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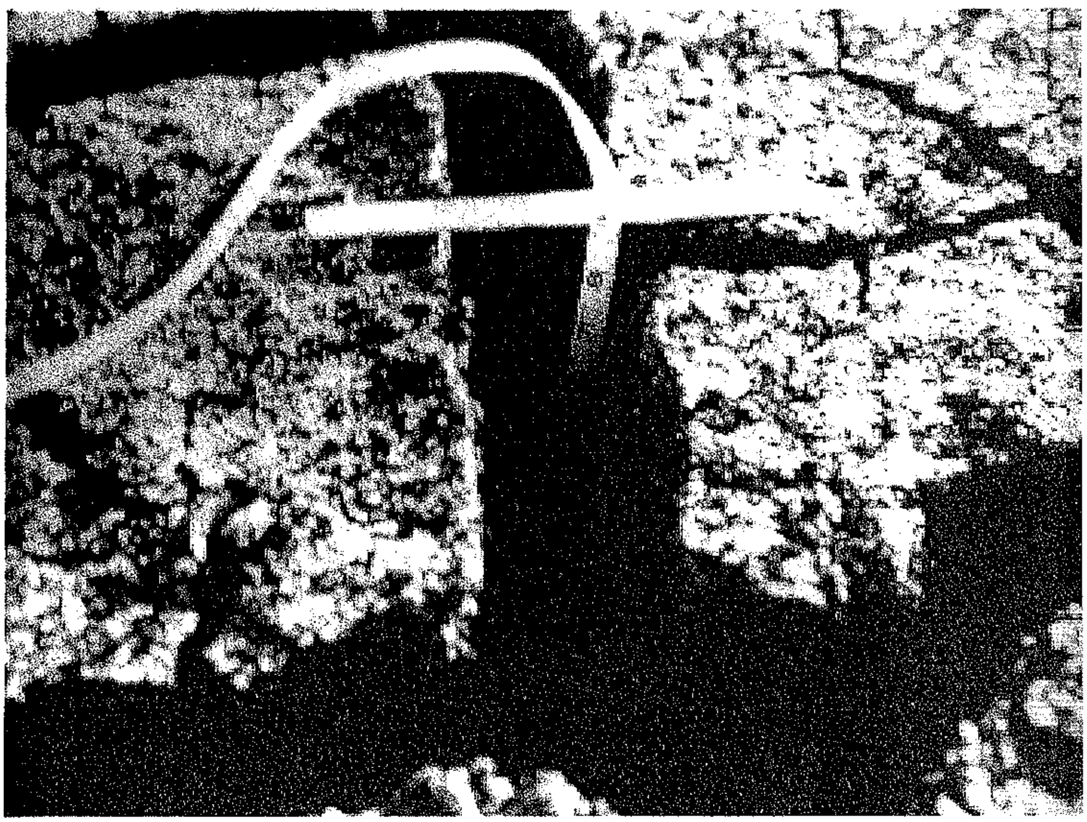
Expansive Soils in Mississippi



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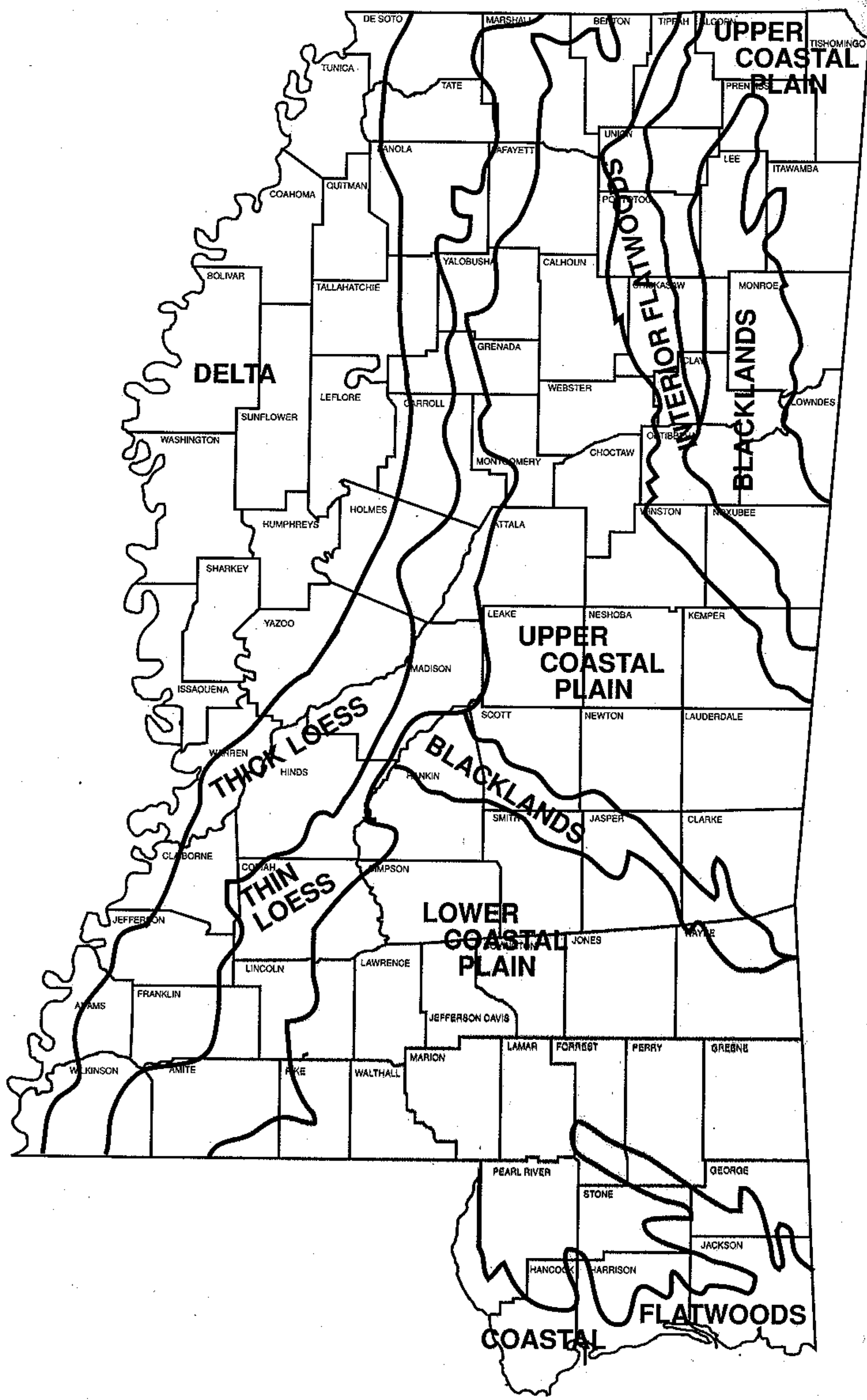

Figure 1. Soil resource areas of Mississippi

Expansive Soils of Mississippi

Introduction

Expansive soils in Mississippi were recognized in the mid-19th century by E. W. Hilgard (1860), who is acknowledged as one of the founders of soil science. He observed that certain clayey soils had a tendency to crack in dry seasons and form large surface cracks 2 to 3 inches wide, which were injurious to vegetation and buildings. Hilgard commented that most brick and stone buildings in Jackson, not secured by wall anchors or concrete foundations, developed cracks in all directions over time.

Expansive soils swell when wet and shrink when dry, causing major problems for foundations, roads, sidewalks, pipelines, excavations, and industrial and agricultural operations. Expansive soils are widely distributed in Mississippi, create severe economic damages, and pose a continued threat.

Various names have evolved to describe the expansive, clayey soils, including gumbo soils, buckshot soils, and black cotton soils. Expansive soils are commonly referred to as "self-mulching" because of movement of surface soil into the open cracks.

In some areas, the expansive soils have a characteristic topography. Hilgard (1860) referred to the surface topography in the prairie region of Smith County as "hogback" or "hogwallow" to describe the microrelief produced by the swelling soils. He proposed that the uneven, hummocky surface was due to the clayey soils bulging upward after soil material crumbled into open cracks preventing crack closure upon wetting.

Gilgai, an Australian Aborigine term referring to seasonal water accumulation in lower parts of microrelief forms, is currently used to describe the landscape microrelief (Prescott, 1931; USDA, 1975). Microhigh and microlow are terms also used to describe the microrelief of expansive soils (Bartelli and McCormack, 1976). Modern explanations of the microrelief (Lynn and Williams, 1992; Ahmad, 1983) differ little from Hilgard's proposal in 1860.

This bulletin describes the types, distribution, and extent of clayey, expansive soils in Mississippi and presents physical, chemical, and mineralogical data of representative soils.

Methods and Materials

Soils were considered expansive based on shrink-swell properties, classification, and severe/moderate limitations for dwellings with and without basements, small commercial buildings, roads, and streets. Data on the extent and types of expansive soils were obtained from published soil surveys and surveys in progress but not published, representing about 80% of the total state acreage. Representative expansive soils were selected after field transect investigations and auger surveys.

Soils were described and sampled in pits using standard methods (Soil Survey Staff, 1984). Samples taken for laboratory analysis were air-dried and sieved to remove coarse fragments. Particle size distribution was determined by the hydrometer method and sieving (Day, 1965). Soil pH was measured in a 1:1 soil/water suspension. Organic matter was determined by wet combustion (Peech et al., 1947). Extractable acidity was determined by the $BaCl_2$-triethanolamine method (Peech, 1965). Exchangeable cations were extracted by 1$\underline{M}$ NH_4OAC (pH 7.0) and determined by atomic absorption spectrophotometry. KCl-exchangeable Al was determined by the method of Yuan (1959).

Clay fractions of selected soils were separated by centrifugal sedimentation. They were analyzed by x-ray diffraction (Jackson, 1956) with a Norelco Geiger counter spectrophotometer using $C\mu$ $K\alpha$ radiation and a Ni filter. Mineral type and content were estimated from basal spacings and x-ray peak intensity. Microscopic examinations were made of soil peds using conventional light microscopy. Coefficient of linear extensibility (COLE) was determined on <2mm extruded soil paste (Schafer and Singer, 1976; Simon, et al., 1987) where

$$\text{COLE} = \frac{\text{length wet} - \text{length dry.}}{\text{length dry}}$$

Results and Discussion

Occurrence and Extent

Expansive, clayey soils occur in all major soil resource areas of the state (Figure 1) and comprise more than 18% of the total state acreage (Table 1). The largest acreage of expansive soils occurs in the Delta (Southern Mississippi Valley Alluvium) and Blackland Prairie regions of the state (Table 1). These two regions contain about 72% of the expansive soil acreage in the state.

Clayey soils comprise the dominant acreage in the Delta counties. For example, expansive soils comprise more than 83% of Sharkey County. In contrast, expan-

Table 2. Soil series, classification, and approximate acreage of expansive soils of Mississippi.

Series	Classification	Approximate Acreage
	Blackland Prairie	
Brooksville	fine, montmorillonitic, thermic Aquic Chromuderts	56,123
Catalpa	fine, montmorillonitic, thermic Fluvaquentic Hapludolls	57,554
Eutaw	very-fine, montmorillonitic, thermic Entic Pelluderts	10,966
Louin	fine, montmorillonitic, thermic Aquentic Chromuderts	15,883
Griffith	fine, montmorillonitic, thermic Vertic Haplaquolls	18,994
Houlka	fine, montmorillonitic, acid, thermic Vertic Haplaquepts	18,902
Houston	very-fine, montmorillonitic, thermic Typic Chromuderts	34,324
Kipling	fine, montmorillonitic, thermic, Vertic Hapludalfs	212,980
Leeper	fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts	176,464
Okolona	fine, montmorillonitic, thermic Typic Chromuderts	49,373
Oktibbeha	very-fine, montmorillonitic, thermic Vertic Hapludalfs	109,162
Pelahatchie	fine-silty, mixed, thermic Aquic Hapludalfs	4,466
Sessums	fine, montmorillonitic, thermic Vertic Ochraqualfs	9,892
Sumter	fine-silty, carbonatic, thermic Rendollic Eutrochrepts	79,783
Tuscumbia	fine, mixed, nonacid, thermic Vertic Haplaquepts	10,414
Una	fine, mixed, acid, thermic Typic Haplaquepts	14,648
Urbo	fine, mixed, acid, thermic, Aeric Haplaquepts	105,874
Vaiden	very-fine, montmorillonitic, thermic Vertic Hapludalfs	221,554
	Interior Flatwoods	
Falkner	fine-silty, siliceous, thermic Aquic Paleudalfs	187,175
Mayhew	fine-montmorillonitic, thermic Vertic Ochraqualfs	34,181
Wilcox	fine, montmorillonitic, thermic Vertic Hapludalfs	108,608
	Delta	
Alligator	very-fine, montmorillonitic, acid, thermic Vertic Haplaquepts	650,356
Bowdre	clayey over loamy, montmorillonitic, thermic Fluvaquentic Hapludolls	32,273
Dowling	very-fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts	537,257
Forestdale	fine, montmorillonitic, thermic Typic Ochraqualfs	454,948
Sharkey	very-fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts	862,093
Tunica	clayey over loamy, montmorillonitic, nonacid, thermic Vertic Haplaquepts	123,019
Tensas	fine, montmorillonitic, thermic Vertic Ochraqualfs	20,800
	Coastal Plain (Upper and Lower)	
Arundel	clayey, montmorillonitic, thermic Typic Hapludults	41,922
Boswell	fine, mixed, thermic Vertic Paleudalfs	62,379
Cadeville	fine, mixed, thermic Albaquic Hapludalfs	55,312
Chastain	fine, mixed, acid, thermic Typic Fluvaquents	33,766
Falkner	fine-silty, siliceous, thermic Aquic Paleudalfs	187,175
Freest	fine-loamy, siliceous, thermic Aquic Paleudalfs	54,548
Kisatchie	fine, montmorillonitic, thermic Typic Hapludalfs	3,575
Leaf	clayey, mixed, thermic Typic Albaquults	37,080
Maben	fine, mixed, thermic Ultic Hapludalfs	98,559
Petal	fine-loamy, siliceous, thermic Typic Paleudalfs	54,227
Siwell	fine-silty, mixed, thermic Typic Hapludalfs	12,542
Susquehanna	fine, montmorillonitic, thermic Vertic Paleudalfs	192,597
	Loess (Thick and Thin)	
Byram	fine-silty, mixed, thermic Typic Fragiudalfs	29,065
Kolin	fine-silty, siliceous, thermic Glossaquic Paleudalfs	81,973
Lorman	fine, montmorillonitic, thermic Vertic Hapludalfs	107,220
Siwell	fine-silty, mixed, thermic Typic Hapludalfs	12,542
Tippah	fine-silty, mixed, thermic Aquic Paleudalfs	210,852

Table 1. Approximate acreage of expansive soils in soil resource areas of Mississippi.

Soil Resource Area	Extent*	Proportion of State
	Acres	%
Delta	2,668,046	8.8
Blackland Prairie	1,207,356	4.0
Coastal Plain	833,682	2.8
Interior Flatwoods	329,964	1.1
Loess	391,152	1.3
TOTALS	5,430,200	18.0

*Based on soil surveys completed 1/92.

sive soils comprise about 50% of Noxubee County, 10% of Forrest County, and 1% of Hancock County.

Forty-five soil series comprise most of the expansive soils in Mississippi (Table 2). Sharkey, Alligator, Dowling, and Forestdale are the most extensive expansive soils mapped in the state.

Swelling soils in the state have been classified into six orders of Soil Taxonomy (Table 3). The largest acreage has been classified as Inceptisols and Alfisols. Although the Vertisol Order represents clayey, expansive soils with shrinking and swelling properties, only about 3% of the expansive soils in the state have been classified as Vertisols. Recent research indicates a large acreage of soils previously classified as Inceptisols and Alfisols should be reclassified as Vertisols.

Depth to expansive clay horizons is variable and horizon thickness is also variable. The swelling clay may occur at the surface and/or in the subsoil. For example, Bowdre soils in the Delta have up to 20 inches of expansive clay overlying loamy material; and Tunica soils have 20 to 36 inches of clay over nonswelling, loamy substratum. In contrast, Alligator, Sharkey, and Dowling soils may have expansive clay extending from the surface to depths of 6 feet and greater.

Soils of the Blackland Prairie in the northeastern part of the state are usually underlain by firm chalk at depths of 5 to 6 feet, except for the Sumter soil, which has chalk within 20 to 40 inches. In contrast, soils of the Blackland Prairie in the east central part of the state, commonly known as the Jackson Prairie, are underlain by expansive, calcareous clay ranging in depth from a few feet to more than 500 feet. Soils of the Blackland Prairies have neutral/calcareous and extremely acid expansive clays overlying chalk and calcareous clays. The soils with acid clays are commonly referred to as the "Post Oak Prairie."

The thickness of stable nonexpanding soil overlying expansive clay is an important consideration in road construction, building foundations, and domestic waste disposal. Soils like Byram, Siwell, and Kolin have loamy horizons underlain by expansive clay below depths of 20 to 40 inches. Equally important is the thickness of expansive clay over underlying stable rocks. Expansive Arundel and Kisatchie soils are underlain by rock at depths of 20 to 40 inches.

Recognition that expansive clay soils occur adjacent to and intermingled with stable loamy soils in the Coastal Plain is important. Sharp boundaries may occur between stable and expansive soils with little or no topographic indication. Expansive Boswell and Susquehanna soils commonly occur adjacent to stable loamy soils in the Coastal Plain uplands. Failure to recognize the boundaries may result in building foundations being placed on both stable and expansive soils with resultant severe structural damage. Soil maps and on-site investigations can be used to identify expansive soils.

Table 3. Acreage and extent of Mississippi expansive, clayey soils in the different orders of soil taxonomy.*

Soil Order	Acreage	Percentage of Expansive Soils
Inceptisols	2,578,810	47.49
Alfisols	2,446,767	45.06
Vertisols	166,669	3.07
Mollisols	108,821	2.00
Ultisols	108,067	1.99
Entisols	33,766	0.62

*Based upon 80% completion of soil survey of the state.

Soil Swelling

Soil swelling occurs when clayey soils absorb water. If soil moisture is unchanged, the soil volume does not change. Very dry clayey soils with water contents less than 15% easily absorb water and swell (Chen, 1975), and most soil expansion usually has occurred at 30% moisture content. Soil moisture is a function of depth. Allen and Braud (1966) reported most soil water change occurs in the upper 8 inches of the soil. Our research on swelling soils indicates about 80% of the soil moisture variation occurs in the surface 20 inches. Cheng (1991) determined that expansive Okolona and Vaiden soils in Monroe County swelled in winter and shrank in mid-spring and summer. He reported the greatest vertical movement occurred in the upper 20 inches with a maximum of 1.1 inches in Okolona and 0.96 inch in Vaiden.

A common method of estimating swelling potential in soils is the coefficient of linear extensibility (COLE). This parameter is used to classify soils in Soil Taxonomy (Soil Survey Staff, 1975). Clayey soils with COLE values of 0.09 and greater are considered expansive and may be classified as Vertisols or in Vertic subgroups of other orders. These soils usually have severe limitations for buildings, roads, and founda-

Table 4. Coefficient of Linear Extensibility (COLE) of selected horizons of representative expansive soils.

Soil Series	Horizon	Depth (in.)	COLE*
Alligator	A	0-5	0.22 ± 0.008**
Alligator	Bgss1	21-40	0.19 ± 0.009
Mayhew	Bgss	20-30	0.18 ± 0.018
Okolona	A	0-5	0.16 ± 0.009
Okolona	Bwss1	21-46	0.15 ± 0.009
Pelahatchie	Bt2	21-29	0.17 ± 0.02
Pelahatchie	Bt3	29-43	0.21 ± 0.001
Petal	Bt	48-60	0.11 ± 0.001
Sharkey	Bgss1	9-19	0.19 ± 0.001
Sharkey	Bgss2	19-40	0.17 ± 0.02
Susquehanna	Btg2	27-42	0.18 ± 0.007
Vaiden	Bt1	4-14	0.14 ± 0.013
Vaiden	Btss2	56-69	0.21 ± 0.014
Wilcox	Bt4	20-35	0.18 ± 0.017
Wilcox	Cg	35-60	0.18 ± 0.016

*Means of 10 replications
**Standard deviation

tions because of the high shrink-swell characteristics. COLE is a reliable estimate of potential volume change. However, actual soil volume change in the field also depends upon external factors such as weather, drainage, crops, and land use (Bronswijk, 1989). COLE values for selected horizons of representative expansive soils are presented in Table 4. The COLE data are similar to values for similar soils reported in Alabama (Karathanasis and Hajek, 1985).

Soil Cracking

Expansive, clayey soils crack upon drying as the volume of soil aggregates decrease. Research indicates the size and extent of cracks vary with clay content and mineralogy, soil moisture fluctuations, absorbed cations, precipitation, vegetation, and land use (Smith et al., 1985; Reeve et al., 1980; Franzmeier and Ross, 1968). Cracks that extend from the surface provide for rapid free water movement into the subsoil. Allen and Braud (1966) reported the effect of cracks on infiltration continued after the cracks appeared to swell shut. Vertical free water movement along cracks in unsaturated soil has been described as channeling (Beven, 1981), short-circuiting (Bouma et al., 1981), and bypass flow (Smettem and Trudgill, 1983).

Rain and irrigation waters containing fertilizers can penetrate the subsoil by flowing through the cracks resulting in drought damage and possible nutrient deficiency (Bouma and Dekker, 1978; Germann et al., 1984). Cracks also provide access for herbicides, insecticides, and other pollutants to move deep into the soil in solution or by transport with surface soil (Bouma and Loveday, 1988; Southard and Graham, 1992). The movement of solutes in cracks may impact groundwater (Bronswijk, 1989; Thomas and Phillips, 1979; Coles and Trudgill, 1985). Research on cracking Vertisols in California detected herbicides at depths 50 inches below open cracks (Graham et al., 1992).

Figure 2. Surface crack research plot (11 ft^2) in an Alligator clay soil in Leflore County.

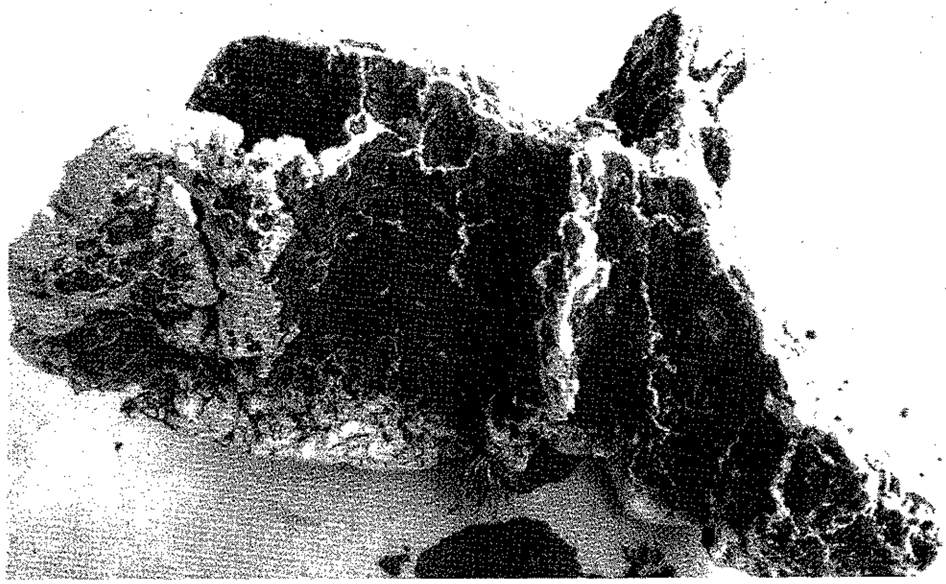

Figure 3. Polyurethane mold of cracks in the Okolona clay soil in Monroe County.

A persistent question that arises concerning soil cracks is whether or not they occur at the same place each year. Several researchers reported that cracks redevelop in the same place after each wetting and drying cycle (Blokhuis et al., 1964; Yong and Warkentin, 1975). Sleeman (1963) and Ahmad (1983) suggested cracks form a semi-permanent pattern, which depends on clay orientation and land use. Komas et al. (1991) determined that cracks conducting bypass water form a semi-permanent network of polygons on the soil surface. They determined the sizes of the polygons increase curvilinearly with clay content.

We measured the width and depth of surface cracks of a typical Alligator clay soil for 3 years in a plot of 11 square feet (Figure 2). We traced the cracks on plastic overlay each year and measured the location and volume of cracks. The major cracks (maximum width and depth) occurred at the same location each year. The surface area comprised by the cracks ranged from 12.2 to 23.4% of the plot over the 3-year period (Table 5). There was little variation in the maximum crack width and depth. Wider cracks extended deeper than smaller cracks. Soil moisture contents showed a horizontal and vertical gradient from the exposed crack surface. Average soil moisture increased from 20.8% at the surface crack face to 21.8% directly inside the ped. The crack interface vertical soil moisture gradient increased from 20.8% at the surface to 24.6% at a depth of 12 inches. Surface cracks developed and were evident at soil moisture contents of 28%.

In a related study (Cheng, 1991) of Okolona and Vaiden soils in Monroe County over a 2-year period, maximum cracks were 2.3 inches wide and 24.4 inches deep in Okolona, and 1 inch wide and 20 inches deep in Vaiden.

It is very difficult to accurately measure crack depth because of the circuitous path of the cracks. We determined that measurements from the surface with a metal tape greatly underestimated the maximum crack depth based on subsequent determination from freshly excavated pits in Alligator, Sharkey, Okolona, and Vaiden soils.

We found that crack depth, width, orientation, and volume can be accurately determined by injecting expanding polyurethane into cracks under nitrogen pressure and allowing it to expand and harden before excavating. The three-dimensional excavated mold of the crack system (Figure 3) can be immersed in water to obtain crack volume by water displacement. This technique revealed that many cracks occur in the subsoil that are not visible at the surface. The larger cracks appear to be associated with planar surfaces of prismatic structural units, which were commonly expressed at the surface as a polygonal pattern.

Table 5. Width, depth, and areal extent of soil cracks in Alligator Clay in Leflore County over a 3-year period.

	Maximum Crack		
Year	Width	Depth	Area
	------ inches ------		%
1987	2.8	26	12.2
1988	3.0	26	23.4
1989	2.9	27	19.2

Landscape Relationships

Expansive soils occur on floodplains, terraces, upland ridges, and sideslopes. The dominant acreage occurs on Mississippi River floodplains and terraces with nearly level topography and slope gradients of 0 to 2%. Most of the acreage of expansive soils has nearly level slopes of 0 to 2%. The Delta soils are mapped in very large delineations. Runoff is very slow because of the nearly level slopes and the poorly defined drainage pattern. The acid, clayey soils comprising the "Post Oak" portions of the Blackland Prairies, including Kipling and Oktibbeha soils, have slopes ranging from 0 to 40%. In contrast, Brooksville, Okolona, and Eutaw soils of the Prairie region have slopes similar to the Delta soils.

Expansive soils in the loessial and coastal plain regions occur on steeper, dissected landscapes with slopes ranging to 40%. Surface drainage is well defined on these steeper soils. The expansive soils on steep slopes have limitations due to the high shrink-swell properties and they are prone to mass movement. Maben soils with slopes greater than 25% are prone to landslides (Pettry et al., 1988).

Morphology

The dominant acreage of clayey, expansive soils (Delta and Blackland Prairie regions) have ochric epipedons and cambic subsurface horizons, except Boudre, Catalpa, and Okolona soils, which have mollic epipedons. The acid, clayey soils of the "Post Oak Prairie," and the expansive soils of the Loessial, Interior Flatwoods, and Coastal Plain regions exhibit greater pedogenic development with ochric epipedons and subsurface argillic horizons.

Subsurface horizons typically have stress surfaces on faces of peds in the upper profile, which grade to slickensides in the lower subsoil. Stress surfaces result from shrink-swell action of expanding clay. Slickensides are shear planes caused by soil movement in the profile that creates smooth, slick, shiny planar surfaces. The slickensides are more extensive and better developed in the lower subsoils, and they commonly exhibit a "tongue and groove" or "corrugated" form (Figure 4). The slickensides commonly intersect and they are usually inclined 10° to 40° from the horizontal (Figure 5). We measured slickensides that were 10 feet long and 8 inches wide in Okolona soils in Monroe County. Typically, the slickensides occur deeper in soils with argillic horizons such as Vaiden, Kipling, and Oktibbeha. Research elsewhere indicates slickensides occur below the depth of cracking and at the seasonal wetting depth, with an optimum depth of 150 to 200 cm (Yaalon and Kalmar, 1978). We traced large "corrugated" slickensides to depths of 120 inches and contact with underlying chalk in Vaiden soils in Monroe County. The angle of inclination of the underlying chalk appeared to influence the slickenside inclination.

Mineralogy

The expansive soils formed in a variety of parent materials including Selma chalk, Yazoo clay, Tallahatta siltstone, and alluvial and marine clayey sediments. Soils inherited their textural characteristics and mineralogy from the parent materials. The clay fractions do not contain a discrete mineral suite, but a mixture of different phyllosilicates in varying proportions with montmorillonite a dominant mineral. Typically, the clay fractions have montmorillonite > kaolinite > interlayer vermiculite > illite >

Figure 4. Well-developed tongue and groove slickenside from Btss horizon in a Vaiden silty clay loam soil in Monroe County.

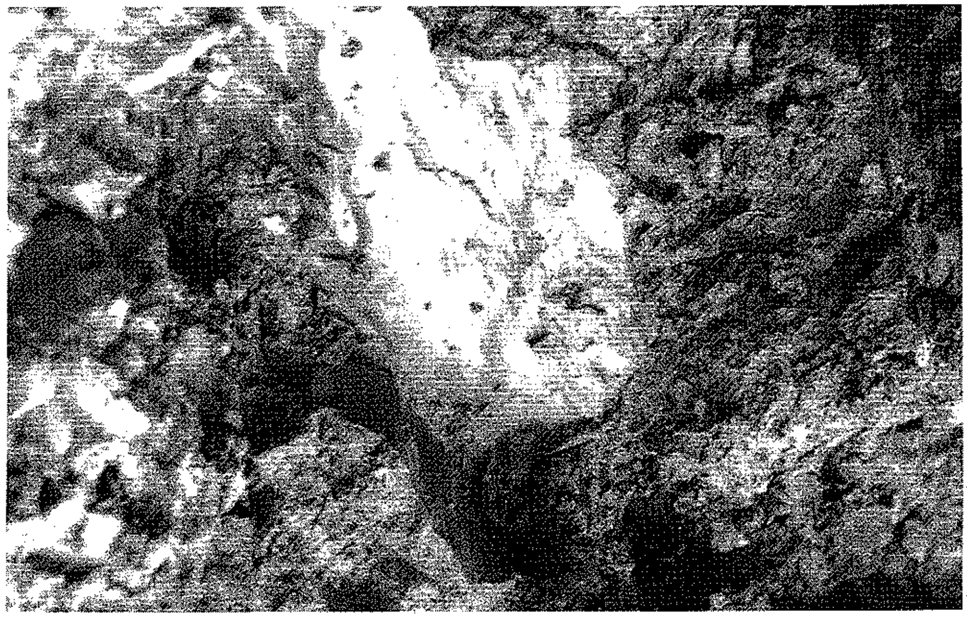

Figure 5. Intersecting slickensides in Okolona clay subsoil.

quartz. The shrinking and swelling are primarily due to the montmorillonitic clay.

We detected no differences in shrink-swell characteristics between acid and neutral clays. The Al-hydroxy-interlayering in the acid clays does not appear to inhibit expansion as postulated by Franzmeier and Ross (1968). Karathanasis and Hajek (1985) also found no Al-interlayer induced swelling reduction in expansive soils in Alabama.

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APPENDIX

Soil Data Tables
(Tables 6-24)

Units and Conventions Used in Soil Data Tables

(Tables 6-24)

The units used in this publication are the same used in published soil survey reports in Mississippi.

Particle Size Distribution

VCS = very coarse sand (2-1 mm)
CS = coarse sand (1-0.5 mm)
MS = medium sand (0.5 - 0.25 mm)
FS = fine sand (0.5 - 0.25 mm)
VFS = very fine sand (0.10-0.05 mm)
SI = silt (0.05 - 0.002 mm)
C = clay (< 0.002 mm)

Clay Minerals

M = montmorillonite; K = kaolinite; I = Illite; V = hydroxy interlayered vermiculite; Q = quartz; F = feldspar; Cr = cristobolite. Abundance: 1 is > 50%; 2 is 20 to 50%; 3 is 10 to 20%; and 4 is < 10%.

Unit Conversions

U.S. Abbr.	Unit	Approximate Metric Equivalent
Length		
in	inch	2.54 centimeters (cm)
ft	foot	30.48 centimeters (cm)
Mass/Weight		
0z	ounce	28.349 grams (g)
Concentration		
meq/100g	milliequivalents per 100 grams	centimole per kilogram (cmole kg^{-1})

Soil Horizon Symbols

Master Horizons

A = Mineral horizons which have formed at the surface.
E = Mineral horizons which have lost silicate clay, iron, or aluminum, leaving a concentration of sand and silt particles.
B = Mineral horizons which have formed below A or E horizons which have illuvial concentrations of silicate clay, iron, aluminum, humus, carbonates, gypsum, or silica alone or in combination.
C = Horizons or layers, excluding hard bedrock, that are little affected by pedogenic processes.
R = Hard bedrock

Subordinate Distinctions within Master Horizons

g = Strong gleying
k = Accumulation of carbonates
p = Tillage or other disturbance
r = Weathered or soft bedrock
ss = Presence of slickensides
t = Accumulation of silicate clay
w = Development of color or structure

Discontinuities

2 = Arabic numerals are used as prefixes to horizon designations (preceding A, E, B, C, R) to indicate discontinuities.

Table 6. Soil series: ALLIGATOR. Location: Leflore County, Mississippi.

Physical Data

Horizon	Depth	VCS	CS	MS	FS	VFS	S	Si	C	Textural Class
				Particle Size Distribution						
	inches	%								
Ap	0-5	1.2	0.4	0.4	0.6	1.1	3.7	28.6	67.7	Clay
Bg1	5-21	0.2	0.1	0.1	0.1	0.8	1.3	15.7	83.0	Clay
Bgss1	21-40	0.0	0.1	0.1	0.1	0.8	1.1	14.7	84.2	Clay
Bgss2	40-50	0.0	0.0	0.1	0.3	2.3	2.7	14.6	82.7	Clay
Cg1	50-60	0.0	0.1	1.3	1.3	2.7	5.4	17.7	76.9	Clay
Cg2	60-70	0.1	0.1	0.1	0.5	5.1	5.9	23.5	70.6	Clay

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
Ap	0-5	4.7	6.0	2.8	5.3	1.7
Bg1	5-21	4.7	1.4	4.6	8.4	1.1
Bss1	21-40	4.6	0.9	3.3	5.8	0.8
Bss2	40-50	6.7	0.4	0.0	0.0	0.6
Cg1	50-60	7.0	0.4	0.0	0.0	1.9
Cg2	60-70	7.6	0.3	0.0	0.0	0.6

Horizon	Depth	Ca	Mg	K	Na	Extractable Acidity	Cation Exchange Capacity	Base Saturation
		Exchangeable Cation						
	inches	meq/100g						%
Ap	0-5	18.6	10.5	0.7	0.3	22.6	52.7	57.1
Bg1	5-21	19.8	17.2	0.6	0.9	15.9	54.4	70.7
Bss1	21-40	18.8	21.7	0.6	1.9	13.5	56.5	76.1
Bss2	40-50	18.7	29.4	0.6	4.6	3.4	56.7	94.0
Cg1	50-60	53.9	28.2	0.5	4.2	2.7	89.5	96.9
Cg2	60-70	18.4	27.2	0.5	4.5	2.5	53.1	95.3

Mineralogical Data

Horizon	Depth	Clay Minerals
	inches	
Bg1	5-21	M_1 K_2 I_4 V_4 F_4 Q_4
Bg2	21-40	M_1 K_3 I_4 F_4 Q_4

Table 7. Soil series: ARUNDEL. Location: Lauderdale County, Mississippi.

Physical Data

Horizon	Depth	VCS	CS	MS	FS	VFS	S	Si	C	Textural Class
				Particle Size Distribution						
	inches	%								
A	0-4	1.7	2.8	6.4	32.9	23.9	67.7	25.9	6.4	Sandy Clay
Bt1	4-10	0.4	0.8	1.8	9.4	13.2	25.3	25.2	49.5	Clay
Bt2	10-30	0.4	0.6	1.0	3.6	9.6	15.1	26.7	58.2	Clay
Bt3	30-40	0.4	1.0	2.2	3.5	13.1	20.2	35.5	44.4	Clay
Cr	40	0.6	1.5	7.0	4.4	16.0	29.5	45.0	25.5	Loam

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
A	0-4	4.3	4.0	3.6	23.2	2.1
Bt1	4-10	4.3	3.9	15.0	37.4	1.1
Bt2	10-30	4.1	0.4	20.2	44.3	1.2
Bt3	30-40	4.3	0.2	21.7	55.5	0.7
Cr	40	4.2	0.1	15.9	52.1	0.6

Horizon	Depth	Exchangeable Cation Ca	Mg	K	Na	Extractable Acidity	Cation Exchange Capacity	Base Saturation
	inches	meq/100g						%
A	0-4	1.9	0.9	0.2	0.1	12.4	15.5	20.0
Bt1	4-10	7.0	6.1	0.6	0.1	26.3	40.1	34.4
Bt2	10-30	6.4	5.5	0.7	0.1	32.9	45.6	27.8
Bt3	30-40	3.2	4.4	1.4	0.6	29.5	39.1	24.5
Cr	40	2.3	4.1	2.2	0.2	21.7	30.5	28.8

Mineralogical Data

Horizon	Depth	Clay Minerals
	inches	
Bt2	10-30	M_1 K_4 I_4 Cr_4

Table 8. Soil series:CATALPA. Location: Lee County, Mississippi.

Physical Data

Horizon	Depth	VCS	CS	MS	FS	VFS	S	Si	C	Textural Class
				Particle Size Distribution						
	inches	%								
Ap	0-6	1.0	1.0	2.3	7.7	10.5	22.5	49.8	27.7	Clay Loam
A2	6-11	0.3	0.6	2.5	8.1	7.2	18.7	51.2	30.1	Silty Clay Loam
Bg1	11-24	0.2	0.6	2.9	8.0	5.4	17.5	38.2	44.3	Clay
Bg2	24-36	0.1	0.5	3.0	8.2	5.5	17.3	37.0	45.7	Clay
Bg3	36-50	0.1	0.5	3.1	9.3	6.2	19.2	38.1	42.7	Clay
Cg	50-60	0.4	0.6	2.8	8.2	6.2	18.2	37.0	44.8	Clay

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
Ap	0-6	7.9	3.0	0.1	0.2	87.2
A2	6-11	7.9	2.4	0.1	0.2	150.7
Bg1	11-24	7.9	1.4	0.0	0	443.0
Bg2	24-36	8.0	1.3	0.0	0	403.0
Bg3	36-50	7.8	0.9	0.0	0	347.0
Cg	50-60	7.8	0.7	0.0	0	190.0

Horizon	Depth	Ca	Mg	K	Na	Extractable Acidity	Cation Exchange Capacity	Base Saturation
		Exchangeable Cation						
	inches	meq/100g						%
Ap	0-6	43.6	0.5	0.3	0.1	0.9	45.4	98.0
A2	6-11	45.2	0.3	0.2	0.1	1.6	47.4	96.6
Bg1	11-24	44.3	0.1	0.2	0.1	2.2	46.9	95.3
Bg2	24-36	40.3	0.1	0.2	0.2	2.2	43.0	94.8
Bg3	36-50	34.7	0.1	0.2	0.2	2.0	37.2	94.6
Cg	50-60	38.0	0.2	0.1	0.2	2.2	40.7	94.5

Table 9. Soil series: FALKNER. Location: Noxubee County, Mississippi.

Physical Data

Horizon	Depth	VCS	CS	MS	FS	VFS	S	Si	C	Textural Class
				Particle Size Distribution						
	inches	%								
Ap	0-5	2.4	3.2	2.9	2.5	1.4	12.4	52.5	35.1	Silty Clay Loam
Bt1	5-13	2.0	4.0	3.4	2.5	1.2	13.1	51.2	35.7	Silty Clay Loam
Bt2	13-28	3.0	4.4	2.8	1.7	0.8	12.7	50.4	36.9	Silty Clay Loam
2Bt3	28-45	2.7	3.8	2.3	1.5	0.7	11.0	47.9	41.1	Silty Clay
2Bt4	45-54	1.8	2.3	1.4	1.1	0.6	7.2	44.2	48.6	Silty Clay
2Bt5	54-68	1.7	1.5	1.4	1.2	0.6	6.4	44.2	49.4	Silty Clay
C	68-80	0.2	0.1	0.3	0.6	0.3	1.5	24.2	74.3	Clay

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
Ap	0-5	4.1	2.4	6.8	22.5	0.8
Bt1	5-13	4.2	0.7	10.9	38.9	0.7
Bt2	13-28	4.5	0.5	11.8	42.6	0.6
2Bt3	28-45	4.3	0.4	10.3	33.1	0.6
2Bt4	45-54	4.3	0.3	10.4	30.5	0.6
2Bt5	54-68	4.2	0.2	8.1	23.0	0.6
C	68-80	4.2	0.2	4.6	8.9	0.6

Horizon	Depth	Exchangeable Cation Ca	Mg	K	Na	Extractable Acidity	Cation Exchange Capacity	Base Saturation
	inches	meq/100g						%
A	0-5	4.4	5.3	0.7	0.3	19.5	30.2	35.4
Bt1	5-13	3.2	4.4	0.5	0.3	19.6	28.0	30.0
Bt2	13-28	2.7	4.5	0.4	0.3	19.8	27.7	28.5
2Bt3	28-45	4.6	7.0	0.4	0.8	18.3	31.1	41.1
2Bt4	45-54	5.1	8.9	0.5	1.2	18.4	34.1	46.0
2Bt5	54-68	6.6	10.9	0.5	1.4	15.8	35.2	55.1
C	68-80	13.8	21.4	1.3	3.1	12.3	51.9	76.3

Table 10. Soil series: GRIFFITH. Location: Noxubee County, Mississippi.

Physical Data

Horizon	Depth	Particle Size Distribution								Textural Class
		VCS	CS	MS	FS	VFS	S	Si	C	
	inches	%								
Ap	0-6	1.5	0.9	1.1	1.6	1.0	6.1	45.0	48.9	Silty Clay
A1	6-18	0.6	0.6	1.0	1.6	1.0	4.8	43.0	52.2	Silty Clay
A2	18-28	0.5	0.8	1.0	1.6	0.9	4.8	39.7	55.5	Clay
Bw1	28-42	0.4	0.8	0.9	1.4	0.9	4.4	37.7	57.9	Clay
Bw2	42-56	0.8	1.2	1.1	1.7	1.1	5.9	37.1	57.0	Clay
Bw3	56-70	1.1	1.2	1.1	1.7	1.0	6.1	38.5	55.4	Clay

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
Ap	0-6	7.6	4.1	0.1	0.1	94.2
A1	6-18	7.7	2.3	0.2	0.3	285.5
A2	18-28	7.7	1.4	0.1	0.2	544.0
Bw1	28-42	7.8	1.1	0.1	0.2	262.0
Bw2	42-56	7.8	0.9	0.1	0.2	180.6
Bw3	56-70	7.7	0.9	0.1	0.2	180.0

Horizon	Depth	Exchangeable Cation				Extractable Acidity	Cation Exchange Capacity	Base Saturation
		Ca	Mg	K	Na			
	inches	meq/100g						%
A	0-6	56.5	0.6	0.7	0.2	0.7	58.7	98.8
A1	6-18	57.1	0.2	0.3	0.2	2.7	60.5	95.5
A2	18-28	54.4	0.1	0.2	0.2	2.6	57.5	95.5
Bw1	28-42	52.4	0.2	0.2	0.2	3.8	56.8	93.3
Bw2	42-56	54.2	0.3	0.3	0.1	3.6	58.5	93.8
Bw3	56-70	54.0	0.3	0.3	0.1	2.1	56.8	96.3

Table 11. Soil series: KIPLING. Location: Smith County, Mississippi.

Physical Data

Horizon	Depth	VCS	CS	MS	FS	VFS	S	Si	C	Textural Class
				Particle Size Distribution						
	inches	%								
A	0-4	0.3	1.6	2.4	2.7	1.4	8.4	55.0	36.6	Silty Clay Loam
Bt1	4-11	0.7	3.2	4.2	3.6	1.6	13.3	57.7	29.0	Silty Clay Loam
Bt2	11-31	0.5	1.5	2.3	2.2	0.9	7.4	36.6	56.0	Clay
Bwss1	31-40	0.2	1.0	1.5	1.5	0.7	4.9	26.3	68.8	Clay
Bwss2	40-53	0.3	0.8	1.4	1.5	0.7	4.7	23.9	71.4	Clay
Bwss3	53-74	0.1	0.2	0.4	0.5	0.7	1.9	18.0	80.1	Clay

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
A	0-4	5.0	7.1	1.5	3.5	4.1
Bt1	4-11	5.1	0.9	3.3	14.7	3.6
Bt2	11-31	5.2	0.5	8.3	21.8	3.4
Bwss1	31-40	5.0	0.4	2.2	4.6	3.7
Bwss2	40-53	6.2	0.3	0.0	0.0	4.0
Bwss3	53-74	7.6	0.2	0.0	0.0	5.1

Horizon	Depth	Ca	Mg	K	Na	Extractable Acidity	Cation Exchange Capacity	Base Saturation
		Exchangeable Cation						
	inches	meq/100g						%
A	0-4	15.5	3.8	0.3	0.1	23.1	42.8	46.0
Bt1	4-11	8.3	2.3	0.1	0.1	11.7	22.5	48.0
Bt2	11-31	15.9	4.6	0.3	0.4	16.8	38.0	55.8
Bwss1	31-40	28.3	7.5	0.5	0.8	10.5	47.6	77.9
Bwss2	40-53	35.9	8.9	0.4	1.4	4.7	51.3	90.8
Bwss3	53-74	49.1	9.5	0.9	1.9	1.5	62.9	97.6

Table 12. Soil series: MAYHEW. Location: Kemper County, Mississippi.

Physical Data

Horizon	Depth	Particle Size Distribution								Textural Class
		VCS	CS	MS	FS	VFS	S	Si	C	
	inches	%								
A1	0-3	2.6	2.8	2.8	2.5	0.9	11.6	63.3	25.1	Silt Loam
A2	3-7	0.6	1.0	1.4	1.8	0.9	5.7	61.4	32.9	Silty Clay Loam
Btg1	7-13	0.3	0.9	1.1	1.5	0.6	4.3	57.9	37.8	Silty Clay Loam
Btg2	13-31	0.1	0.5	0.8	1.4	0.6	3.5	56.4	40.1	Silty Clay
Btgss1	31-40	0.2	0.3	0.5	1.0	0.4	2.4	46.1	51.5	Silty Clay
Btgss2	40-62	0.2	0.4	0.6	1.1	0.4	2.7	50.1	47.2	Silty Clay
C	62-68	1.6	0.5	0.6	1.2	1.0	4.9	12.9	82.2	Clay

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
A1	0-3	4.2	2.9	4.1	11.4	3.3
A2	3-7	4.0	1.1	5.7	15.7	3.3
Btg1	7-13	3.9	0.3	9.2	24.1	3.5
Btg2	13-31	4.0	0.1	10.9	28.4	3.5
Btgss1	31-40	4.0	0.2	9.5	18.4	3.2
Btgss2	40-62	4.3	0.2	3.9	8.3	3.1
C	62-68	5.6	0.2	0.1	0.1	3.2

Horizon	Depth	Exchangeable Cation				Extractable Acidity	Cation Exchange Capacity	Base Saturation
		Ca	Mg	K	Na			
	inches	meq/100g						%
A1	0-3	10.9	3.3	0.2	0.3	21.2	35.9	40.9
A2	3-7	12.9	3.9	0.2	0.4	18.9	36.3	47.9
Btg1	7-13	13.5	3.9	0.2	0.5	20.0	38.1	47.5
Btg2	13-31	12.5	3.6	0.2	0.7	21.4	38.4	44.3
Btgss1	31-40	20.4	6.5	0.2	2.1	22.3	51.5	56.7
Btgss2	40-62	22.1	7.0	0.2	2.4	15.1	46.8	67.7
C	62-68	44.6	14.1	0.9	5.3	10.4	75.3	86.2

Table 13. Soil series: LORMAN. Location: Franklin County, Mississippi.

Physical Data

Horizon	Depth	VCS	CS	Particle Size Distribution MS	FS	VFS	S	Si	C	Textural Class
	inches	%								
A	0-2	1.7	2.3	2.6	4.0	7.0	17.6	65.9	16.5	Silt Loam
E	2-5	0.8	0.9	2.0	5.0	7.7	16.4	53.3	30.3	Silty Clay Loam
Bt1	5-10	0.1	0.1	0.2	1.4	7.8	9.6	38.2	52.2	Clay
Bt2	10-16	0.0	0.1	0.1	1.0	12.4	13.6	40.5	45.9	Silty Clay
Bt3	16-27	0.0	0.0	0.0	0.8	13.8	14.6	53.2	32.2	Silty Clay Loam
BC	27-33	0.0	0.0	0.0	0.6	10.3	10.9	51.1	38.0	Silty Clay Loam
C1	33-53	0.0	0.0	0.0	1.2	16.9	18.1	44.7	37.2	Silty Clay Loam
C2	53-63	0.0	0.0	0.0	3.0	21.9	24.9	69.8	5.3	Silt Loam

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
A	0-2	4.9	14.3	0.2	0.5	3.4
E	2-5	4.6	3.7	2.4	6.7	1.9
Bt1	5-10	4.5	0.9	5.8	12.7	1.6
Bt2	10-16	4.5	0.5	8.6	19.7	1.7
Bt3	16-27	4.6	0.2	8.9	25.3	1.7
BC	27-33	4.5	0.1	9.1	23.6	1.6
C1	33-53	4.7	0.2	3.7	11.0	1.8
C2	53-63	4.8	0.2	2.3	7.0	1.9

Horizon	Depth	Exchangeable Cation Ca	Mg	K	Na	Extractable Acidity	Cation Exchange Capacity	Base Saturation
	inches	meq/100g						%
A	0-2	15.8	4.7	0.5	0.2	23.1	44.3	47.8
E	2-5	14.2	7.2	0.5	0.2	13.5	35.6	62.1
Bt1	5-10	19.1	11.7	0.5	0.2	13.9	45.4	69.4
Bt2	10-16	16.6	9.9	0.4	0.2	16.6	43.7	62.0
Bt3	16-27	12.4	7.2	0.3	0.2	15.1	35.2	57.1
BC	27-33	15.1	9.1	0.3	0.4	13.7	38.6	64.5
C1	33-53	16.9	9.3	0.3	0.6	6.4	33.5	80.9
C2	53-63	16.9	8.7	0.3	0.6	6.3	32.8	80.8

Table 14. Soil series: LOUIN. Location: Smith County, Mississippi.

Physical Data

Horizon	Depth	Particle Size Distribution: VCS	CS	MS	FS	VFS	S	Si	C	Textural Class
	inches	%								
A	0-3	0.1	0.3	1.0	2.2	1.1	4.7	51.5	43.8	Silty Clay
Bw	3-8	0.3	0.4	0.7	0.7	0.5	2.6	37.3	60.1	Clay
Bwss1	8-19	0.1	0.4	0.7	0.7	0.5	2.4	38.4	59.2	Clay
Bwss2	19-49	0.1	0.3	0.4	0.5	0.3	1.6	29.4	69.0	Clay
Bwss3	49-67	0.0	0.3	0.6	0.8	0.6	2.3	31.4	66.3	Clay

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
A	0-3	5.5	10.9	0.1	0.2	5.8
Bw	3-8	4.9	1.9	7.1	16.9	3.6
Bwss1	8-19	5.1	0.6	11.5	29.1	3.0
Bwss2	19-49	4.8	0.1	2.6	5.4	4.4
Bwss3	49-67	6.6	0.9	0.0	0.0	5.4

Horizon	Depth	Exchangeable Cation: Ca	Mg	K	Na	Extractable Acidity	Cation Exchange Capacity	Base Saturation
	inches	meq/100g						%
A	0-3	28.8	5.0	0.5	0.1	17.7	52.1	66.0
Bw	3-8	18.2	5.0	0.4	0.1	18.1	41.8	56.7
Bwss1	8-19	14.6	4.8	0.3	0.2	19.6	39.5	50.4
Bwss2	19-49	30.2	6.8	0.4	0.8	9.7	47.9	79.7
Bwss3	49-67	38.7	7.1	0.4	1.6	3.0	50.8	94.1

Table 15. Soil series: OKOLONA. Location: Monroe County, Mississippi.

Physical Data

Horizon	Depth	VCS	CS	MS	FS	VFS	S	Si	C	Textural Class
				Particle Size Distribution						
	inches	%								
A	0-5	0.2	0.4	0.5	1.1	1.3	3.5	52.8	43.7	Silty Clay
Bw	5-21	0.1	0.4	0.4	0.7	0.9	2.5	43.6	53.9	Silty Clay
Bwss1	21-46	0.1	0.3	0.4	0.6	0.7	2.1	41.2	56.7	Silty Clay
Bwss2	46-58	0.2	0.5	0.3	0.6	0.6	2.2	34.4	63.4	Clay
Ckss1	58-84	0.6	0.6	0.4	0.7	0.7	3.0	35.1	61.9	Clay
Ckss2	84-101	0.0	0.1	0.2	1.0	1.6	2.9	35.3	61.8	Clay

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
A	0-5	6.4	2.8	0.0	0	23.2
Bw	5-21	7.3	1.0	0.0	0	86.2
Bwss1	21-46	7.6	0.7	0.0	0	147.6
Bwss2	46-58	7.8	0.4	0.0	0	95.0
Ckss1	58-84	7.8	0.3	0.0	0	72.0
Ckss2	84-101	7.6	0.1	0.0	0	49.0

Horizon	Depth	Ca	Mg	K	Na	Extractable Acidity	Cation Exchange Capacity	Base Saturation
		Exchangeable Cation						
	inches	meq/100g						%
A	0-5	34.9	1.5	0.3	0.2	6.3	43.2	85.4
Bw	5-21	43.1	0.5	0.2	1.0	3.5	48.3	92.7
Bwss1	21-46	44.3	0.3	0.2	1.3	2.4	48.5	95.0
Bwss2	46-58	47.5	0.5	0.2	2.1	2.1	52.4	95.9
Ckss1	58-84	50.6	0.7	0.2	1.3	1.6	54.4	97.0
Ckss2	84-101	44.1	0.9	0.3	1.0	2.6	48.9	94.7

Mineralogical Data

Horizon	Depth	Clay Minerals
	inches	
Bwss2		M_1 K_3 I_4

Table 16. Soil series: PELAHATCHIE. Location: Scott County, Mississippi.

Physical Data

Horizon	Depth	VCS	CS	MS	FS	VFS	S	Si	C	Textural Class
				Particle Size Distribution						
	inches	%								
Ap	0-8	0.2	0.3	0.5	0.9	0.7	2.6	66.2	31.2	Silty Clay Loam
Bt1	8-18	0.1	0.2	0.4	0.7	0.5	1.9	61.7	36.4	Silty Clay Loam
Bt2	18-25	0.1	0.2	0.3	0.4	0.4	1.4	49.0	49.6	Silty Clay
2Btss1	33-48	0.1	0.2	0.2	0.4	0.4	1.3	49.0	49.7	Silty Clay
2Btss2	66-82	0.0	0.2	0.5	0.9	0.7	2.3	50.1	47.6	Silty Clay

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
Ap	0-8	4.7	2.7	1.6	5.4	3.2
Bt1	8-18	4.5	1.6	4.7	15.3	2.8
Bt2	18-25	4.7	1.2	3.3	8.1	2.5
2Btss1	33-48	6.6	0.5	0.0	0.0	3.1
2Btss2	66-82	6.8	0.1	0.0	0.0	2.8

Horizon	Depth	Exchangeable Cation Ca	Mg	K	Na	Extractable Acidity	Cation Exchange Capacity	Base Saturation
	inches	meq/100g						%
Ap	0-8	12.4	3.9	0.4	0.6	12.2	29.5	58.6
Bt1	8-18	10.8	3.9	0.2	0.8	14.9	30.6	51.3
Bt2	18-25	17.5	6.9	0.3	1.3	14.8	40.8	63.7
2Btss1	33-48	25.4	8.2	0.4	1.4	4.3	39.7	89.2
2Btss2	66-82	24.3	8.7	0.4	1.4	2.7	37.5	92.8

Table 17. Soil series: SESSUM. Location: Noxubee County, Mississippi.

Physical Data

Horizon	Depth	VCS	CS	MS	FS	VFS	S	Si	C	Textural Class
				Particle Size Distribution						
	inches	%								
Ap	0-6	2.9	1.3	2.9	3.3	1.6	12.0	44.1	43.9	Silty Clay
Btg1	6-10	0.4	1.2	2.6	2.4	1.1	7.5	39.2	53.3	Clay
Btg2	10-24	0.1	0.9	2.2	2.0	0.9	6.1	34.8	59.1	Clay
Btgss1	24-40	0.2	0.8	1.5	1.3	0.6	4.4	31.3	64.3	Clay
Btgss2	40-54	0.3	2.0	3.1	2.6	1.1	9.1	41.3	49.6	Clay
BCss1	54-60	0.1	0.4	1.6	1.7	0.9	4.7	30.4	64.9	Clay
C	60-70	0.1	0.4	0.9	2.1	3.2	6.7	10.6	82.7	Clay

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
Ap	0-6	5.4	5.5	0.1	0.2	4.8
Btg1	6-10	4.9	1.6	7.0	12.6	4.7
Btg2	10-24	4.8	0.8	14.5	25.5	4.9
Btgss1	24-40	4.6	0.3	9.4	16.0	5.5
Btgss2	40-54	4.7	0.2	5.8	11.5	5.6
BCss1	54-60	4.7	0.2	5.3	7.9	5.5
C	60-70	7.3	0.3	0.2	0.2	7.7

Horizon	Depth	Ca	Mg	K	Na	Extractable Acidity	Cation Exchange Capacity	Base Saturation
		Exchangeable Cation						
	inches	meq/100g						%
Ap	0-6	32.9	6.8	0.6	0.1	14.6	55.0	73.4
Btg1	6-10	29.0	6.1	0.2	0.2	19.9	55.4	64.1
Btg2	10-24	25.9	5.2	0.2	0.4	25.2	56.9	55.7
Btgss1	24-40	33.6	6.1	0.2	1.0	17.7	58.6	69.7
Btgss2	40-54	29.8	5.3	0.2	1.0	14.3	50.6	71.7
BCss1	54-60	42.3	7.7	0.2	1.8	15.4	67.4	77.1
C	60-70	67.8	8.8	0.4	3.3	1.1	81.4	98.6

Table 18. Soil series: SHARKEY. Location: Washington County, Mississippi.

Physical Data

Horizon	Depth	VCS	CS	MS	FS	VFS	S	Si	C	Textural Class
		Particle Size Distribution								
	inches	%								
A	0-5	0.0	0.2	0.4	1.1	0.6	2.3	23.2	74.5	Clay
Bg1	5-9	0.0	0.2	0.4	1.1	0.7	2.4	14.3	83.3	Clay
Bgss1	9-19	0.0	0.2	0.4	1.0	0.6	2.2	13.7	84.1	Clay
Bgss2	19-40	0.0	0.1	0.4	1.1	0.7	2.3	14.3	83.4	Clay
BCgss1	40-60	0.0	0.1	1.3	4.7	2.7	8.8	17.6	73.6	Clay
Cg	60-70	0.1	0.8	4.2	12.4	5.9	23.4	35.6	41.0	Clay

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
A	0-5	5.5	3.0	0.1	0.1	2.4
Bg1	5-9	5.1	1.8	1.5	2.5	2.1
Bgss1	9-19	5.1	1.5	1.8	2.9	1.9
Bgss2	19-40	5.2	1.5	0.3	0.5	1.9
BCgss1	40-60	6.9	0.6	0.0	0.0	1.6
Cg	60-70	7.3	0.2	0.0	0.0	4.0

Horizon	Depth	Ca	Mg	K	Na	Extractable Acidity	Cation Exchange Capacity	Base Saturation
		Exchangeable Cation						
	inches	meq/100g						%
A	0-5	30.5	12.4	1.6	0.2	12.9	57.6	77.6
Bg1	5-9	27.7	13.1	1.4	0.5	17.8	60.5	70.6
Bgss1	9-19	28.3	14.6	1.0	1.0	15.9	60.8	73.8
Bgss2	19-40	29.7	15.2	1.2	2.3	15.2	63.6	76.1
BCgss1	40-60	27.2	16.6	0.9	5.0	4.1	53.8	92.3
Cg	60-70	38.5	9.6	0.4	3.3	2.1	53.9	96.1

Table 19. Soil series: SIWELL. Location: Madison County, Mississippi.

Physical Data

Horizon	Depth	VCS	CS	MS	FS	VFS	S	Si	C	Textural Class
				Particle Size Distribution						
	inches	%								
Ap	0-5	0.9	1.5	1.0	0.8	1.1	5.3	70.7	24.0	Silt Loam
Bt1	5-13	0.4	0.5	0.4	0.4	0.4	2.1	64.4	33.5	Silty Clay Loam
Bt2	13-19	0.3	1.0	0.7	0.5	0.6	3.1	69.2	27.7	Silty Clay Loam
Bt3	19-26	0.2	0.7	0.6	0.5	0.4	2.4	64.9	32.7	Silty Clay Loam
2Bt4	26-38	0.3	0.6	0.4	0.6	0.5	2.4	48.2	49.4	Silty Clay
2C1	38-54	0.3	0.3	0.3	0.4	0.6	1.9	25.4	72.7	Clay
2C2	54-70	1.6	1.2	0.7	0.5	0.8	4.8	17.4	77.8	Clay

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
Ap	0-5	5.3	1.5	0.7	4.0	2.4
Bt1	5-13	5.1	0.6	3.8	18.2	1.9
Bt2	13-19	5.0	0.5	2.8	18.0	2.0
Bt3	19-26	5.3	0.4	5.0	23.5	1.9
2Bt4	26-38	5.6	0.3	1.4	4.1	2.0
2C1	38-54	7.6	0.3	0.0	0	2.6
2C2	54-70	7.7	0.2	0.0	0	2.5

Horizon	Depth	Ca	Mg	K	Na	Extractable Acidity	Cation Exchange Capacity	Base Saturation
		Exchangeable Cation						
	inches	meq/100g						%
Ap	0-5	6.7	2.8	0.2	0.3	7.5	17.5	57.1
Bt1	5-13	6.1	3.2	0.2	0.3	11.1	20.9	47.1
Bt2	13-19	4.4	2.2	0.1	0.2	9.1	16.0	43.1
Bt3	19-26	5.7	3.5	0.2	0.4	11.5	21.3	46.0
2Bt4	26-38	16.1	8.2	0.3	1.4	8.4	34.4	75.6
2C1	38-54	45.0	17.3	0.4	2.3	5.3	70.3	92.5
2C2	54-70	46.1	18.6	0.6	2.6	1.3	69.2	98.1

Table 20. Soil series: SUSQUEHANNA. Location: Forrest County, Mississippi.

Physical Data

Horizon	Depth	VCS	CS	MS	FS	VFS	S	Si	C	Textural Class
				Particle Size Distribution						
	inches	%								
A	0-3	1.2	1.3	2.0	12.6	16.1	33.2	60.5	6.3	Silt Loam
E	3-6	0.5	0.6	0.7	9.3	14.7	25.8	57.6	16.6	Silt Loam
Bt1	6-10	0.2	0.2	0.3	4.2	6.9	11.8	35.9	52.3	Clay
Bt2	10-17	0.0	0.1	0.2	3.3	6.6	10.2	34.2	55.6	Clay
Btg1	17-27	0.0	0.0	0.1	2.2	8.4	10.7	39.4	49.9	Clay
Btg2	27-42	0.0	0.0	0.1	1.7	9.3	11.1	44.7	44.2	Silty Clay
Btg3	42-55	0.0	0.0	0.1	1.8	10.4	12.3	46.3	41.4	Silty Clay
Btg4	55-65	0.0	0.0	0.1	2.6	11.5	14.2	44.4	41.4	Silty Clay

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
A	0-3	5.0	2.0	1.7	21.5	2.0
E	3-6	5.1	0.6	4.0	40.0	1.2
Bt1	6-10	4.9	0.8	13.9	43.3	1.1
Bt2	10-17	4.9	0.4	17.6	47.3	1.0
Btg1	17-27	5.0	0.2	16.1	43.3	1.0
Btg2	27-42	4.9	0.1	12.2	35.2	0.9
Btg3	42-55	5.1	0.1	8.6	26.2	1.0
Btg4	55-65	5.3	0.1	6.5	19.9	1.0

Horizon	Depth	Ca	Mg	K	Na	Extractable Acidity	Cation Exchange Capacity	Base Saturation
		Exchangeable Cation						
	inches	meq/100g						%
A	0-3	1.2	0.6	0.1	0.1	5.9	7.9	25.3
E	3-6	1.8	1.5	0.1	0.1	6.5	10.0	35.0
Bt1	6-10	5.8	5.4	0.2	0.2	20.5	32.1	36.1
Bt2	10-17	6.5	6.5	0.2	0.3	23.7	37.2	36.2
Btg1	17-27	7.8	7.8	0.3	0.5	20.7	37.1	44.2
Btg2	27-42	9.0	9.1	0.2	0.8	15.5	34.6	55.2
Btg3	42-55	10.3	10.0	0.3	0.8	11.4	32.8	65.2
Btg4	55-65	11.5	10.7	0.3	0.8	9.3	32.6	71.4

Mineralogical Data

Horizon	Depth	Clay Minerals
	inches	
Btg1	17-27	M_1 K_2 Q_4

Table 21. Soil series: TIPPAH. Location: Lafayette County, Mississippi.

Physical Data

Horizon	Depth	VCS	CS	MS	FS	VFS	S	Si	C	Textural Class
				Particle Size Distribution						
	inches	%								
A	0-2	0.4	2.1	2.4	3.0	3.6	11.5	80.3	8.2	Silt
E	2-6	0.2	0.6	0.9	1.6	3.7	7.0	84.1	8.9	Silt
Bt1	6-15	0.1	0.3	0.5	0.8	1.5	3.2	65.4	31.4	Silty Clay Loam
Bt2	15-22	0.0	0.2	0.4	0.7	1.9	3.2	65.3	31.5	Silty Clay Loam
Btg1	22-37	0.1	0.3	0.5	1.2	3.0	5.1	61.9	33.0	Silty Clay Loam
Btg2	37-47	0.8	1.5	1.1	2.9	8.1	14.4	49.9	35.7	Silty Clay Loam
Btg3	47-50	0.1	0.1	0.2	0.5	1.5	2.4	38.0	59.6	Clay
2C	50-61	0.0	0.1	0.1	0.3	0.5	1.0	39.6	59.4	Clay

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
A	0-2	5.0	6.1	0.7	4.2	3.1
E	2-6	5.0	1.1	2.3	33.8	1.7
Bt1	6-15	5.2	0.8	7.4	42.5	0.7
Bt2	15-22	5.2	0.4	8.3	41.1	0.4
Btg1	22-37	5.5	0.2	6.5	30.1	0.5
Btg2	37-47	5.3	0.2	3.2	12.8	0.6
Btg3	47-50	5.0	0.2	2.5	6.0	0.6
2C	50-61	5.9	0.2	0.5	1.2	0.7

Horizon	Depth	Ca	Mg	K	Na	Extractable Acidity	Cation Exchange Capacity	Base Saturation
		Exchangeable Cation						
	inches	meq/100g						%
A	0-2	3.8	1.2	0.3	0.1	11.1	16.5	32.7
E	2-6	0.5	0.3	0.1	0.0	5.9	6.8	13.2
Bt1	6-15	1.4	2.1	0.1	0.1	13.7	17.4	27.0
Bt2	15-22	1.2	2.8	0.1	0.2	14.1	18.4	23.4
Btg1	22-37	3.2	6.3	0.2	0.5	11.4	21.6	41.5
Btg2	37-47	6.0	10.1	0.2	0.9	7.7	42.9	69.1
Btg3	47-50	13.0	19.9	0.3	1.2	7.1	41.5	82.9
2C	50-61	14.6	21.6	0.3	1.3	3.9	41.7	90.6

Table 22. Soil series: UNA. Location: Lee County, Mississippi.

Physical Data

Horizon	Depth	VCS	CS	MS	FS	VFS	S	Si	C	Textural Class
				Particle Size Distribution						
	inches	%								
Ap	0-4	0.8	1.1	3.9	12.1	7.2	25.1	38.8	36.1	Clay Loam
Bg1	4-9	0.1	0.5	2.6	9.1	5.4	17.7	41.1	41.2	Clay
Bg2	9-17	0.1	0.4	3.3	14.4	10.2	28.4	38.5	33.1	Clay loam
Bgss1	17-25	0.0	0.2	2.2	10.4	7.3	20.1	37.0	42.9	Clay Loam
Bgss2	25-45	0.1	0.3	2.5	11.1	7.9	21.9	34.0	44.1	Clay
Bgss3	45-60	0.0	0.3	3.1	16.1	11.9	31.4	33.2	35.4	Clay Loam

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
Ap	0-4	5.6	5.6	0.2	0.6	8.7
Bg1	4-9	5.5	2.6	0.7	2.3	9.2
Bg2	9-17	5.2	1.2	2.7	11.4	10.1
Bgss1	17-25	4.9	0.7	3.4	12.4	9.9
Bgss2	25-45	4.9	0.5	2.1	7.5	9.9
Bgss3	45-60	5.7	0.3	0.2	0.9	10.5

Horizon	Depth	Ca	Mg	K	Na	Extractable Acidity	Cation Exchange Capacity	Base Saturation
		Exchangeable Cation						
	inches	meq/100g						%
Ap	0-4	18.3	2.1	0.3	0.1	12.8	33.6	61.9
Bg1	4-9	16.6	1.8	0.2	0.1	11.3	30.0	62.3
Bg2	9-17	12.1	1.2	0.1	0.1	10.2	23.7	56.9
Bgss1	17-25	14.9	1.5	0.2	0.1	10.6	27.3	61.1
Bgss2	25-45	16.9	1.7	0.2	0.2	9.0	28.0	67.8
Bgss3	45-60	16.8	1.6	0.2	0.2	3.7	22.5	83.5

Table 23. Soil series: VAIDEN. Location: Monroe County, Mississippi.

Physical Data

Horizon	Depth	VCS	CS	MS	FS	VFS	S	Si	C	Textural Class
				Particle Size Distribution						
	inches	%								
Ap	0-4	0.2	0.5	1.6	5.0	12.1	19.4	49.9	30.7	Silty Clay Loam
Bt1	4-14	0.1	0.2	0.6	2.2	7.9	11.0	53.7	35.3	Silty Clay Loam
Bt2	14-42	0.0	0.2	0.5	1.6	6.3	8.6	49.5	41.9	Silty Clay
Btss1	42-56	0.0	0.1	0.4	1.7	6.5	8.7	48.0	43.3	Silty Clay
Btss2	56-69	0.0	0.1	0.4	1.4	5.6	7.5	43.5	49.0	Silty Clay
Btss3	59-81	0.0	0.1	0.5	1.8	6.1	8.5	37.0	54.5	Clay

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
Ap	0-4	4.8	2.5	4.7	16.2	9.1
Bt1	4-14	5.0	0.9	8.9	29.3	15.0
Bt2	14-42	4.8	0.3	14.4	40.2	16.0
Btss1	42-56	5.2	0.2	11.6	32.6	20.0
Btss2	56-69	4.9	0.2	3.8	8.7	20.1
Btss3	59-81	6.7	0.1	0.0	0,0	21.0

Horizon	Depth	Ca	Mg	K	Na	Extractable Acidity	Cation Exchange Capacity	Base Saturation
		Exchangeable Cation						
	inches	meq/100g						%
Ap	0-4	13.7	1.5	0.1	0.1	13.6	29.0	53.1
Bt1	4-14	13.5	0.9	0.1	0.3	15.5	30.3	48.8
Bt2	14-42	12.8	0.8	0.1	0.5	21.6	35.8	39.7
Btss1	42-56	16.0	0.8	0.1	1.3	17.4	35.6	51.1
Btss2	56-69	30.2	1.5	0.1	1.7	10.0	43.5	77.0
Btss3	59-81	39.9	1.9	0.2	2.3	2.8	47.1	94.0

Mineralogical Data

Horizon	Depth	Clay Minerals
	inches	
Bt2	4-42	M_2 K_2 I_2
Btss1	42-56	M_1 K_2 I_4

Table 24. Soil series: WILCOX. Location: Winston County, Mississippi.

Physical Data

Horizon	Depth	VCS	CS	MS	FS	VFS	S	Si	C	Textural Class
				Particle Size Distribution						
	inches	%								
Ap	0-3	3.0	4.0	5.8	6.6	3.0	22.4	53.1	24.5	Silt Loam
Bt1	3-13	1.1	1.5	1.7	2.5	1.6	8.4	35.4	56.2	Clay
Bt2	13-20	0.6	1.2	1.2	1.7	1.2	5.9	29.3	64.8	Clay
Bt3	20-35	0.8	1.3	1.3	1.8	1.3	6.5	32.3	61.2	Clay
Bt4	35-60	0.7	1.5	1.5	2.2	1.2	7.1	32.3	60.6	Clay
C	60-80	1.3	3.8	4.7	4.7	1.9	16.4	44.2	39.4	Silty Clay Loam

Chemical Data

Horizon	Depth	pH H_2O	Organic Matter	KCl Exchangeable Al	Al Saturation	Exchangeable Ca/Mg
	inches		%	meq/100g	%	
Ap	0-3	5.3	7.0	0.6	1.6	1.2
Bt1	3-13	4.7	1.8	12.9	28.3	0.8
Bt2	13-20	4.8	0.8	21.0	47.1	0.5
Bt3	20-35	4.7	0.5	19.9	48.2	0.2
Bt4	35-60	4.1	0.3	19.1	45.3	0.3
C	60-80	3.7	0.3	14.6	30.7	0.3

Horizon	Depth	Ca	Mg	K	Na	Extractable Acidity	Cation Exchange Capacity	Base Saturation
		Exchangeable Cation						
	inches	meq/100g						%
Ap	0-3	10.1	8.4	0.6	0.1	17.7	36.9	52.0
Bt1	3-13	8.2	9.9	0.6	0.1	26.4	45.5	41.9
Bt2	13-20	4.5	8.7	0.6	0.4	30.4	44.6	31.8
Bt3	20-35	2.3	9.0	0.6	0.6	28.8	41.3	30.2
Bt4	35-60	2.9	10.6	0.6	1.1	27.0	42.2	36.0
C	60-80	5.0	14.7	0.7	0.4	26.7	47.5	43.8

Mineralogical Data

4Horizon	Depth	Clay Minerals
	Inches	
Bt2	13-20	M_1 K_2 I_3

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