59.17
0 – 0.2 in./hr	30,327	12,273	5.87
0.06 – 0.2 in./hr	9,310	3,768	1.80
0.2 – 2.0 in./hr	5,195	2,102	1.01
0.6 – 2.0 in./hr	107,675	43,575	20.86
6 – 20 in./hr	2,148	869	0.42
Other	19,121	7,738	3.70
Water	36,979	14,966	7.17
TOTAL	516,236	208,918	100.00

Soil Runoff Classes

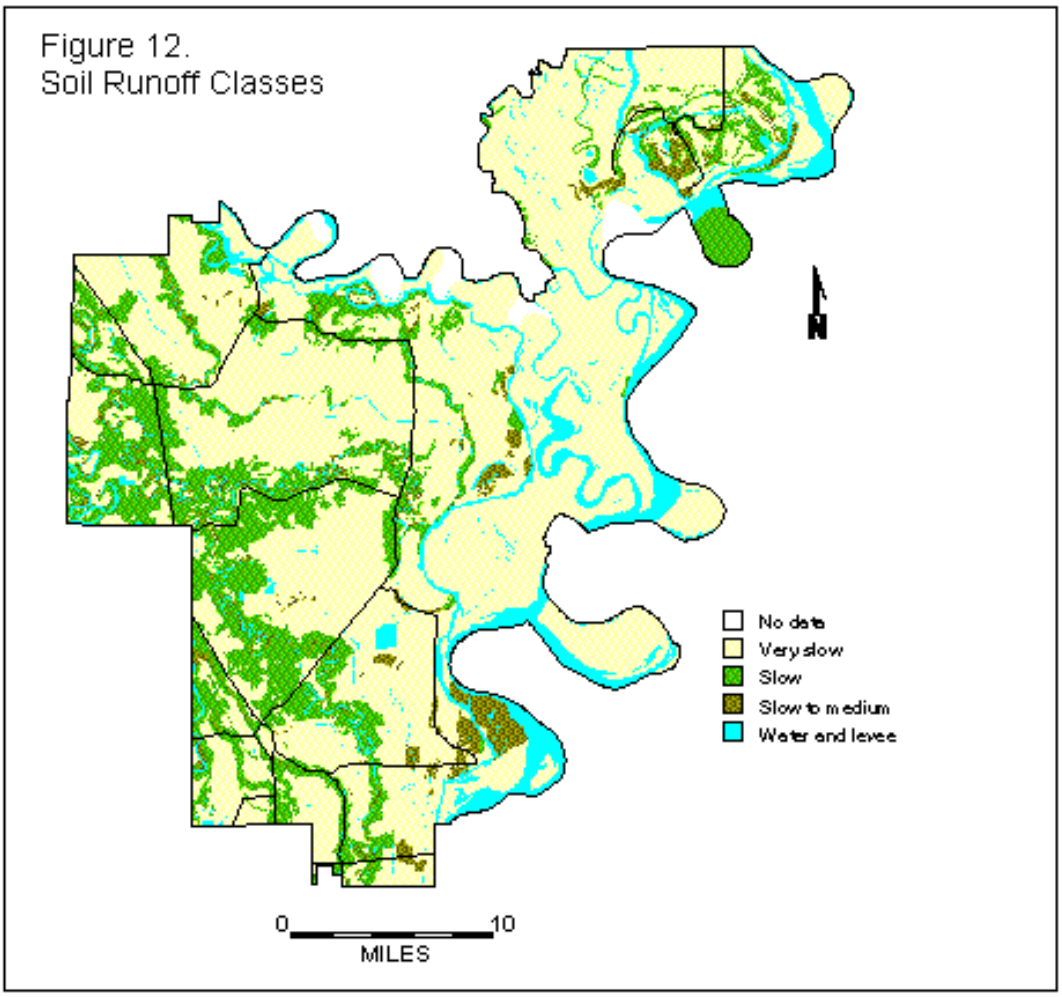
Surface runoff refers to the loss of water from an area by flow over the land surface. Surface runoff differs from subsurface flow or interflow that results when infiltrated water encounters a zone with lower permeability than the soil above.

Most of Desha County has soils with very slow runoff, which accounts for about 66% of the total area (Table 10). Compared to the eastern part, the western part of the county has a higher distribution of soils in the slow runoff category, comprising almost 19.5% of the total area (Figure 12).

The runoff category for slow to medium comprises only 4% of the total area and is found mainly in the eastern part of Desha County.

Table 10. Areal distribution of soil runoff classes in Desha County.

Runoff class	acres	hectares	% cover
Very slow	339,032	137,205	65.67
Slow	100,311	40,595	19.43
Slow to medium	20,793	8,415	4.03
Water	56,100	22,703	10.87
TOTAL	516,236	208,918	100.00



Potential Hydric Soils

A hydric soil is a soil that is saturated, flooded or ponded long enough during the growing season to develop anaerobic conditions in the upper part of the soil profile. Hydric soils are developed under sufficiently wet conditions to support the growth and regeneration of hydrophytic vegetation.

The determination of hydric soils requires an on-site evaluation. Some hydric soils may occur within the indicated soil series. The percentage of the designated area that is hydric soils is undetermined. Identification of potential hydric soils helps landuse planning, conservation planning and assessment of potential wildlife habitat. It is one of the criteria that defines the location of wetlands. The soils of Desha County that are in the potential hydric category (Table 11) occupy 75.16% of the total area. Spatially, most of Desha County is covered with potential hydric soils except the northeastern part (Figure 13).

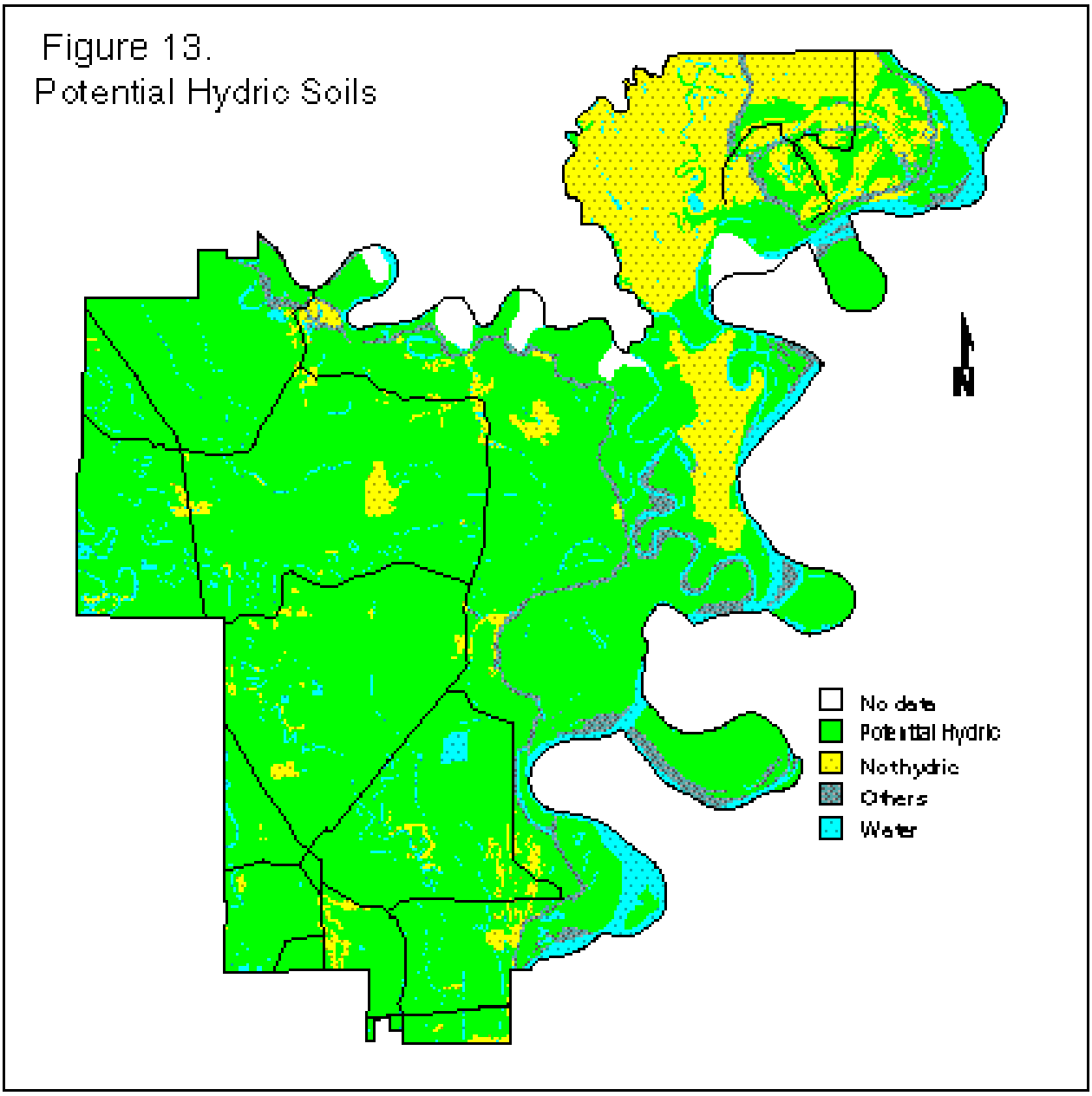


Table 11. Areal distribution of potential hydric soils in Desha County.

Category	acres	hectares	% cover
Potential hydric soils	388,024	157,031	75.16
Not Hydric	72,112	29,183	13.97
Others	19,121	7,738	3.70
Water	36,979	14,965	7.17
TOTAL	516,236	208,917	100.00

Soil Shrink-Swell Potential

Soil shrink-swell potential is an indication of the volume change to be expected with changes in soil water content. This information is important for construction work and affects building foundations, roads, ponds and other structures. The majority of Desha County has low shrink-swell potential (Table 12). The soils with low shrink-swell potential are found in the western and central part of the county, which covers 58% of the total county area. Soils in the northern and eastern parts of Desha County show high shrink-swell potential with small patches of low shrink-swell potential. Soils with high shrink-swell potential cover 30% of the total area. Moderate shrink swell potential is found in the central part of the county, which covers only 0.76% of the county (Figure 14).

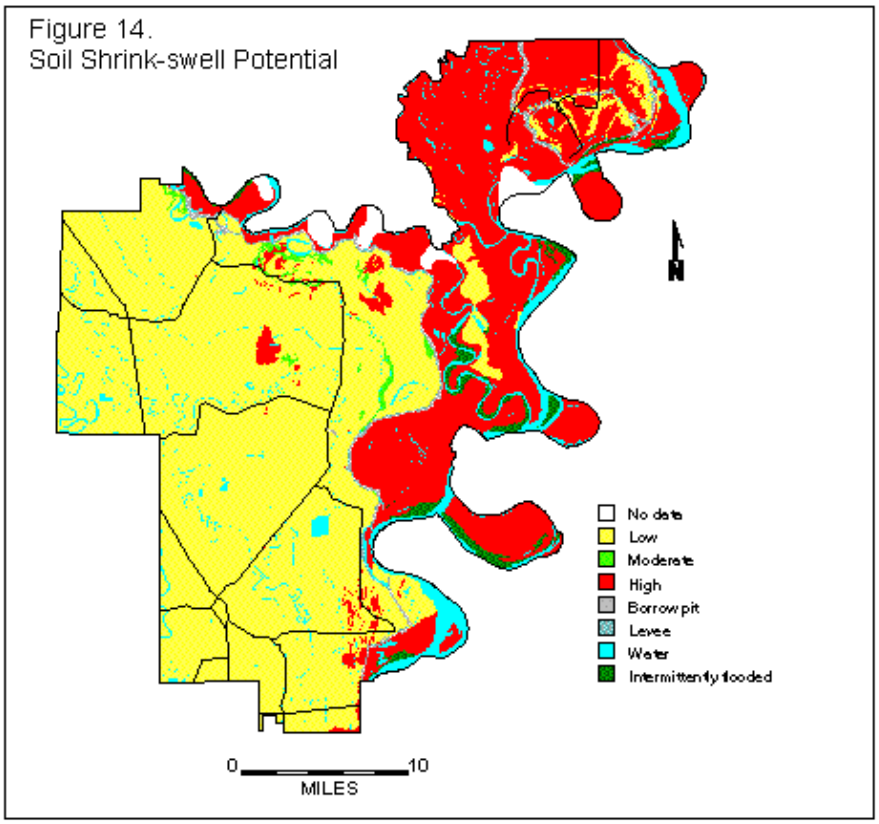


Table 12. Areal distribution of soil shrink-swell potential in Desha County.

Shrink-swell potential	acres	hectares	% cover
Low	300,028	121,420	58.12
Moderate	3,941	1,595	0.76
High	156,167	63,200	30.25
Borrow pit	5,635	2,280	1.09
Levee	3,827	1,549	0.74
Water	36,979	14,965	7.16
Intermittently flooded	9,659	3,909	1.88
TOTAL	516,236	208,918	100.00

Flood Frequency

Flooding refers to the temporary inundation by flowing water. The flood frequency of Desha County can be classified into three categories: none (no reasonable possibility), rare (1-5 times in 100 years) and frequent (> 50 times in 100 years). The northwestern and western part of Desha County show areas with a low possibility of flood, which comprises about 35% of the total area (Table 13). The central and north-central part of the county shows rare flood frequency and accounts for about 38% of the total area (Figure 15). Frequently flooded soils are found in the eastern part of the county and along the Lower Arkansas River and cover about 18% of the total area.

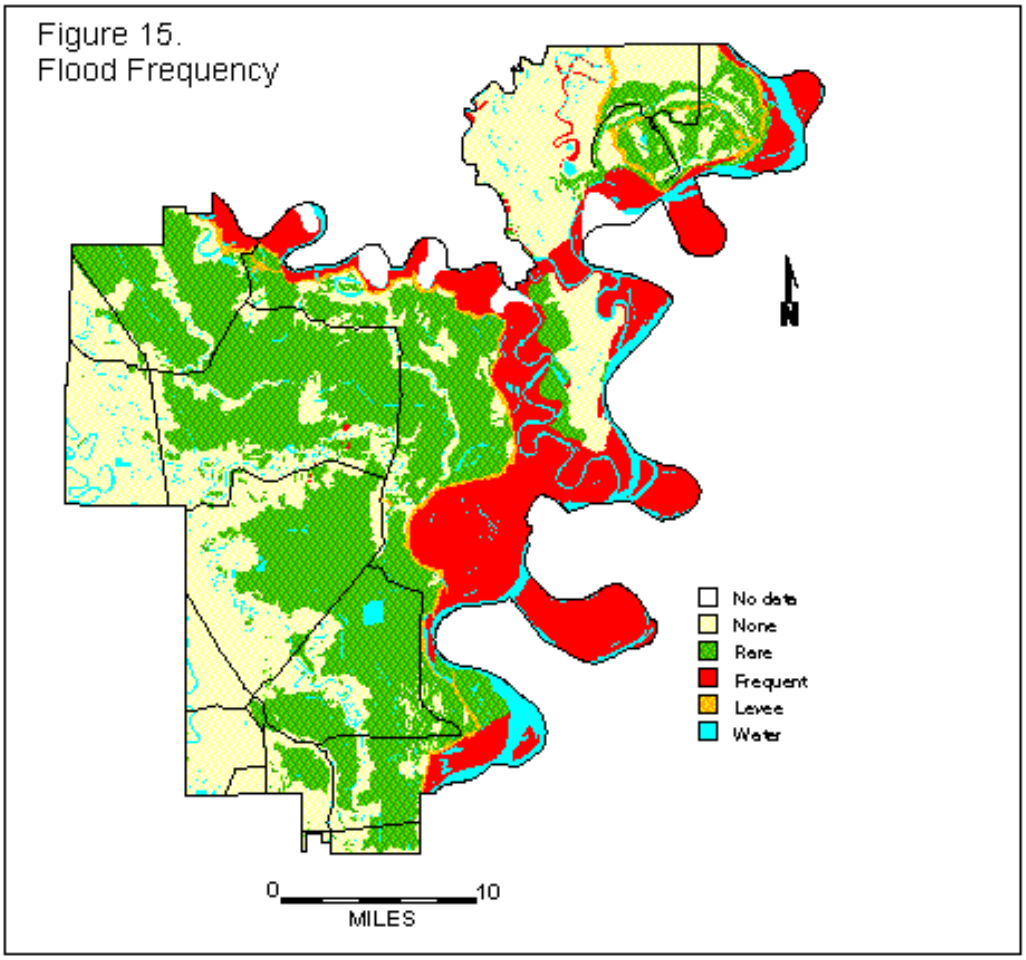


Table 13. Areal distribution of flood frequency in Desha County.

Flood frequency	acres	hectares	% cover
None	179,699	72,723	34.82
Rare	196,685	79,597	38.10
Frequent	93,411	37,804	18.09
Levee	9,462	3,829	1.83
Water	36,979	14,965	7.16
TOTAL	516,236	208,918	100.00

Soil Erodibility (K) Factor

The soil K factor is used in the Universal Soil Loss Equation (USLE) as a relative index of susceptibility of bare, cultivated soil to particle detachment and transport by rainfall. The higher the K factor, the greater the susceptibility of the soil to erosion. The tabular data by soil series were obtained from NRCS. Small patches of soil with a low K factor of 0.15 are found in the northern part of the county and occupy only 0.4% of the total area (Table 14). About 61% of Desha County has soils with a K factor of 0.32, which are found all over the county. Soils in the central part of the county tend to have a K value of 0.37, which covers 8% of the total area. A high K factor of 0.43 covers 20% of the total area and is found mainly in the western part of the county. Small patches of this highly erodible soil are also found in the northern and eastern part of the county (Figure 16).

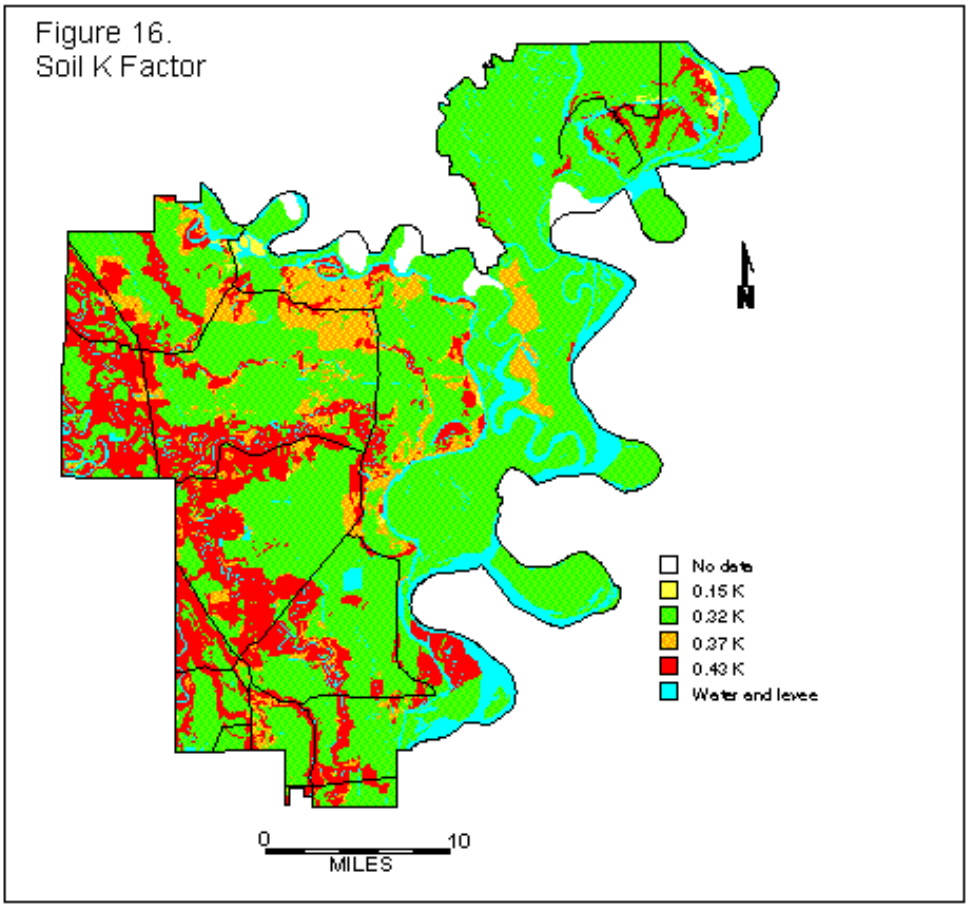


Table 14. Areal distribution of soil K factor in Desha County.

K Factor	acres	hectares	% cover
0.15	2,148	869	0.42
0.32	313,010	126,673	60.63
0.37	42,550	17,221	8.24
0.43	102,428	41,452	19.84
Water and Levee	56,100	22,703	10.87
TOTAL	516,236	208,918	100.00

Soil Tolerance (T) Factor

This is the soil loss tolerance, which can also be used with the USLE model. The data for T factor by soil series were obtained from NRCS. It is defined as the maximum rate of annual soil erosion that will permit crop productivity to be sustained economically and indefinitely. A T value of 5 tons/acre/yr covers almost all of Desha County with the exception of the areas along the streams and rivers (Table15 and Figure 17).

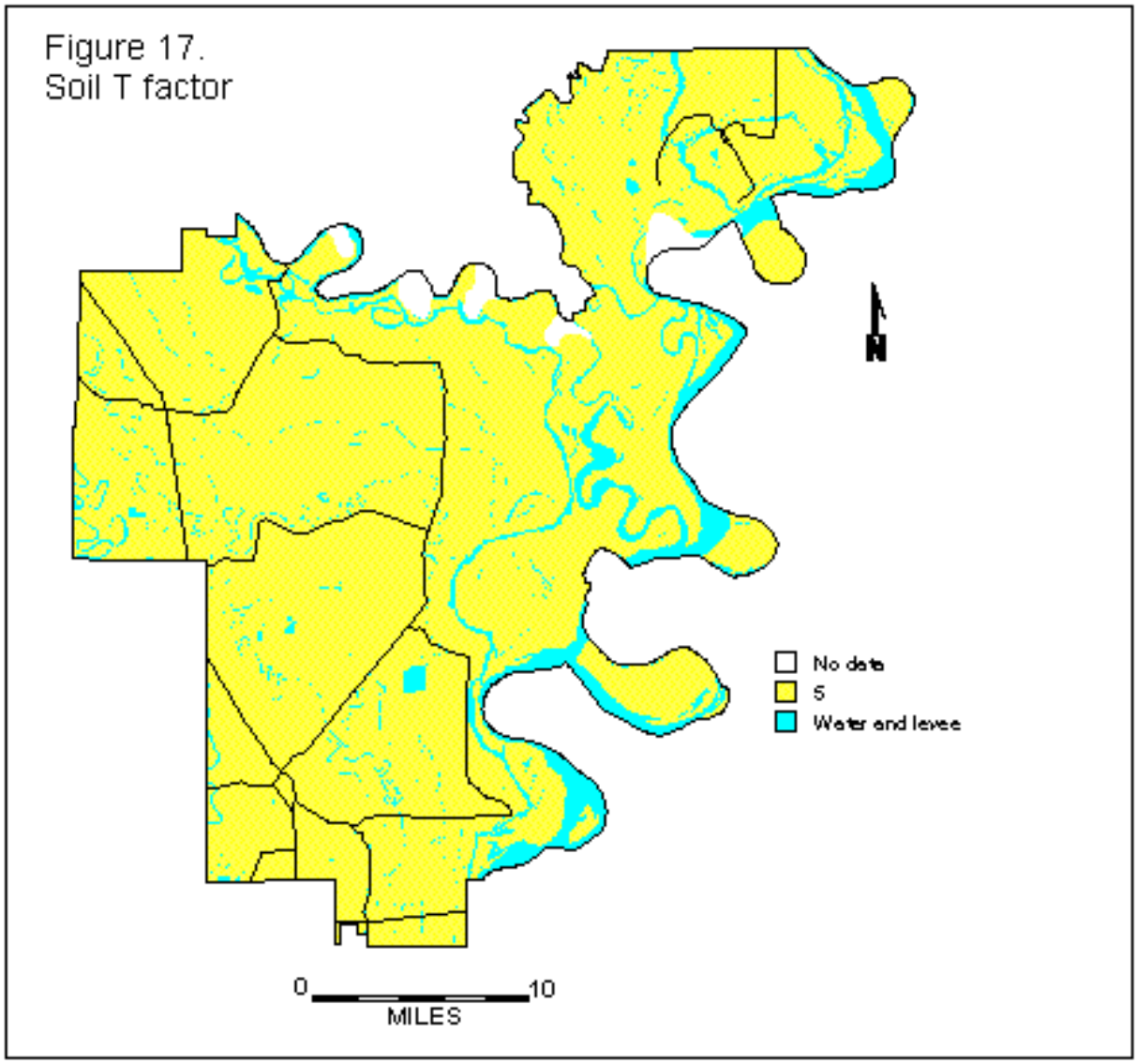


Table 15. Areal distribution of soil T factor in Desha County.

Description	acres	hectares	% cover
5 tons/acre/yr	460,121	186,209	89.13
Water and Levee	56,115	22,709	10.87
Total	516,236	208,918	100.00

Estimated Surface Soil Organic Matter

The presence of organic materials affects the structure and color of the soils as well as the retention of water, infiltration and inorganic and organic molecules such as nutrients and pesticides. The data were obtained from NRCS where organic matter was calculated on percent by weight basis. Surface organic matter contents in the range of 0.5 – 2% occur in the western part of Desha County and covers about 19% of the total area (Table 16). Soils with surface organic matter contents ranging between 1 – 3% are found in the northern part of the county and occupy only 2% of the total area. Approximately 61% of Desha County has soils with organic matter contents between 0.5 – 4.0%, which are found all over the county. The central part of the county has organic matter content of 1 – 4%, which covers 8% of the total area (Figure 18).

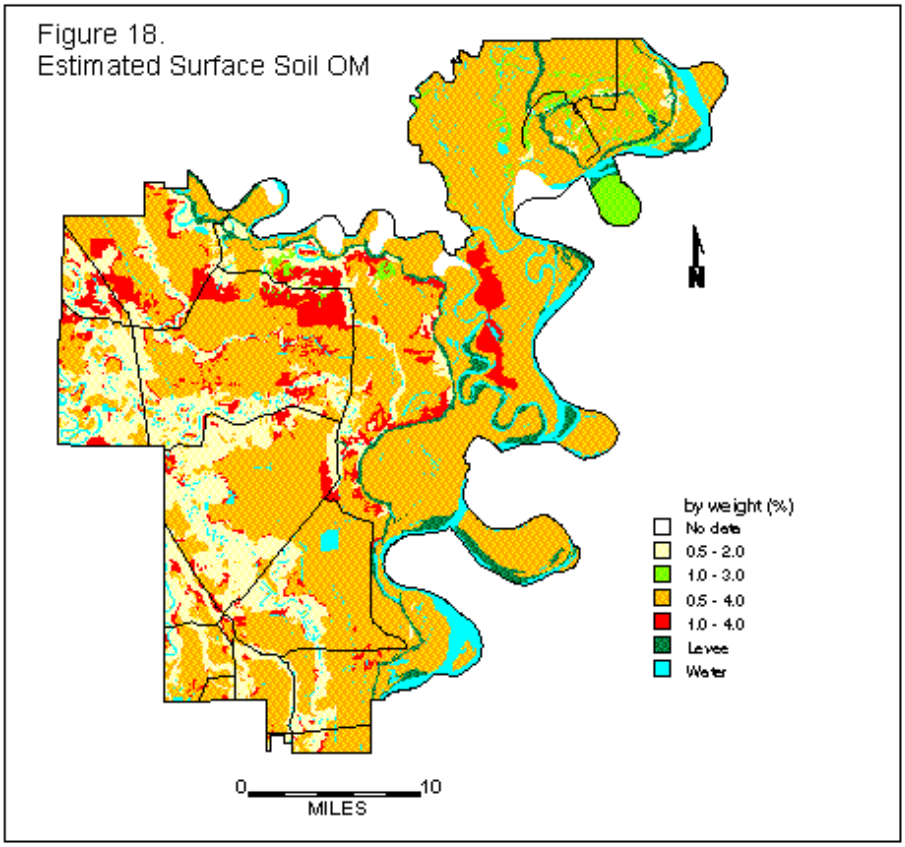


Table 16. Areal distribution of estimated surface soil organic matter (weight by %) in Desha County.

Organic matter	acres	hectares	% cover
0.5 – 2.0	95,734	38,743	18.54
1.0 – 3.0	10,308	4,172	2.01
0.5 – 4.0	315,045	127,498	61.03
1.0 – 4.0	39,048	15,802	7.56
Levee	19,122	7,738	3.70
Water	36,979	14,965	7.16
TOTAL	516,236	208,918	100.00

Depth to Bedrock

This refers to depth from the surface of the soil to fixed rock (in-place hard). The data were obtained from NRCS. All of the usable land area of Desha County is characterized by a depth to bedrock deeper than 60 in. (Table 17 and Figure 19). This is due to the extensive alluvial processes that were involved in the soil formation in this county.

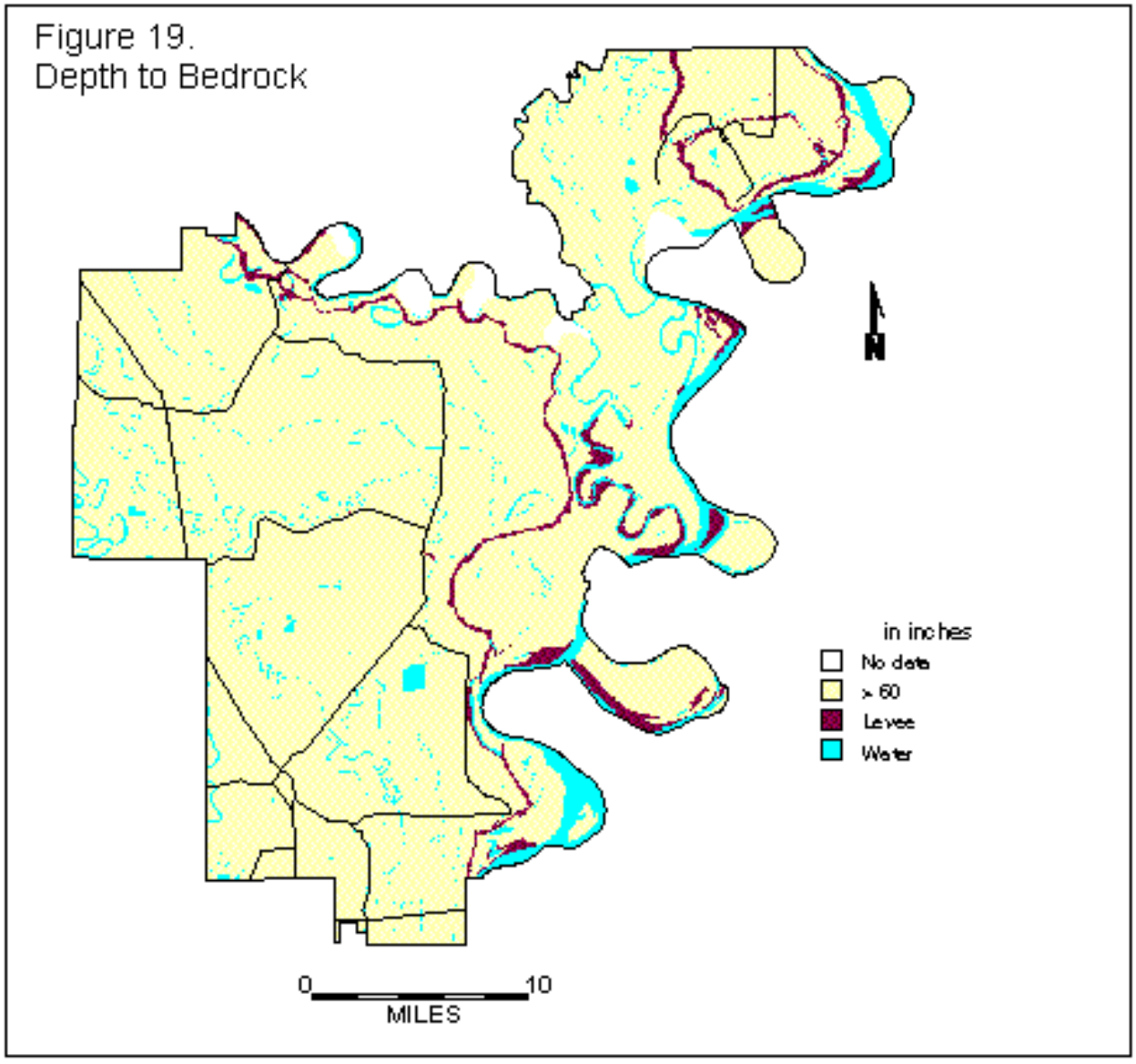


Table 17. Areal distribution of depth to bedrock in Desha County.

Depth to bedrock	acres	hectares	% cover
60 in. (1.52 m)	460,136	186,214	89.13
Levee	19,121	7,738	3.71
Water	36,979	14,966	7.16
TOTAL	516,236	208,918	100.00

Soil Slope

Land surface configuration includes soil slope. This indicates the slope of a soil component within a mapping unit. The slope data for each mapping unit were obtained from NRCS (Figure 20). Soils with a slope of 0-1% comprise almost 69% of Desha County and are found all over the county with the exception of the eastern part of the county (Table 18).

Soil slopes from 0 – 2% are found in the north-central part of the county, which covers only 0.28% of the total land. Soils in the eastern part of Desha County have slopes of 0-3% and covers about 18% of the total area.

The soil slope category of 1-3% covers 1.8% of the total area and is found in small patches in the northern and central part of the county. This soil slope category is also found along the stream beds in the western and central part of the county.

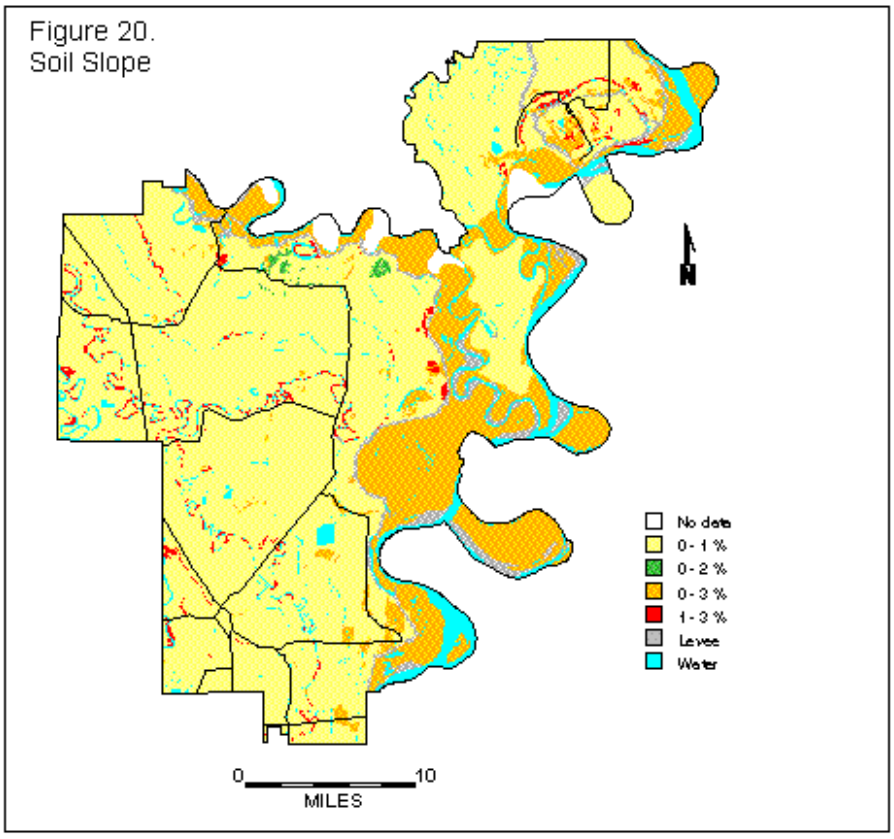


Table 18. Areal distribution of soil slope (in percent) in Desha County.

Soil slope	acres	hectares	% cover
0 – 1	355,217	143,754	68.81
0 – 2	1,423	576	0.28
0 – 3	94,146	38,101	18.24
1 – 3	9,350	3,784	1.81
Levee	19,121	7,738	3.70
Water	36,979	14,965	7.16
Total	515,236	208,918	100.00

Prime Farmland

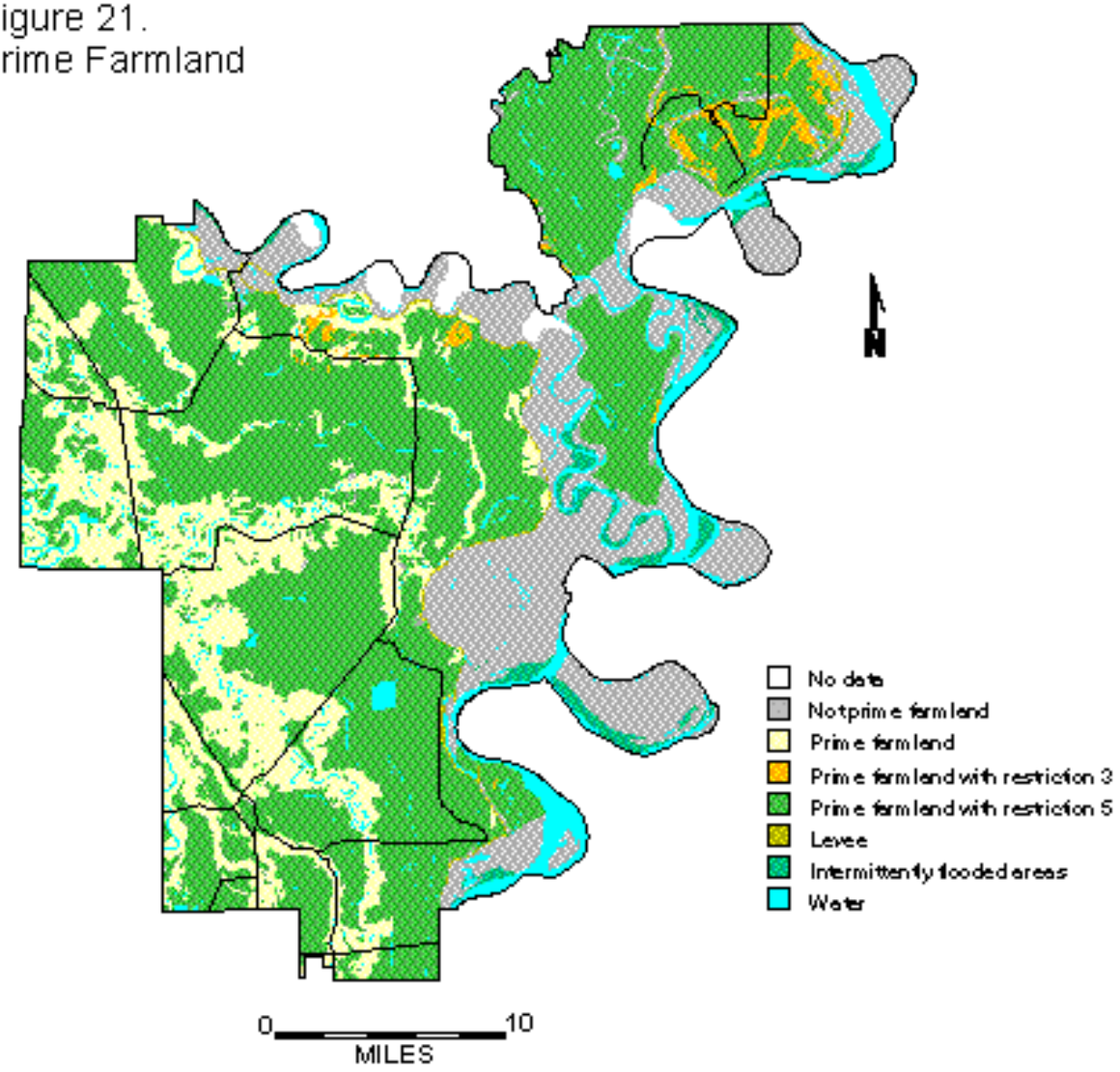
This is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops. It must be available for these uses. It has the soil quality, growing season and water supply needed to produce economically sustained high yields of crops when treated and managed according to acceptable farming methods, including water management. In general, prime farmlands have an adequate and dependable water supply from rainfall or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content and few or no rocks. They are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding (USDA, 1993).

The areal distribution of prime farmland in Desha County is presented in Table 19. Most of the prime farmland is found in the western part of the county (Figure 21). Prime farmland with restriction 3 is found in patches in the northern part of Desha County. Prime farmland with restriction 3 applies only to areas protected from flooding or not frequently flooded during the growing season. Most of the county (53%) has prime farmland with restriction 5, i.e., only drained areas that are either protected from flooding or not frequently flooded during the growing season are prime farmland.

Table 19. Areal distribution of prime farmland in Desha County.

Prime farmland	acres	hectares	% cover
Not prime farmland	91,534	37,043	17.73
Prime farmland	92,630	37,489	17.94
Prime farmland with restriction 3	7,180	2,906	1.39
Prime farmland with restriction 5	274,427	111,059	53.16
Levee	3,827	1,547	0.74
Intermittently flooded areas	9,659	3,909	1.88
Water	36,979	14,965	7.16
Total	516,236	208,918	100.00

Figure 21.
Prime Farmland



CONCLUDING REMARKS

This report has presented information on the amount and spatial distribution of soils in Desha County, Arkansas. Hard copy maps of natural resources such as soil were digitized to create the primary soil layer. Tabular summaries and maps were presented of the primary soil mapping units and several secondary attributes of soil in the county. These maps and tables showed that Desha County has a wide range of soil attributes, which affect the behavior of soils and potential uses of soils.

The spatial distribution of soils in this report is based on the intrinsic variability of soil properties. As a result of the activities and uses of soil by man (extrinsic variability), an on-site evaluation of these soil properties may differ slightly from the data presented in this report. This report can help, however, to analyze the relationship between landuse and soil properties, e.g., most of the deciduous forests occur in the eastern part of Desha County in areas with high flood frequency, high shrink-swell potential, tending toward neutral soils, slow runoff, low permeability and low soil slope. A majority of the agricultural land in Desha County is associated with low soil slopes and low shrink-swell potentials.

Different sources of information used in this study have different regional definition and masks, resulting in different total areal coverage between the maps, as seen in Tables 1 - 19. For example, the landuse data was classified from Thematic Mapper (TM) satellite imagery by the Center for Advanced Spatial Technologies (CAST), and the Hydrologic Units were obtained from the U.S. Geological Survey, Water Resource Division. Moreover, for certain maps borrow pit, levee and intermittently flooded areas are not used in calculating the total areal coverage; in these cases areal coverage is found to differ from the ones where borrow pit, levee and intermittently flooded areas were used in the calculation of areal coverage.

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APPENDIX A

RELATIONSHIP BETWEEN CURRENT LANDUSE, SOIL PROPERTIES

Coincidence reports tabulate the mutual occurrence of categories for two map layers with respect to one another. Map outputs are stated in acres. The body of the coincidence table is arranged in panels. The map layer with the most categories is arranged in the vertical axis of the table; the other is arranged along the horizontal axis. The last two columns reflect a cross total of each column for each row. The row at the bottom of the each column represents the sum of all the rows in the column. Data for landuse was obtained from a different source than the soils data. Thus the definition of county boundaries from landuse data do not match the soils data. This results in a category "0," which means no data. Therefore, coincidence tables with landuse information show a zero category. However, prime farmland and soils data have the same source; therefore, coincidence tables with prime farmland do not have a zero category.

Drainage and Landuse

The majority of the agricultural land coincides with poorly drained soils, followed by somewhat poorly drained soils. About 131,750 acres of poorly drained soils coincides with deciduous forest (Table 1). Most of the urban areas coincide with poorly drained soils.

Table 1. Mutual occurrence of drainage categories and landuse in acres.

	Landuse Categories*						
Drainage Categories	0	1	2	3	4	Rows with 0	Rows without 0
1 Poorly drained	4,872	131,751	200,497	1,271	11,990	350,382	345,510
2 Somewhat poorly drained	898	10,297	59,658	414	859	72,126	71,228
3 Well drained	1,060	2,910	30,860	202	448	35,480	34,420
4 Excessively drained	54	332	1,711	0	51	2,148	2,094
5 Others	699	6697	7336	0	4389	19,121	18422
6 Water	1,926	7,811	5,480	0	21,762	36,979	35,053
Total without 0	9,509	159,798	305,542	1,888	39,498	516,236	506,727

*0:No data, 1:Deciduous forest, 2:Agriculture, 3:Urban, 4:Water.

Drainage and Prime Farmland

The majority of prime farmlands coincide with poorly drained soils followed by well drained soils (Table 2). Prime farmland with restriction 3 coincides with somewhat poorly drained soils. Most of the non-prime farmlands coincide with poorly drained soils. The majority of the prime farmlands with restriction 5 coincide with poorly drained soils followed by somewhat poorly drained soils. Restriction 5 implies that only drained areas that are either protected from flooding or not frequently flooded during the growing season are prime farmland.

Table 2. Mutual occurrence of drainage categories and prime farmland in acres.

	Drainage Categories*						
Prime farmland Categories	1	2	3	4	5	6	Rows without 0
1 Not prime farmland	83,751	0	0	2,148	5,635	0	91,534
2 Prime farmland	38,778	18,372	35,480	0	0	0	92,630
3 Prime farmland with restriction 3	0	7,180	0	0	0	0	7,180
4 Prime farmland with restriction 5	227,852	46,575	0	0	0	0	274,427
5 Levee	0	0	0	0	3,827	0	3,827
6 Intermittently flooded areas	0	0	0	0	9,659	0	9,659
7 Water	0	0	0	0	0	36,979	36,979
Total without 0	350,382	72,126	35,480	2,148	19,121	36,979	516,326

* 0:No data, 1:Poorly drained, 2:Somewhat poorly drained, 3:Well drained, 4:Excessively drained, 5: Other; 6:Water.

Runoff and Landuse

Most of the agricultural land coincides with very slow runoff followed by slow runoff. Most of the urban land also coincides with very slow runoff areas. Most of the deciduous forests coincide with very slow runoff.

Table 3. Mutual occurrence of runoff categories and landuse in acres.

	Runoff Categories*				
Landuse Categories	1	2	3	4	Rows without 0
0 No data	3,672	3,062	150	2,625	9,509
1 Deciduous forest	133,284	8,080	3,927	14,508	159,798
2 Agriculture	188,993	87,438	16,295	12,816	305,542
3 Urban	1,033	833	22	0	1,888
4 Water	12,051	898	399	26,151	39,498
Total with 0	339,032	100,311	20,793	56,100	516,236
Total without 0	335,360	97,249	20,643	53,475	506,727

* 1:Very slow, 2:Slow, 3:Slow to medium, 4:Water.

Runoff and Prime Farmland

The majority of the prime farmlands with restriction 5 coincide with soils that have very slow runoff followed by soils with slow to medium runoff (Table 4). Restriction 5 implies that only drained areas that are either protected from flooding or not frequently flooded during the growing season are prime farmland. Most of the prime farmlands coincide with slow runoff. The majority of the prime farmlands with restriction 3 coincides with slow runoff category followed by slow to medium runoff category.

Table 4. Mutual occurrence of runoff categories and prime farmland in acres.

	Runoff Catgories*				
Prime Farmland Categories	1	2	3	4	Rows without 0
1 Not prime farmland	80,780	5,119	0	5,635	91,534
2 Prime farmland	0	85,203	7,426	0	92,630
3 Prime farmland with restriction 3	0	6,223	957	0	7,180
4 Prime farmland with restriction 5	258,252	3,765	12,410	0	274,427
5 Levee	0	0	0	3,827	3,827
6 Intermittently flooded areas	0	0	0	9,659	9,659
7 Water	0	0	0	36,979	36,979
Total without 0	339,032	100,311	20,793	56,100	516,236

* 1:Very slow, 2:Slow, 3:Slow to medium, 4:Water.

Potential Hydric Soils and Landuse

Most of the agricultural landuse of Desha County coincides with potential hydric soils as these areas have very slow runoff and poor drainage. Most of the deciduous forests are also found with potential hydric soils. The majority of urban land also coincides with potential hydric soils (Table 5).

Table 5 Mutual occurrence of potential hydric soils categories and landuse in acres.

	Potential Hydric Soils*				
Landuse Categories	1	2	3	4	Rows without 0
0 No data	6,591	293	699	1,926	9,509
1 Deciduous forest	102,705	42,585	6,697	7,811	159,798
2 Agriculture	265,748	26,978	7,336	5,480	305,542
3 Urban	1,865	24	0	0	1,888
4 Water	11,114	2,233	4,389	21,762	39,498
Total with 0	388,024	72,112	19,121	36,979	516,236
Total without 0	381,432	71,820	18,422	35,053	506,727

*1:Potential Hydric; 2:Not Hydric; 3:Others; 4:Water.

Potential Hydric Soils and Prime Farmland

The majority of the prime farmlands with restriction 5 coincide with potential hydric soils (Table 6). Restriction 5 implies that only drained areas that are either protected from flooding or not frequently flooded during the growing season are prime farmland. Most of the prime farmlands coincide with potential hydric soils. All of the prime farmlands with restriction 3 coincides with potential hydric soils.

Table 6. Mutual occurrence of potential hydric soils categories and prime farmland in acres

	Potential Hydric Soils*				
Prime Farmland Categories	1	2	3	4	Rows without 0
1 Not prime farmland	83,751	2,148	5,635	0	91534
2 Prime farmland	86,130	6,500	0	0	92630
3 Prime farmland with restriction 3	7,180	0	0	0	7,180
4 Prime farmland with restriction 5	210,963	63,465	0	0	274,427
5 Levee	0	0	3,827	0	3,827
6 Intermittently flooded areas	0	0	9,659	0	9,659
7 Water	0	0	0	36,979	36,979
Total without 0	388,024	72,112	19,121	36,979	516,236

*1:Potential Hydric; 2:Not Hydric; 3:Others; 4:Water.

Soil Permeability and Landuse

The majority of soils with 0.0 – 0.06 in./hr permeability coincides with agriculture followed by deciduous forest (Table 7). The majority of the soils with 0.6 – 2.0 in/hr permeability also coincide agriculture.

Table 7. Mutual occurrence of soil permeability categories and landuse in acres

	Landuse Categories*						
Permeability Categories	0	1	2	3	4	Rows with 0	Rows without 0
1 0.0 – 0.06 in./hr	3,346	129,355	159,907	941	11,932	305,482	302,136
2 0.0 – 0.2 in./hr	310	6,924	22,771	77	245	30,327	30,017
3 0.06 – 0.2 in./hr	13	1,256	7,982	0	60	9,310	9,297
4 0.2 – 2.0 in./hr	169	270	4,703	14	38	5,195	5,026
5 0.6 – 2.0 in./hr	2,992	7,153	95,652	856	1,022	107,674	104,682
6 6 – 20 in./hr	54	332	1,711	0	51	2,148	2,094
7 Other	699	6,697	7,336	0	4,389	19,121	18,422
8 Water	1,926	7,811	5,480	0	21,762	36,979	35,053
Total without 0	9,509	159,798	305,542	1,888	39,498	516,236	506,727

*0:No data, 1:Deciduous forest, 2:Agriculture, 3:Urban, 4:Water.

Soil Permeability and Prime Farmland

All of the prime farmland coincides with soil permeability of 0.6-2.0 in./hr soil permeability. Most of the non-prime farmland coincides with the permeability category of 0.0 – 0.06 in./hr. Most of the prime farmland with restriction 3 coincides with 0.6 – 2.0 in./hr followed by permeability of 0.06-0.2 in./hr. The majority of the prime farmland with restriction 5 coincides with permeability of 0.0 – 0.06 in./hr followed by 0.0 – 0.2 in./hr. About 9,288 acres of prime farmland with restriction 5 coincide with 0.6 – 2.0 in./hr permeability.

Table 8. Mutual occurrence of soil permeability categories and prime farmland in acres.

	Prime farmland Categories*							
Permeability Categories	1	2	3	4	5	6	7	Rows without 0
1 0 – 0.06 in./hr	83,751	0	0	221,731	0	0	0	305,482
2 0 – 0.2 in./hr	0	0	0	30,327	0	0	0	30,327
3 0.06 – 0.2 in./hr	0	0	1,423	7,887	0	0	0	9,310
4 0.2 – 2.0 in./hr	0	0	0	5195	0	0	0	5195
5 0.6 – 2.0 in./hr	0	92,630	5,756	9,288	0	0	0	107,674
6 6 – 20 in./hr	2,148	0	0	0	0	0	0	2,148
7 Other	5,635	0	0	0	3,827	9,659	0	19,121
8 Water	0	0	0	0	0	0	36,979	36,979
Total without 0	91,534	92,630	7,180	274427	3,827	9,659	36,979	516,236

* 1:Not prime farmland, 2:Prime farmland, 3:Prime farmland with restriction 3, 4:Prime farmland with restriction 5, 5:Levee, 6:Intermittently flooded areas, 7:Water.