Heavy Metal Concentration in Selected Soils and Parent Materials in Mississippi

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Mn

Fe

Zn

Cd

Pb

Ni

Cu

MAFES
MSU
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Heavy Metal Concentration in Selected Soils and Parent Materials in Mississippi

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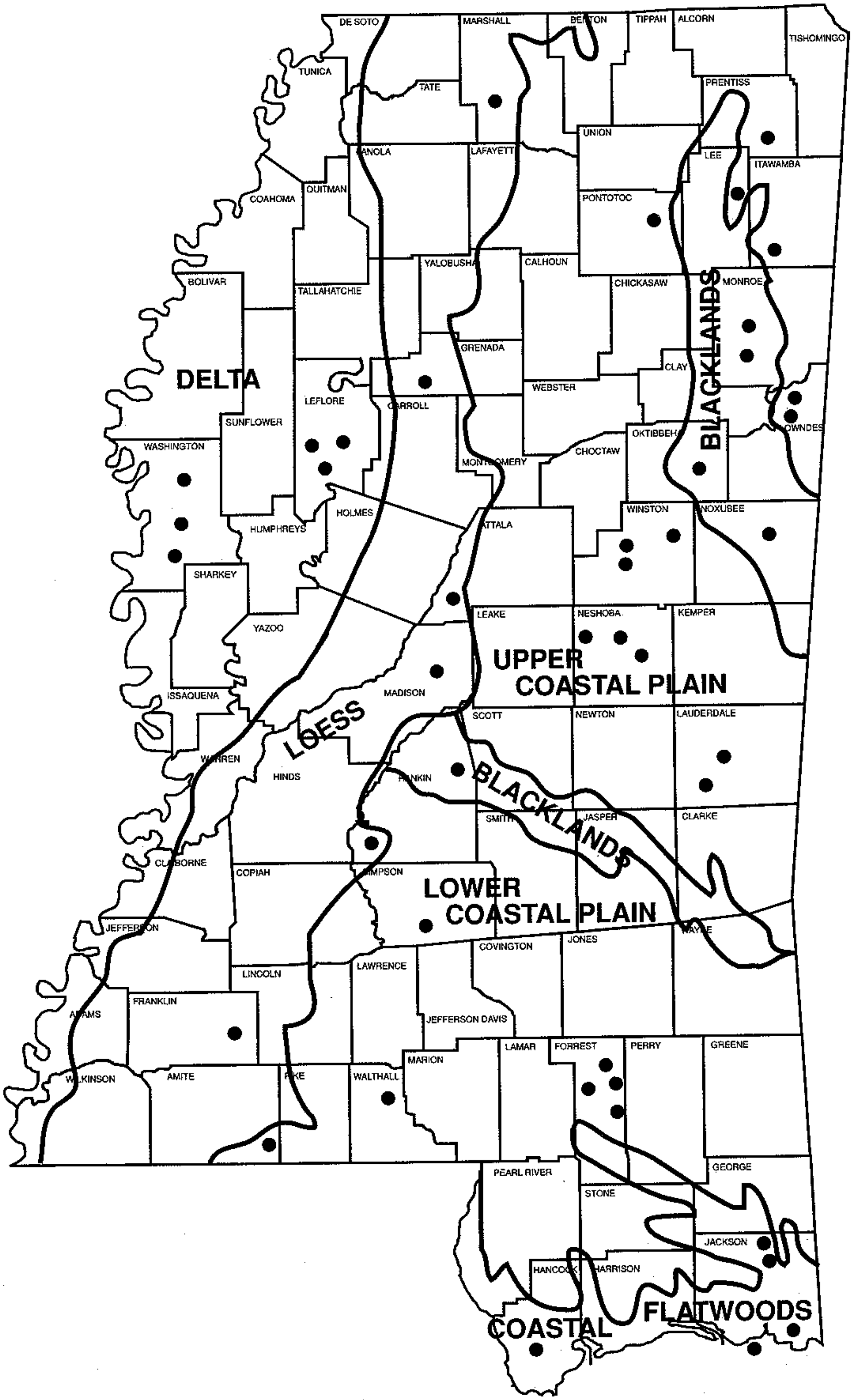

Figure 1. Location of sites in Mississippi.

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Abstract

Heavy metal concentrations in Mississippi soils reflect the influence of parent materials, pedogenesis, weathering, and age. Metal concentrations were highest in the Delta soils and lowest in the Coastal Flatwoods soils. Iron concentrations were dominant at all depths in the soils analyzed followed by manganese, which usually exceeded other metals. Cadmium concentrations were the lowest of the metals analyzed.

Heavy metal levels in individual soil resource areas are considerably different and reflect the dominant influence of different factors. The use of state average metal concentrations could be misleading when establishing natural background levels for soils in different resource areas. The Delta, Blackland Prairie, and Loessial soils developed in uniform deposits where parent material exerts a strong influence on metal concentrations. The heavy metals tended to increase in the Coastal Plain soils with increased distance from the Gulf of Mexico, reflecting effects of weathering and pedogenesis.

Introduction

Public attention on environmental contaminants has increased significantly in recent years. A major area of concern is the accumulation and persistence of heavy metals in soils. The increased awareness and concern have been accompanied by regulations regarding waste disposal and establishing levels of soil contamination. Heavy metals receiving attention relevant to accumulation in soils, uptake by plants, and contamination of ground water include cadmium (Cd), copper (Cu), nickel (Ni), lead (Pb), and zinc (Zn) (Dowdy and Volk, 1983). Much of the concern with heavy metals has arisen from the use of soils for disposal of sewage sludge and industrial waste, accumulation in landfills, and the application of fertilizers and pesticides (Basta and Tabatabai, 1982).

Studies have documented the relationships between heavy metal adsorption and soil chemical and physical properties (Hassott, 1974; Singh, 1979; Barrows et al., 1960; Corey et al., 1981; Gerrisce and Van Oriel, 1984; Sposito, 1984; Shuman, 1975), and toxicity of heavy metals (Gough et al., 1976; Foy, 1966; Bates, 1971; Czuba and Hutcheson, 1980). Considerable research has focused on chemical forms of heavy metals relative to plant uptake (Chaney and Giodarno, 1976; Stoner et al., 1976; Mahler et al., 1980). Researchers indicate Cu, Zn, and Ni are the metals most likely to cause toxicities in crops (CAST, 1976). Cadmium is toxic to animals at much lower concentrations than other metals. However, it may accumulate in plant tissue in concentrations that are nontoxic to the crop, but potentially harmful to consumers of that crop (Chaney, 1980).

Retention of heavy metals provides an estimate of the soil effects on metal availability to plants. Heavy metals become unavailable to plants because of precipitation as metal carbonates, phosphates, sulfides, and silicates; and by forming complexes with organic matter and hydrous oxides of iron (Fe), aluminum (Al), and manganese (Mn) (Verry and Vermette, 1991). Cation exchange capacity (CEC) is widely used in regulations governing metal loading rates in soils (Read et al., 1984). Sposito et al., (1982) suggested iron oxides and clay content would be better parameters for soils in the southeastern United States. Korts et al., (1976) reported that knowledge of the CEC does not improve the ability to predict ion movement in natural soils. Tiller et al., (1963) and Jenne (1968) suggested that CEC is not related to environmental fixation of trace elements and they proposed instead control by hydrous oxides of Fe and Mn. The role of organic matter in heavy metal retention in soils has received attention because of its effects on CEC and the tendency of heavy metals to form stable complexes with organic ligands (Ailed et al., 1986).

A data base deficit severely limits accurate definition of heavy metal background levels for specific geographical areas. Limited data on heavy metal contents in soils have been published (Lindsay, 1979; Shacklette and Boerngen, 1984; Sposito, 1989), but the data are general with a broad range, and based on limited soil samples that may not be representative of a specific region.

This publication presents heavy metal concentrations and physical, chemical, and mineralogical data for representative soils and parent materials in the major soil resource areas of Mississippi.

Methods and Materials

Representative soils were sampled in major soil resource areas in 25 Mississippi counties (Figure 1). Sites selected had minimum cultural influence and alteration, and most had been in forest vegetation for the past 50 years. Soils analyzed included Alfisols, Entisols, Histosols, Inceptisols, Spodosols, Ultisols, and Vertisols, which represent the diversity in the state (Table 1). An archaeological site (Anthrosol) with an established habitation period of at least 5,000 years (Pettry and Bense, 1989) was included in the study for comparisons. Soils were described and sampled in pits using standard methods (Soil Survey Staff, 1984). Selected soil parent materials were sampled in soil pits and freshly exposed borrow pits. Fresh material was obtained in borrow pits by excavating 3 feet behind exposed surfaces.

Samples were air-dried and sieved to remove coarse fragments (>2mm). Consolidated parent material samples were crushed in an agate mortar and pestle before sieving. Soil 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., 1949). Cation exchange capacity was determined by summation of extractable cations and acidity. Cations were extracted with M NH_4OAc (pH 7.0) and determined by atomic absorption spectrophotometry. Acidity was determined by the $BaCl_2$-triethanolamine method (Peech, 1965).

Silt and clay fractions of selected soils and parent materials were separated by centrifugal sedimentation and analyzed by x-ray diffraction (Jackson, 1956). Oriented clay specimens were prepared for x-ray examination by sedimentation of K- and Mg-saturated samples onto glass slides. These specimens were glycerol-solvated by equilibrating in a 10% glycerol-methanol solution. X-ray diffraction patterns were obtained using a Norelco Geiger counter detector, Cu K radiation, and a Ni filter. Estimation of the mineral type and content was made from the basal spacings and x-ray peak intensity (Dixon and Weed, 1989).

Table 1. Representative soils sampled and analyzed.

Number Pedons	Soil	Classification
2	Alligator	very-fine,montmorillonitic, acid, thermic Vertic Haplaquepts
1	Anthrosol+	sandy, siliceous, thermic Typic Fluvaquents
1	Atwood	fine-silty, mixed, thermic Typic Paleudalfs
1	Ariel	coarse-silty, mixed, thermic Fluvaquentic Dystrochrepts
1	Arundel	clayey, montmorillonitic, thermic Typic Hapludults
1	Bassfield	coarse-loamy, siliceous, thermic Typic Hapludults
1	Byram	fine-silty, mixed, thermic Typic Fragiudalfs
1	Croatan	loamy, siliceous, dysic, thermic Terric Medisaprists
1	Dundee	fine-silty, mixed, thermic Aeric Ochraqualfs
1	Deerford	fine-silty, mixed, thermic, albic Glossic Natraqualfs
1	Eustis	sandy, siliceous, thermic Psammentic Paleudults
1	Kipling variant	fine, montmorillonitic,thermic Vertic Hapludalfs
2	Leon	sandy, siliceous, thermic Aeric Alaquods
1	Lexington	fine-silty, mixed, thermic Typic Paleudalfs
1	Loring	fine-silty, mixed, thermic Typic Fragiudults
1	Louin	fine, montmorillonitic, thermic Aquentic Chromuderts
1	Okolona	fine, montmorillonitic, thermic Typic Chromuderts
1	Ora	fine-loamy, siliceous, thermic Typic Fragiudults
1	Pelahatchie	fine -silty, mixed, thermic Aquic Hapludalfs
2	Petal	fine-loamy, siliceous, thermic Typic Paleudalfs
1	Quitman	fine-loamy, siliceous, thermic Aquic Paleudalfs
2	Savannah	fine-loamy, siliceous, thermic Typic Fragiudults
3	Sharkey	very-fine, montmorillonitic, non-acid, thermic Vertic Haplaquepts
3	Smithdale	fine-loamy, siliceous, thermic Typic Hapludults
1	Susquehanna	fine, montmorillonitic, thermic Vertic Paleudalfs
1	Tensas	fine, montmorillonitic, thermic Vertic Ochraqualfs
1	Vaiden variant	fine, montmorillonitic, thermic Vertic Hapludalfs

+ Human modified soil

Selected heavy metals (trace metals) were determined using the Environmental Protection Agency (EPA) method 3050 (EPA, 1989). This method is an acid digestion procedure used to quantify heavy metal contents in sediments, sludges, and soil samples, and it approximates total content procedures. Representative 2-gram samples (<2mm) were digested in nitric acid and hydrogen peroxide, and refluxed in hydrochloric acid. Extracted Cd, Cu, Zn, Pb, Ni, Fe, and Mn were determined by atomic absorption spectrophotometry. Metal concentrations are expressed on an ovendry soil basis.

Results and Discussion

Soil Parent Materials

The heavy metal content in soils is strongly influenced by the parent materials in which they form (Esser et al., 1991). The soils of Mississippi formed in alluvial, marine, and eolian parent materials ranging from Cretaceous to Holocene age. Episodic erosion, sedimentation, and sediment reworking by streams have resulted in complex distribution of parent materials of diverse origin. The oldest sediments, including Tombigbee sand and Selma chalk, are in the northeastern part of the state, and parent material age decreases from east to west. The youngest major soil parent material is the Mississippi River alluvium, which is dominated by montmorillonite clay. Parent materials in the state range from firm chalk and unconsolidated sediments (containing sands, silts, clays, and gravels) to eolian silts. Unconsolidated sediments are dominant in the state and include materials that were highly weathered prior to deposition in Mississippi.

Selma chalk (Blackland Prairie) was dominantly comprised of calcium carbonate (>80%) and contained montmorillonite clay. The Porters Creek Clay (Upper Coastal Plain) was dominated by montmorillonite, with lesser amounts of kaolinite and illite. Peoria loess was comprised of quartz, feldspar, mica, and dolomite silt-sized particles with small amounts of illite, kaolonite, and montmorillonite clay. The Mississippi River Alluvium (Delta) and Yazoo Clay were dominated by montmorillonitic clay. The Citronelle, Hattiesburg, and Meridian Sand Formations had quartz sand and silt fractions, and kaolinitic clay fractions. The Tombigbee sand was comprised of quartz, calcite, and glauconite sand and silt fractions with the clay fraction dominated by kaolinite, illite, and montmorillonite. The Winona material had quartz and glauconite sand and silt fractions, and a clay fraction dominated by kaolinite and illite.

A degree of uniformity exists in the soil resource areas that have common parent materials and similar topography and climate (Pettry, 1977). The humid temperate climate produces an intense weathering environment. Annual precipitation in the state ranges from about 50 to 65 inches and soil temperatures are in the thermic regime (59 to 72 °C).

Metal concentrations of selected parent materials are presented in Table 2. Iron was the dominant metal in all parent materials, followed by Mn, which generally exceeded the other metals. The highest Cd, Pb, and Ni levels were detected in Selma chalk, which is the parent material for the Blackland Prairie (northeast). The Cd levels in chalk were 2.5 to 45 times greater than other parent materials analyzed. The Mississippi River Alluvium of the Delta had the highest Cu and Fe concentrations. The Porters Creek Clay had the highest Zn levels, and the Peoria Loess had the highest Mn levels. Average metal concentrations in the parent materials analyzed were Fe > Mn > Zn > Ni > Pb > Cu > Cd.

The coarser-textured, siliceous parent materials, such as Meridian sand from Lauderdale County, and the Wilcox Group from Choctaw County, had very low metal concentrations. The Winona and Tombigbee sands (Upper Coastal Plain) had higher Fe concentrations because of the content and weathering of glauconite.

Soil Heavy Metal Concentrations

State Distribution. Soil and heavy metal data for the 35 soil pedons analyzed are presented in the Appendix. The distribution of heavy metals in soils is related to many factors, including parent material, mineralogy, organic matter content, particle size distribution, soil horizonation, soil age, drainage, vegetation, and aerosol input (Esser et al., 1991). Tiller (1958) and Fieler and Rotsche (1977) correlated heavy metal concentrations to soil mineralogy and organic matter content, and concluded that feldspars, micas, iron oxides and hydroxides, clay minerals, and organic matter are the principal carriers of heavy metals.

The heavy metal concentrations averaged across all soil resource areas present a varied picture reflecting relationships with clay content, organic matter content, pH, and parent material (Table 3). Metals such as Cd, Zn, Pb, and Mn tend to be higher in the surface horizons reflecting their association with organic matter. Copper, Ni, and Fe concentrations increased in the subsoils, suggesting an association with pedogenesis and clay content and/or the parent material. Iron was the dominant metal, exceeding Mn by 17- to 46-fold, while Mn exceeded the other metals by 10 to 1,394. Iron and Mn are normally present in large amounts in soils and they are commonly associated with silicate clays (Brady, 1984). Cadmium concentrations were the lowest of the trace metals analyzed, and levels were uniform at all soil depths. Metals with the highest concentrations exhibited the widest variation from minimum to maximum levels.

Correlation analyses between clay content and metal concentrations across all Soil Resource Areas revealed significant correlations for all metals analyzed except Mn (Table 4).

Researchers (Tiller, 1958; Fleming and Ryan, 1964) have demonstrated the effects of soil particle-size distribution on trace element concentrations, with enrichment occurring in the clay and silt fractions. Esser et al., (1991) determined that distribution of trace elements with particle size is a function of mineral composition and amount of adsorption sites in each size fraction.

Data suggested that elements are present in adsorbed form on clay minerals and in the structure of sesquioxides. Soil pH was correlated with all metals, and cation exchange capacity was correlated with all metals except Mn. The r values were relatively low for all correlations (r=.26 to .81), indicating that about 7 to 66% of the metal distribution was related to the soil parameters. Clay and cation exchange capacity (CEC) were correlated with the same metals, which would be expected, since the type and amount of clay, along with organic matter are the principal factors determining the CEC.

Organic matter was not significantly correlated with metal concentrations.

Table 2. Mean heavy metal concentration in selected soil parent materials

Parent Material	Soil Resource Area	No. Sites	Cd	Cu	Zn	Pb	Ni	Fe	Mn
			-----------	-----------	-----------	PPM (ugg-1)	-----------	-----------	-----------
Citronelle Formation	Lower Coastal Plain	3	0.5 ±0.05*	8.4 ±2.97	11.9 ±9.20	12.4 ±1.95	15.7 ±1.56	19,302 ±4,781	90.0 ±134.24
Hattiesburg Formation	Lower Coastal Plain	2	0.3 ±0.07	6.7 ±0.14	19.7 ±2.54	13.8 ±0.42	18.2 ±6.08	14,240 ±7,773	19.0 ±6.36
Miss. River Alluvium	Delta	3	0.9 ±0.13	27.4 ±6	96.2 ±12.82	27.82 ±2.27	38.9 ±12.61	31,553 ±2,653	452.0 ±66
Meridian Sand	Upper Coastal Plain	3	0.1 ±0.05	0.3 ±0.2	0.1 ±0.17	2.2 ±1.25	0.7 ±0.45	851 ±40.7	0.9 ±0.17
Peoria Loess	Loess	3	1.0 ±0.71	14.3 ±0.75	38.9 ±8.55	26.3 ±17.93	30.6 ±10.09	15,004 ±2,307	509.0 ±107
Porters Creek Clay	Upper Coastal Plain	3	0.7 ±0.1	18.6 ±3.46	98.9 ±21.7	30.9 ±12.80	19.3 ±3.6	30,467 ±12,033	54.0 ±9.6
Selma Chalk	Blackland Prairie	3	4.6 ±0.3	13.1 ±1.1	56.3 ±4.25	35 ±0.62	59.1 ±23.56	11,757 ±2,298	240.0 ±10.78
Tombigbee Sand	Upper Coastal Plain	4	0.8 ±0.21	2.6 ±0.17	24.6 ±2.01	9.6 ±1.11	17.7 ±2.81	14,052 ±987	115.0 ±22.47
Wilcox Group	Upper Coastal Plain	3	0.1 ±0.1	0.7 ±0.61	0.9 ±0.82	2.9 ±3.36	1.6 ±1.30	1,898 ±1,274	4.0 ±4.90
Winona Formation	Upper Coastal Plain	3	0.5 ±0.36	2.5 ±2.25	24.3 ±12.47	10.9 ±6.33	18.5 ±13.34	30,686 ±14,371	37.3 ±29.80
Yazoo City	Loess	3	1.3 ±0.46	8.9 ±3.33	68.1 ±29.95	28.3 ±2.2	32.3 ±19.40	23,353 ±1,699	388.0 ±256.80

*Standard deviation

Blackland Prairie. Soils in this area formed in chalk and calcareous clays with montmorillonitic mineralogy and high cation exchange capacities. Free carbonates ($CaCO_3$) and neutral to alkaline pH levels typically occur in the deeper subsoil horizons. All metals except Pb and Mn increased with depth reflecting the parent material influence (Table 5). Iron and Mn were present in the highest concentrations.

Table 3. Clay and organic matter contents, pH, cation exchange capacity (CEC), and heavy metal concentrations in surface (A), subsoil (B), and deep subsoil (C) horizons averaged across all soils analyzed.

Element	Horizon	N	Mean	Minimum	Maximum
CLAY (%)	A	34	22.1	2.0	77.2
	B	34	36.5	3.0	84.2
	C	34	33.0	0.5	86.5
ORGANIC MATTER (%)	A	35	6.1	0.9	83.7
	B	35	1.7	0.1	34.8
	C	34	0.3	0.0	1.8
pH	A	35	5.0	3.7	6.5
	B	35	5.0	4.0	7.7
	C	34	5.7	3.7	8.1
CEC ($cmol_c$ kg-1)	A	35	25.6	7.3	112.1
	B	35	26.6	3.6	63.6
	C	34	27.9	0.2	89.5
CADMIUM (ppm)	A	35	0.5	0.0	2.0
	B	35	0.5	0.0	1.1
	C	34	0.5	0.0	1.3
COPPER (ppm)	A	35	10.4	0.8	45.5
	B	35	13.5	0.4	39.2
	C	34	11.4	0.4	36.3
ZINC (ppm)	A	35	47.8	2.1	197.8
	B	35	43.3	1.6	129.3
	C	34	39.0	0.9	117.3
LEAD (ppm)	A	35	20.8	4.4	65.8
	B	35	16.6	3.5	31.5
	C	34	13.8	0.6	29.9
NICKEL (ppm)	A	35	15.2	1.5	51.3
	B	35	19.8	0.6	51.6
	C	34	20.3	0.2	64.9
IRON (ppm)	A	35	11,616.1	268.4	31,740.2
	B	35	20,448.9	20.2	58,751.6
	C	34	17,461.6	6.3	44,178.2
MANGANESE (ppm)	A	29	696.8	3.7	6,211.8
	B	29	442.0	0.6	4,597.5
	C	28	460.9	0.2	3,203.4

Cadmium and Fe were significantly correlated with clay and Pb and Mn were correlated with organic matter (Table 4). Soil pH was correlated with Cd, Cu, Zn, Ni, and Fe; and Cd, Ni, and Fe were correlated with cation exchange capacity. The mean heavy metal concentrations for the three depths were Fe > Mn > Zn > Pb > Ni > Cu > Cd.

Coastal Flatwoods. This area contains organic and mineral soils, which are typically sandy, siliceous, and strongly acid. The lowest mean concentrations of heavy metals in the state occurred in this soil resource area, which borders the Gulf of Mexico. Iron, Cd, Zn, Pb, Ni, and Mn concentrations were highest in the surface horizons, indicating that organic matter plays a dominant role in heavy metal distribution (Table 6).

All metals except Fe were significantly correlated with organic matter and cation exchange capacity (Table 4), and correlation coefficients indicated about 58 to 98% of the metal distribution could be associated with these parameters. Clay was correlated with Cd, Zn, and Ni.

Table 4. Linear correlation coefficients for the relationships among metals and soil properties for all sites and the Major Soil Resource Areas.

Location	Factor	No.	Cd	Cu	Zn	Pb	Ni	Fe	Mn
ALL SITES	CLAY	104	0.75***	0.70***	0.67***	0.58***	0.75***	0.81***	
	ORGANIC MATTER	104							
	pH	104	0.41***	0.39***	0.39***	0.28**	0.53***	0.46***	0.26*
	CEC	104	0.62***	0.62***	0.57***	0.53***	0.71***	0.55***	
BLACKLAND PRAIRIE	CLAY	12	0.69*					0.72**	
	ORGANIC MATTER	12				0.62*			0.82**
	pH	12	0.69*	0.82***	0.91***		0.89***	0.74**	
	CEC	12	0.77**				0.61*	0.61*	
COASTAL FLATWOODS	CLAY	7	0.89**		0.76*		0.90**		
	ORGANIC MATTER	9	0.87**	0.76*	0.95***	0.86**	0.78*		0.94***
	pH	9							
	CEC	9	0.87**	0.78*	0.93***	0.90***	0.78*		0.90***
DELTA	CLAY	21	0.78***	0.87***	0.76***	0.89***	0.74***	0.83***	
	ORGANIC MATTER	21	0.67***		0.65**	0.70***			
	pH	21							
	CEC	21	0.73***	0.78***	0.59**	0.72***	0.85***	0.71***	
LOESS	CLAY	17	0.49*			0.59*		0.58*	
	ORGANIC MATTER	17							
	pH	17							
	CEC	17							
LOWER COASTAL PLAIN	CLAY	21	0.54*	0.83***			0.59**	0.56**	
	ORGANIC MATTER	21							0.77***
	pH	21							
	CEC	21	0.57**	0.71***			0.54**		
UPPER COASTAL PLAIN	CLAY	24	0.41*					0.83***	
	ORGANIC MATTER	24				0.53**			
	pH	24	0.47*	0.67***	0.58**		0.62***		0.68***
	CEC	24							

*, **, ***Significant at the 0.05, 0.01, and 0.001 probability levels, respectively

Inclusion of the organic Croatan soil (Histosol) tended to skew the mean organic matter content for the area.

The only soils analyzed that had no detectable Cd concentrations were the two sandy Spodosol pedons in Jackson County, which were located about 29 miles apart at elevations of 15 and 100 feet, respectively. The mean heavy metal concentrations for the three depths analyzed were Fe>Ni>Pb>Mn>Zn>Cu>Cd.

Table 5. Clay and organic matter contents, pH, cation exchange capacity (CEC), and heavy metal concentrations in surface (A), subsoil (B), and deep subsoil (C) horizons in selected soils in the Blackland Prairie Soil Resource Area.

ELEMENT	HORIZON	N	MEAN	MINIMUM	MAXIMUM
CLAY (%)	A	4	38.7	30.7	43.8
	B	4	59.3	37.6	69.0
	C	4	64.4	49.2	80.1
ORGANIC MATTER (%)	A	4	5.6	1.7	10.9
	B	4	0.3	0.1	0.5
	C	4	0.4	0.11	0.9
pH	A	4	5.5	5.0	6.4
	B	4	5.7	4.8	7.7
	C	4	6.7	4.9	7.7
CEC ($cmol_c\ kg^{-1}$)	A	4	41.8	28.6	52.2
	B	4	44.7	31.6	51.6
	C	4	52.5	44.8	63.0
CADMIUM (ppm)	A	4	0.6	0.3	0.9
	B	4	0.7	0.5	0.9
	C	4	0.9	0.8	1.2
COPPER (ppm)	A	4	8.9	5.4	15.3
	B	4	10.1	5.9	15.8
	C	4	12.3	8.5	18.6
ZINC (ppm)	A	4	47.2	33.2	86.2
	B	4	58.5	35.3	103.8
	C	4	78.3	47.4	112.9
LEAD (ppm)	A	4	25.6	18.8	29.1
	B	4	22.4	15.5	25.6
	C	4	22.0	20.4	22.5
NICKEL (ppm)	A	4	17.9	12.2	27.6
	B	4	21.2	11.9	34.6
	C	4	27.1	17.0	38.2
IRON (ppm)	A	4	20,928.6	16,785.6	31,740.2
	B	4	27,888.4	15,910.1	37,628.5
	C	4	30,373.0	22,642.7	38,166.1
MANGANESE (ppm)	A	4	1,226.0	252.5	2,246.4
	B	4	284.4	24.0	543.4
	C	4	749.8	54.5	1,264.9

Delta. Soils in this area formed in Mississippi River Alluvium and they are generally considered the youngest soils in the state. A large proportion of this area contains clayey, montmorillonitic soils with high cation exchange capacities.

Average heavy metal concentrations were the highest in the state for Fe, Cd, Cu, Zn, Pb, and Ni (Table 7).

The metals were distributed uniformly with depth reflecting the young age and weathering stage of the

Table 6. Clay and organic matter contents, pH, cation exchange capacity (CEC), and heavy metal concentrations in surface (A), subsoil (B), and deep subsoil (C) horizons in selected soils in the Coastal Flatwoods Soil Resource Area.

Element	Horizon	N	Mean	Minimum	Maximum
CLAY (%)	A	2	2.3	2.0	2.6
	B	2	5.3	3.0	7.6
	C	3	5.7	0.5	14.7
ORGANIC MATTER (%)	A	3	33.9	4.9	83.7
	B	3	13.5	1.9	34.8
	C	3	0.7	0.0	1.8
pH	A	3	3.9	3.7	4.2
	B	3	4.1	4.0	4.3
	C	3	4.4	3.7	5.0
CEC ($cmol_c$ kg^{-1})	A	3	52.8	14.1	112.1
	B	3	28.9	12.3	59.0
	C	3	3.3	0.2	8.4
CADMIUM (ppm)	A	3	0.1	0.0	0.4
	B	3	0.1	0.0	0.3
	C	3	0.1	0.0	0.2
COPPER (ppm)	A	3	3.6	0.8	8.5
	B	3	5.2	0.4	9.7
	C	3	0.7	0.4	1.2
ZINC (ppm)	A	3	6.6	2.1	13.9
	B	3	3.7	1.6	7.4
	C	3	2.3	0.9	5.0
LEAD (ppm)	A	3	9.6	6.5	15.8
	B	3	7.6	3.5	15.6
	C	3	2.4	0.6	5.8
NICKEL (ppm)	A	3	9.4	3.7	20.5
	B	3	6.9	0.6	17.0
	C	3	5.3	0.2	15.1
IRON (ppm)	A	3	1,558.6	268.4	3,987.7
	B	3	1,451.2	20.2	3,652.7
	C	3	182.3	6.3	469.8
MANGANESE (ppm)	A	3	12.3	3.7	29.3
	B	3	2.4	0.6	3.6
	C	3	1.1	0.2	2.5

clayey, montmorillonitic sediments. Clay content and cation exchange capacity were significantly correlated with all the metals analyzed except Mn (Table 4). Organic matter content was correlated with Cd, Zn, and Pb. The r values were high (0.59 to 0.89) and related 35 to 79% of the metal distribution to clay, cation exchange capacity, and organic matter content. The mean heavy metal concentrations for the three depths analyzed were Fe>Mn>Zn>Ni>Cu>Pb>Cd.

Table 7. Clay and organic matter contents, pH, cation exchange capacity (CEC), and heavy metal concentrations in surface (A), subsoil (B), and deep subsoil (C) horizons in selected soils in the Delta Soil Resource Area.

Element	Horizon	N	Mean	Minimum	Maximum
CLAY (%)	A	7	60.4	20.6	77.2
	B	7	60.8	23.4	84.2
	C	7	48.8	7.7	86.5
ORGANIC MATTER (%)	A	7	3.1	0.9	5.9
	B	7	0.8	0.3	1.6
	C	7	0.4	0.1	0.7
pH	A	7	4.9	4.2	5.5
	B	7	5.1	4.1	6.8
	C	7	7.1	5.7	8.1
CEC ($cmol_c$ kg^{-1})	A	7	45.7	17.1	57.7
	B	7	45.8	23.5	63.6
	C	7	51.9	14.1	89.5
CADMIUM (ppm)	A	7	1.1	0.3	2.0
	B	7	0.7	0.2	1.1
	C	7	0.7	0.1	1.3
COPPER (ppm)	A	7	29.8	13.1	45.5
	B	7	28.0	17.3	39.2
	C	7	24.8	11.8	36.3
ZINC (ppm)	A	7	127.0	44.3	197.8
	B	7	92.2	62.0	129.3
	C	7	78.6	42.5	117.3
LEAD (ppm)	A	7	30.3	13.1	37.5
	B	7	23.7	12.2	31.5
	C	7	20.6	10.8	29.9
NICKEL (ppm)	A	7	34.8	17.0	51.3
	B	7	37.4	21.7	51.6
	C	7	40.1	23.9	64.9
IRON (ppm)	A	7	25,150.0	12,595.8	29,631.9
	B	7	30,787.7	16,625.9	44,380.3
	C	7	24,442.3	12,278.1	44,178.2
MANGANESE (ppm)	A	5	5552.6	331.9	785.0
	B	5	340.4	69.3	889.0
	C	5	571.3	346.3	794.0

Loess. Soils in this area formed in thick, unweathered deposits of wind-blown, silty sediments rich in weatherable minerals. The Peoria Loess parent material, while older than the Delta parent material, is younger than the other soil resource areas. Metal concentrations were highest in the subsoil because of pedogenic accumulation of clay and unweathered parent material (Table 8). Cadmium, Pb, and Fe were correlated with clay content (Table 4). The r values were low, relating only 24 to 35% of the metal con-

Table 8. Clay and organic matter contents, pH, cation exchange capacity (CEC), and heavy metal concentrations in surface (A), subsoil (B), and deep subsoil (C) horizons in selected soils in the Loess Soil Resource Area.

Element	Horizon	N	Mean	Minimum	Maximum
CLAY (%)	A	6	12.8	8.4	19.0
	B	6	30.6	17.8	46.7
	C	5	31.0	11.5	47.0
ORGANIC MATTER (%)	A	6	2.6	1.5	5.0
	B	6	0.5	0.2	1.0
	C	5	0.2	0.0	0.5
pH	A	6	5.2	4.2	6.5
	B	6	5.0	4.3	5.2
	C	5	6.4	5.7	7.7
CEC ($cmol_c\ kg^{-1}$)	A	6	14.0	9.3	18.8
	B	6	21.3	12.1	36.1
	C	5	26.2	10.5	38.6
CADMIUM (ppm)	A	6	0.4	0.3	0.5
	B	6	0.6	0.3	0.9
	C	5	0.7	0.5	1.0
COPPER (ppm)	A	6	7.0	4.2	10.7
	B	6	15.2	6.9	23.3
	C	5	14.1	8.9	22.7
ZINC (ppm)	A	6	24.8	13.8	34.5
	B	6	50.5	31.6	76.6
	C	5	39.4	29.2	57.0
LEAD (ppm)	A	6	17.9	11.8	21.0
	B	6	20.4	15.1	24.1
	C	5	19.3	13.3	26.8
NICKEL (ppm)	A	6	11.8	4.6	16.9
	B	6	21.3	11.7	29.2
	C	5	26.8	16.9	48.4
IRON (ppm)	A	6	10,238.6	7,698.3	15,868.3
	B	6	22,215.6	13,887.5	28,227.8
	C	5	21,074.1	17,425.8	26,878.6
MANGANESE (ppm)	A	5	669.2	152.6	1,141.5
	B	5	987.8	71.5	3,269.9
	C	4	876.6	210.0	1,965.8

centrations to clay content. The mean heavy metal concentrations for the three depths analyzed were Fe > Mn > Zn > Ni > Cu > Pb > Cd.

Lower Coastal Plain. Soils in this area formed in weathered, stratified deposits of sand, silt, clay, and gravels, and exhibit mature pedogenic development. Cation exchange capacity tends to parallel clay distribution reflecting pedogenic development (Table 9). Zinc, Pb, and Mn concentrations were highest in sur-

Table 9. Clay and organic matter contents, pH, cation exchange capacity (CEC), and heavy metal concentrations in surface (A), subsoil (B), and deep subsoil (C) horizons in selected soils in the Lower Coastal Plain Soil Resource Area.

Element	Horizon	N	Mean	Minimum	Maximum
CLAY (%)	A	7	4.9	2.5	7.6
	B	7	24.6	6.2	49.9
	C	7	26.9	5.3	46.2
ORGANIC MATTER (%)	A	7	2.6	1.7	3.6
	B	7	0.3	0.1	0.6
	C	7	0.1	0.0	0.5
pH	A	7	5.1	4.3	6.1
	B	7	5.0	4.4	5.5
	C	7	4.9	4.3	5.4
CEC ($cmol_c\ kg^{-1}$)	A	7	9.2	7.3	13.2
	B	7	13.3	3.6	37.1
	C	7	17.0	1.9	34.4
CADMIUM (ppm)	A	7	0.3	0.2	0.4
	B	7	0.3	0.1	0.6
	C	7	0.3	0.0	0.6
COPPER (ppm)	A	7	3.3	1.9	5.2
	B	7	6.3	2.7	10.3
	C	7	5.1	2.0	8.2
ZINC (ppm)	A	7	33.9	3.6	183.2
	B	7	14.6	7.7	28.6
	C	7	12.8	2.3	26.0
LEAD (ppm)	A	7	18.4	4.4	65.8
	B	7	10.3	4.4	16.7
	C	7	8.7	4.8	11.6
NICKEL (ppm)	A	7	7.6	1.5	16.0
	B	7	13.1	6.9	20.6
	C	7	11.1	2.8	20.9
IRON (ppm)	A	7	4,415.3	1,686.1	8,048.7
	B	7	11,964.4	3,685.8	18,145.0
	C	7	12,203.4	3,612.9	31,949.1
MANGANESE (ppm)	A	6	243.2	84.8	406.7
	B	6	22.1	6.1	33.1
	C	6	20.5	10.5	33.5

Table 10. Clay and organic matter contents, pH, cation exchange capacity (CEC), and heavy metal concentrations in surface (A), subsoil (B), and deep subsoil (C) horizons in selected soils in the Upper Coastal Plain Soil Resource Area.

Element	Horizon	N	Mean	Minimum	Maximum-
CLAY (%)	A	8	7.4	5.1	13.9
	B	8	26.6	6.9	58.2
	C	8	20.1	7.1	44.7
ORGANIC MATTER (%)	A	8	4.0	1.8	6.1
	B	8	0.9	0.2	4.1
	C	8	0.4	0.0	1.6
pH	A	8	4.9	5.0	4.9
	B	8	4.0	4.1	4.2
	C	8	5.9	5.8	5.5
CEC ($cmol_c$ kg^{-1})	A	8	12.9	15.6	14.3
	B	8	7.9	8.5	3.4
	C	8	17.7	45.7	34.2
CADMIUM (ppm)	A	8	0.4	0.2	1.0
	B	8	0.6	0.4	0.9
	C	8	0.5	0.2	0.8
COPPER (ppm)	A	8	5.6	1.5	22.0
	B	8	10.6	5.7	26.1
	C	8	7.0	2.5	24.3
ZINC (ppm)	A	8	23.7	7.5	114.1
	B	8	27.2	10.9	70.4
	C	8	21.0	2.1	88.6
LEAD (ppm)	A	8	18.5	7.0	25.3
	B	8	13.5	8.8	19.2
	C	8	9.2	5.8	17.4
NICKEL (ppm)	A	8	8.2	2.5	30.8
	B	8	13.5	5.4	20.5
	C	8	9.2	3.6	21.4
IRON (ppm)	A	8	6,228.8	3,667.7	9,011.8
	B	8	17,155.8	9,333.7	28,751.6
	C	8	13,715.7	4,726.7	35,916.3
MANGANESE (ppm)	A	6	1,282.7	20.3	6,211.2
	B	6	816.5	12.3	4,597.5
	C	6	569.6	4.1	3,203.4

face horizons. Elevated Zn and Pb concentrations in the surface horizon of the Eustis soil in Hancock County are attributed to anthropogenic additions (Appendix Table 32). Cadmium, Cu, Ni, and Fe levels increased with depth suggesting they become more closely associated with clay content as pedogenesis and clay illuviation occur. Clay content and cation exchange capacity were significantly correlated with Cd, Cu, and Ni; and organic matter content was correlated with Mn (Table 4). The r values were low, relating about 29 to 69% of the metal distribution to clay content, organic matter content, and/or cation exchange capacity. Mean heavy metal concentrations for the depths analyzed were Fe > Mn > Zn > Pb > Ni > Cu > Cd.

Upper Coastal Plain. Soils in this area formed in weathered, stratified deposits of sand, silt, clay, and gravels in several geologic formations. The soils exhibit mature pedogenic development. Distribution of metals was similar to the Lower Coastal Plain and the highest concentrations of all except Pb and Mn occurred in the subsoil (Table 10) reflecting age, weathering and pedogenic development. Cadmium and Fe were correlated with clay content, Pb with organic matter, and Cd, Cu, Zn, Ni, and Mn with pH (Table 4). There were no significant correlations with cation exchange capacity. The r values were low, relating about 17 to 69% of the heavy metal distribution to clay, organic matter, and pH. Mean heavy metal concentrations for these depths analyzed were Fe > Mn > Zn > PB > Ni > Cu > Cd.

The soil from the archaeological site in Itawamba County (Appendix Table 39) was used as a habitation site by early man from at least 5,000 years before present until it reverted to forest about 300 years ago based on radiocarbon and archaeomagnetic dates, and time-diagnostic artifact assemblages (Pettry and Bense, 1989). The soil showed evidence of enrichment with Zn, Cu, and Ni in all three depths sampled, and Pb in the surface horizon, compared to natural soils in the area. However, the apparent elevated anthropogenic heavy metal concentrations caused by 5,000 years habitation before the modern era are lower than natural soil levels in the Delta and similar to levels in the Blackland Prairie and Loess.

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APPENDIX

Selected Properties and Heavy Metal Concentrations in Representative Mississippi Soils

(Tables 11-45)

Table 11. Selected properties and heavy metal concentrations of Pelahatchie silt loam, Blackland Prairie Region.

Soil: Pelahatchie
Classification: fine-silty, mixed thermic Aquic Hapludalfs
Location: Rankin County; Blackland Prairie
Landscape Position: Uplands
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches		%			%		$cmol_c kg^{-1}$
0-4	3.5	77.5	19.0	silt loam	2.3	5.0	18.8
21-29	1.2	52.1	46.7	silty clay	1.0	5.1	36.1
29-43	0.8	53.4	45.8	silty clay	0.5	5.7	37.6

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches				$\mu g\ g^{-1}$ (ppm)			
0-4	0.5	4.2	17.4	19.5	9.1	10,908	179
21-29	0.7	6.9	31.6	23.5	16.6	19,510	87
29-43	0.8	9.3	35.4	26.8	19.7	20;504	210

Table 12. Selected properties and heavy metal concentrations of Okolona silty clay, Blackland Prairie Region.

Soil: Okolona
Classification: fine, montmorillonitic, thermic Typic Chromuderts
Location: Monroe County; Blackland Prairie
Landscape Position: Upland
Land Use: Pasture Plots

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches		%			%		$cmol_c kg^{-1}$
0-10	3.6	52.7	43.7	Silty Clay	2.8	6.4	43.3
30-40	2.7	35.4	61.9	Clay	0.5	7.7	51.6
60-70	3.0	35.1	61.9	Clay	0.1	7.7	51.2

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches				$\mu g\ g^{-1}$ (ppm)			
0-10	0.9	15.3	86.2	26.6	27.6	31,740	452
30-40	0.9	15.7	103.8	24.6	34.6	37,628	543
60-70	1.2	18.6	112.9	22.5	38.2	38,166	1264

Table 13. Selected properties and heavy metal concentrations of Kipling Variant silty clay loam, Blackland Prairie Region.

Soil: Kipling Variant
Classification: fine, montmorillonitic, thermic Vertic Hapludalfs
Location: Smith County; Blackland Prairie
Landscape Position: Upland
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	----	%	----		%		$cmol_c kg^{-1}$
0-4	8.4	55.0	36.6	silty clay loam	7.1	5.0	42.9
31-40	4.9	26.3	68.8	clay	0.4	5.0	47.6
53-74	1.8	18.1	80.1	clay	0.2	7.6	63.0

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches	----	----	----	$\mu g\ g^{-1}$ (ppm)	----	----	----
0-4	0.4	6.8	34.8	29.0	15.8	18,036	1,952
31-40	0.9	10.0	51.0	24.0	18.7	33,146	430
53-74	1.0	12.9	100.5	22.5	26.8	32,234	488

Table 14. Selected properties and heavy metal concentrations of Louin silty clay, Blackland Prairie Region.

Soil: Louin
Classification: fine, montmorillonitic, thermic Aquentic Chromuderts
Location: Smith County; Blackland Prairie
Landscape Position: Upland
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	----	%	----		%		$cmol_c kg^{-1}$
0-3	4.8	51.4	43.8	silty clay	10.9	5.6	52.2
19-49	1.6	29.4	69.0	clay	0.1	4.8	47.9
49-67	2.3	31.3	66.3	clay	0.9	6.6	50.8

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches	----	----	----	$\mu g\ g^{-1}$ (ppm)	----	----	----
0-3	0.8	8.0	33.2	28.0	15.8	16,785	2,246
19-49	0.7	8.5	44.0	25.6	19.4	24,859	139
49-67	0.7	9.0	52.4	22.5	26.5	28,488	1,191

Table 15. Selected properties and heavy metal concentrations of Vaiden Variant silty clay loam, Blackland Prairie Region.

Soil: Vaiden Variant
Classification: fine, montmorillionitic, thermic Vertic Hapludalfs
Location: Monroe County; Blackland Prairie
Landscape Position: Upland
Land Use: Pasture

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches		%			%		$cmol_c kg^{-1}$
0-10	17.7	51.6	30.7	silty clay loam	1.7	5.1	28.6
30-40	11.8	50.6	37.6	silty clay loam	0.2	5.3	31.6
60-70	7.0	43.8	49.2	silty clay	0.2	4.9	44.8

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches				$\mu g\ g^{-1}$ (ppm)			
0-10	0.3	5.4	34.7	18.8	12.2	17,152	252
30-40	0.5	5.9	35.3	15.5	11.9	15,920	24
60-70	0.8	8.5	47.4	20.4	17.0	22,642	54

Table 16. Selected properties and heavy metal concentrations of Croatan peat, Coastal Flatwoods Region.

Soil: Croatan
Classification: loamy, siliceous, dysic, thermic Terric Medisaprists
Location: Jackson County; Coastal Flatwoods
Landscape Position: Swamp
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches		%			%		$cmol_c kg^{-1}$
0-8				peat	83.7	4.2	112.1
8-16				peat	48.8	4.1	59.0
50-56	21.1	64.2	14.7	silt loam	1.8	3.7	8.4

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches				$\mu g\ g^{-1}$ (ppm)			
0-8	0.3	8.5	13.8	15.8	20.5	3,988	29
8-16	0.3	9.7	7.4	15.6	17.0	681	4
50-56	0.1	1.2	5.0	5.8	15.1	470	2

Table 17. Selected properties and heavy metal concentrations of Leon sand, Coastal Flatwoods Region Site 1.

Soil: Leon
Classification: sandy, siliceous, thermic, Aeric Alaquods
Location: Jackson County; Coastal Flatwoods
Landscape Position: Flatwoods Drain
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches		%			%		$cmol_c kg^{-1}$
0-5	90.2	7.8	2.0	sand	4.8	3.7	14.1
11-21	82.7	9.7	7.6	loamy sand	1.9	4.3	12.3
57-72	98.0	0.0	2.0	sand	0.3	4.4	1.2

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches				$\mu g\ g^{-1}$ (ppm)			
0-5	nd	1.6	3.7	6.5	4.0	420	4.0
11-21	nd	5.5	2.2	3.8	3.0	3,653	3.0
57-72	nd	0.6	1.1	0.8	0.5	71	0.5

nd - Below detection limits

Table 18. Selected properties and heavy metal concentrations of Leon sand, Coastal Flatwoods Region Site 2.

Soil: Leon
Classification: sandy, siliceous, thermic Aeric Alaquods
Location: Jackson County; Coastal Flatwoods
Landscape Position: Flatwoods
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches		%			%		$cmol_c kg^{-1}$
0-5	86.6	10.8	2.6	sand	13.3	3.7	32.2
11-15	90.4	6.6	3.0	sand	3.7	4.0	15.3
46-60	98.2	1.3	0.5	sand	0.0	5.0	0.2

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches				$\mu g\ g^{-1}$ (ppm)			
0-5	nd	0.8	2.1	6.5	3.7	268	3.0
11-15	nd	0.3	1.6	3.5	0.6	20	0.6
46-60	nd	0.4	0.8	0.6	0.2	6	0.2

nd - Below detection limits

Table 19. Selected properties and heavy metal concentrations of Alligator clay, Delta Region Site 1.

Soil: Alligator
Classification: very-fine, montmorillonitic, acid, thermic Vertic Haplaquepts
Location: Leflore County; Delta
Landscape Position: Terrace
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	----------------	%	----------------		%		$cmol_c kg^{-1}$
0-5	3.7	28.6	67.7	clay	5.9	4.6	52.7
21-30	1.1	14.7	84.2	clay	0.9	4.6	56.5
50-60	6.3	23.1	70.6	clay	0.4	7.0	89.5

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches	----------------	----------------	----------------	$\mu g\ g^{-1}$ (ppm)	----------------	----------------	----------------
0-5	1.4	24.4	105.2	34.0	32.8	24,424	574
21-30	0.9	25.4	79.6	28.0	34.4	43,406	69
50-60	1.3	33.6	96.9	25.7	64.9	26,438	702

Table 20. Selected properties and heavy metal concentrations of Alligator clay, Delta Region Site 2.

Soil: Alligator
Classification: very-fine, montmorillonitic, acid, thermic Vertic Haplaquepts
Location: Holmes County; Delta
Landscape Position: Terrace
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	----------------	%	----------------		%		$cmol_c kg^{-1}$
0-6	4.3	35.7	60.0	clay	2.5	4.3	45.4
30-40	5.6	35.3	59.1	clay	0.5	4.9	46.7
72-82	7.3	53.0	39.7	silty clay loam	0.3	8.0	35.7

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches	----------------	----------------	----------------	$\mu g\ g^{-1}$ (ppm)	----------------	----------------	----------------
0-6	0.6	25.7	127.2	30.1	26.0	28,471	635
30-40	0.3	32.3	93.3	22.5	30.3	27,321	889
72-82	0.4	26.3	82.1	18.3	34.6	22,781	794

Table 21. Selected properties and heavy metal concentrations of Sharkey clay, Delta Region Site 1.

Soil: Sharkey
Classification: very-fine, montmorillonitic, non-acid, thermic Vertic Haplaquepts
Location: Washington County; Delta
Landscape Position: Terrace
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches		%			%		$cmol_c kg^{-1}$
0-5	2.1	20.7	77.2	clay	3.7	5.0	57.4
30-40	1.4	35.4	63.2	clay	0.7	6.8	50.6
50-60	2.0	17.4	80.6	clay	0.7	7.5	77.4

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches				$\mu g\ g^{-1}$ (ppm)			
0-5	1.9	43.6	187.8	32.1	45.7	28,703	785
30-40	1.0	28.8	99.8	25.7	49.5	44,380	525
50-60	1.1	32.4	117.3	29.7	44.7	44,178	593

Table 22. Selected properties and heavy metal concentrations of Sharkey clay, Delta Region Site 2.

Soil: Sharkey
Classification: very-fine, montmorillonitic, non-acid, thermic Vertic Haplaquepts
Location: Washington County; Delta
Landscape Position: Terrace
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches		%			%		$cmol_c kg^{-1}$
0-5	2.4	23.1	74.5	clay	3.0	5.5	57.7
20-30	2.4	14.2	83.4	clay	1.6	5.2	63.5
60-70	23.5	35.5	41.0	clay	0.2	7.4	53.8

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches				$\mu g\ g^{-1}$ (ppm)			
0-5	1.5	34.2	153.3	37.5	50.0	29,632	–
20-30	1.1	39.2	129.3	31.5	50.0	33,389	–
60-70	0.6	20.7	50.0	18.8	37.6	22,187	–

– not determined

Table 23. Selected properties and heavy metal concentrations of Sharkey clay, Delta Region Site 3.

Soil: Sharkey
Classification: very-fine, montmorillonitic, non-acid, thermic Vertic Haplaquepts
Location: Washtington County; Delta
Landscape Position: Terrace
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	---	%	---		%		$cmol_c kg^{-1}$
0-5	2.1	20.7	77.2	clay	3.4	5.0	57.4
25-30	1.4	21.4	77.2	clay	1.3	5.1	54.6
60-70	3.2	10.2	86.6	clay	0.6	7.5	77.5

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches				$\mu g\ g^{-1}$ (ppm)			
0-5	1.9	45.5	197.8	35.4	51.3	28,118	–
25-30	0.9	33.1	116.5	30.0	51.6	32,802	–
60-70	1.0	36.3	115.0	29.9	48.1	29,989	–

– not determined

Table 24. Selected properties and heavy metal concentrations of Dundee loam, Delta Region.

Soil: Dundee
Classification: fine-silty, mixed, thermic Aeric Ochraqualfs
Location: Leflore County; Delta
Landscape Position: Terrace
Land Use: Cultivation

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	---	%	---		%		$cmol_c kg^{-1}$
0-8	35.0	44.5	20.5	loam	0.9	5.5	17.1
26-38	40.2	36.4	23.4	loam	0.3	4.1	23.5
55-70	40.0	52.4	7.6	silt loam	0.1	6.2	15.3

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches				$\mu g\ g^{-1}$ (ppm)			
0-8	0.3	13.1	44.3	13.1	17.0	12,596	437
26-38	0.2	17.3	64.9	12.2	24.0	16,626	90
55-70	0.1	11.8	42.5	10.7	27.0	12,278	422

Table 25. Selected properties and heavy metal concentrations of Tensas silty clay, Delta Region.

Soil: Tensas
Classification: fine, montmorillonitic, thermic Vertic Ochraqualfs
Location: Leflore County; Delta
Landscape Position: Terrace
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	%				%		$cmol_c kg^{-1}$
0-7	6.8	47.9	45.3	silty clay	2.0	4.2	32.2
13-35	31.0	33.7	35.3	clay loam	0.3	4.8	25.1
71-83	38.0	46.5	15.5	loam	0.1	5.7	14.1

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches	$\mu g\ g^{-1}$ (ppm)						
0-7	0.3	21.9	73.4	30.0	20.7	24,106	332
13-35	0.2	19.8	62.0	16.2	21.7	17,588	129
71-83	0.1	12.3	45.9	11.1	23.9	13,243	346

Table 26. Selected properties and heavy metal concentrations of Ariel silt, Loessial Region.

Soil: Ariel
Classification: coarse-silty, mixed, thermic Fluventic Dystrochrepts
Location: Franklin County; Loess
Landscape Position: Terrace
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	%				%		$cmol_c kg^{-1}$
0-8	3.6	85.8	10.6	silt	1.8	4.2	12.7
28-38	3.6	67.3	29.1	silty clay loam	0.9	4.3	20.1

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches	$\mu g\ g^{-1}$ (ppm)						
0-8	0.3	7.0	33.7	17.5	16.9	7,698	1,141
28-38	0.3	11.8	50.4	18.6	24.9	13,887	3,270

Table 27. Selected properties and heavy metal concentrations of Byram silt loam, Loessial Region.

Soil: Byram
Classification: fine-silty, mixed, thermic Typic Fragiudalfs
Location: Madison County; Loess
Landscape Position: Upland
Land Use: Pasture

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	%				%		$cmol_c kg^{-1}$
0-5	3.2	78.7	18.1	silt loam	1.5	5.6	14.6
20-30	1.7	80.5	17.8	silt loam	0.2	4.9	12.1
56-72	1.1	51.9	47.0	silty clay	0.2	6.8	38.6

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches	$\mu g\ g^{-1}$ (ppm)						
0-5	0.5	10.7	26.2	17.5	14.1	15,868	754
20-30	0.7	19.4	51.2	20.2	22.6	28,228	704
56-72	0.6	8.9	31.6	23.6	24.3	22,950	594

Table 28. Selected properties and heavy metal concentrations of Deerford silt, Loessial Region.

Soil: Deerford
Classification: fine-silty, mixed, thermic, albic Glossic Natraqualfs
Location: Attala County; Loess
Landscape Position: Terrace
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	%				%		$cmol_c kg^{-1}$
0-7	4.2	84.1	11.7	silt	1.5	6.5	9.3
11-28	2.8	64.5	32.7	silty clay loam	0.4	5.1	25.0
28-36	4.8	66.2	29.0	silty clay loam	0.2	6.2	30.8

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches	$\mu g\ g^{-1}$ (ppm)						
0-7	0.3	6.0	13.8	11.8	4.6	38,498	153
11-28	0.6	14.5	38.0	15.0	11.7	20,766	71
28-36	1.0	22.7	57.0	18.3	48.4	26,879	1,966

Table 29. Selected properties and heavy metal concentrations of Lexington silt, Loessial Region.

Soil: Lexington
Classification: fine-silty, mixed, thermic Typic Paleudalfs
Location: Marshall County; Loess
Landscape Position: Upland
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches		%			%		$cmol_c kg^{-1}$
0-2	9.9	81.7	8.4	silt	5.0	5.1	14.6
12-38	2.0	68.2	29.8	silty clay loam	0.3	5.2	14.8
54-62	11.7	66.5	21.8	silt loam	0.1	5.8	10.5

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches				$\mu g\ g^{-1}$ (ppm)			
0-2	0.4	5.1	23.0	20.9	10.1	8,701	1,119
12-38	0.7	15.5	55.3	21.2	22.7	24,830	807
54-62	0.5	12.3	29.2	13.3	16.9	17,425	737

Table 30. Selected properties and heavy metal concentrations of Loring silt, Loessial Region.

Soil: Loring
Classification: fine-silty, mixed, thermic Typic Fragiudalfs
Location: Grenada County; Loess
Landscape Position: Upland
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches		%			%		$cmol_c kg^{-1}$
0-3	5.2	85.8	9.0	silt	3.3	4.8	13.8
17-26	1.9	71.0	27.3	silt loam	0.3	5.2	19.6
93	1.2	87.3	11.5	silt	0.0	7.6	13.5

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches				$\mu g\ g^{-1}$ (ppm)			
0-3	0.5	8.7	34.5	19.9	15.7	9,758	–
17-26	0.8	23.3	76.6	24.1	29.2	26,071	–
93	0.7	17.1	43.8	14.4	24.8	17,611	–

– not determined

Table 31. Selected properties and heavy metal concentrations of Bassfield sandy loam, Lower Coastal Plain Region.

Soil: Bassfield
Classification: coarse-loamy, siliceous, thermic Typic Hapludults
Location: Forrest County; Lower Coastal Plain
Landscape Position: Upland Terrace
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches		%			%		$cmol_c kg^{-1}$
0-4	55.0	39.4	5.6	sandy loam	3.6	5.5	11.3
13-23	43.0	38.1	18.9	loam	0.3	5.0	8.5
33-40	59.8	31.1	9.1	sandy loam	0.1	5.1	3.4

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches				$\mu g\ g^{-1}$ (ppm)			
0-4	0.3	3.9	10.5	16.9	5.1	5,011	632
13-23	0.5	6.3	14.7	9.7	10.0	12,872	68
33-40	0.2	4.0	7.7	5.8	5.8	6,576	18

Table 32. Selected properties and heavy metal concentrations of Eustis loamy sand, Lower Coastal Plain Region.

Soil: Eustis
Classification: sandy, siliceous, thermic Psammentic Paleudults
Location: Hancock County; Lower Coastal Plain
Landscape Position: Upland
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches		%			%		$cmol_c kg^{-1}$
0-6	82.8	13.1	4.0	loamy sand	2.7	5.5	7.5
26-44	83.5	10.3	6.2	loamy sand	0.6	5.5	3.6
68-73	85.8	8.9	5.3	loamy sand	0.5	5.0	2.5

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches				$\mu g\ g^{-1}$ (ppm)			
0-6	0.2	5.2	183.2	65.8	16.0	3,459	335
26-44	0.1	1.7	13.0	4.4	12.2	3,686	19
68-73	0.0	1.9	10.9	4.8	11.0	4,050	21

Table 33. Selected properties and heavy metal concentrations of Petal loamy sand, Lower Coastal Plain Region Site 1.

Soil: Petal
Classification: fine-loamy, siliceous, thermic Typic Paleudalfs
Location: Forrest County; Lower Coastal Plain
Landscape Position: Upland
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	---------%		---------		%		$cmol_c kg^{-1}$
0-4	74.0	23.5	2.5	loamy sand	1.7	4.4	7.2
17-26	47.5	29.1	23.4	loam	0.4	4.3	12.3
40-60	4.7	49.4	45.9	silty clay	0.0	4.3	34.4

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches	----------			$\mu g\ g^{-1}$ (ppm)			----------
0-4	0.2	1.9	3.6	4.4	1.5	1,686	85
17-26	0.5	4.5	9.3	8.2	7.2	12,477	12
40-60	0.6	7.0	16.8	9.6	11.8	18,424	19

Table 34. Selected properties and heavy metal concentrations of Petal silt loam, Lower Coastal Plain Region Site 2.

Soil: Petal
Classification: fine-loamy, siliceous, thermic Typic Paleudalfs
Location: Simpson County; Lower Coastal Plain
Landscape Position: Upland
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	---------%		---------		%		$cmol_c kg^{-1}$
0-4	45.5	50.5	4.0	silt loam	2.2	5.5	8.0
18-26	48.6	25.5	25.9	sandy clay loam	0.2	5.1	14.0
48-60	8.8	45.0	46.2	silty clay	0.1	4.3	30.6

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches	----------			$\mu g\ g^{-1}$ (ppm)			----------
0-4	0.2	3.4	14.8	10.0	15.2	4,179	325
18-26	0.1	6.5	9.6	9.4	17.3	7,732	6
48-60	0.2	7.0	18.8	9.2	15.6	6,091	10

Table 35. Selected properties and heavy metal concentrations of Susquehanna silt loam, Lower Coastal Plain Region.

Soil: Susquehanna
Classification: fine,montmorillonitic, thermic Vertic Paleudalfs
Location: Forrest County; Lower Coastal Plain
Landscape Position: Upland
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches		%			%		$cmol_c kg^{-1}$
0-3	33.2	60.5	6.3	silt loam	2.0	4.9	7.9
17-27	10.8	39.3	49.9	clay	0.2	4.9	37.1
55-60	14.2	44.4	41.4	silty clay	0.1	5.3	32.6

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches				$\mu g\ g^{-1}$ (ppm)			
0-3	0.3	3.1	8.4	11.9	5.5	8,048	407
17-27	0.6	10.2	28.6	13.0	19.2	17,180	30
55-60	0.6	8.2	26.0	11.0	20.9	9,810	33

Table 36. Selected properties and heavy metal concentrations of Smithdale sandy loam, Lower Coastal Plain Region Site 1

Soil: Smithdale
Classification: fine-loamy, siliceous, thermic Typic Hapludults
Location: Prentiss County; Lower Coastal Plain
Landscape Position: Upland
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches		%			%		$cmol_c kg^{-1}$
0-6	66.6	29.6	3.8	sandy loam	2.7	6.1	7.9
23-38	65.9	12.6	21.5	sandy clay loam	0.1	5.3	9.5
52-64	71.4	5.4	23.1	sandy clay loam	0.1	5.4	12.2

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches				$\mu g\ g^{-1}$ (ppm)			
0-6	0.2	1.9	7.6	8.7	3.2	3,289	119
23-38	0.4	5.2	11.5	9.2	8.0	14,508	32
52-64	0.6	5.0	8.1	9.5	7.2	31,949	17

Table 37. Selected properties and heavy metal concentrations of Smithdale loam, Lower Coastal Plain Region Site 2.

Soil: Smithdale
Classification: fine-loamy, siliceous, thermic Typic Hapludults
Location: Amite County; Lower Coastal Plains
Landscape Position: Upland
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	--------%	--------			%		$cmol_c kg^{-1}$
0-5	51.5	41.0	7.6	loam	3.5	4.2	12.6
33-56	69.6	12.0	18.4	sandy loam	0.1	4.5	6.1
80-85	86.5	6.0	7.5	loamy sand	0.0	4.6	1.8

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches	---------------	---------------	---------------	$\mu g\ g^{-1}$ (ppm)	---------------	---------------	---------------
0-5	0.3	4.4	12.6	13.0	4.6	5,821	188
33-56	0.1	6.0	7.7	11.3	6.9	10,020	33
80-85	0.0	2.2	2.2	4.9	2.7	3,612	21

Table 38. Selected properties and heavy metal concentrations of Savannah silt loam, Lower Coastal Region.

Soil: Savannah
Classification: fine-loamy, siliceous, thermic Typic Fragiudults
Location: Wathall County; Lower Coastal Plain
Landscape Position: Upland
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	--------%	--------			%		$cmol_c kg^{-1}$
0-4	34.0	60.1	5.9	silt loam	3.6	5.0	13.2
8-18	21.7	51.3	27.0	clay loam	0.2	5.4	10.8
73	75.4	5.6	19.0	sandy loam	0.0	5.4	5.1

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches	---------------	---------------	---------------	$\mu g\ g^{-1}$ (ppm)	---------------	---------------	---------------
0-4	0.4	3.3	7.0	15.3	7.3	4,421	–
8-18	0.6	10.3	22.7	16.7	20.6	18,145	–
73	0.4	4.4	6.8	11.6	8.6	11,485	–

– not determined

Table 39. Selected properties and heavy metal concentrations of Anthrosol sandy loam, Upper Coastal Plain Region.

Soil: Anthrosol
Classification: sandy, siliceous, thermic Typic Fluvaquents
Location: Itawamba County; Upper Coastal Plain
Landscape Position: Floodplain
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	%				%		$cmol_c kg^{-1}$
0-4	66.9	27.4	5.7	sandy loam	2.7	5.9	17.7
8-12	62.4	30.8	6.8	sandy loam	0.7	5.8	11.2
40-44	64.3	28.6	7.1	sandy loam	1.0	5.5	17.2

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches	$\mu g\ g^{-1}$ (ppm)						
0-4	0.9	22.0	114.1	22.6	30.8	9,012	6,211
8-12	0.5	26.1	70.4	11.0	20.5	9,333	4,597
40-44	0.8	24.3	88.6	9.9	21.4	8,687	3,203

Table 40. Selected properties and heavy metal concentrations of Arundel sandy loam, Upper Coastal Plain Region.

Soil: Arundel
Classification: clayey, montmorillonitic, thermic Typic Hapludults
Location: Lauderdale County; Upper Coastal Plain
Landscape Position: Upland
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	%				%		$cmol_c kg^{-1}$
0-4	67.7	25.9	6.4	sandy loam	4.0	4.3	15.4
10-30	15.1	26.7	58.2	clay	0.8	4.1	45.6
40-45	29.4	45.1	25.5	loam	0.4	4.2	30.5

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches	$\mu g\ g^{-1}$ (ppm)						
0-4	0.2	1.5	8.1	25.3	2.5	5,026	20
10-30	0.5	5.9	20.9	8.8	9.5	20,257	12
40-45	0.4	4.3	23.1	6.2	6.6	9,046	4

Table 41. Selected properties and heavy metal concentrations of Atwood silt loam, Upper Coastal Plain Region.

Soil: Atwood
Classification: fine-silty, mixed, thermic Typic Paleudalfs
Location: Pontotoc County; Upper Coastal Plain
Landscape Position: Upland
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	---%	---	---		%		$cmol_c kg^{-1}$
0-1	20.6	70.2	9.2	silt loam	5.7	5.2	12.9
11-49	16.0	48.6	35.4	silty clay loam	0.4	5.5	13.3
57-66	37.8	34.8	27.4	clay loam	0.1	5.2	6.7

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches	---$\mu g\ g^{-1}$ (ppm)---						
0-1	0.4	3.8	12.9	18.7	6.4	8,483	648
11-49	0.9	13.8	39.0	19.1	19.7	28,752	158
57-66	0.6	5.9	16.4	10.1	10.6	18,039	147

Table 42. Selected properties and heavy metal concentrations of Ora silt loam, Upper Coastal Plain Region.

Soil: Ora
Classification: fine-loamy, siliceous, thermic Typic Fragiudults
Location: Winston County; Upper Coastal Plain
Landscape Position: Upland
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	---%	---	---		%		$cmol_c kg^{-1}$
0-2	32.0	62.9	5.1	silt loam	6.1	4.7	16.1
10-20	19.2	51.7	29.1	silty clay loam	0.5	5.1	14.4
71	66.7	9.3	24.0	sandy clay loam	0.0	5.1	7.9

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches	---$\mu g\ g^{-1}$ (ppm)---						
0-2	0.3	3.2	12.3	18.3	4.7	3,668	–
10-20	0.7	11.3	25.4	18.9	19.3	22,187	–
71	0.5	5.5	2.2	10.1	7.4	16,729	–

– Not Determined

Table 43. Selected properties and heavy metal concentrations of Quitman silt loam, Upper Coastal Plain Region.

Soil: Quitman
Classification: fine-loamy, siliceous, thermic Aquic Paleudults
Location: Lee County; Upper Coastal Plain
Landscape Position: Upland
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches		%			%		$cmol_c kg^{-1}$
0-2	26.3	59.8	13.9	silt loam	1.8	4.0	7.8
25-36	21.0	57.5	21.5	silt loam	0.8	4.6	12.2
120	24.1	31.2	44.7	clay	0.0	4.4	34.2

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches				$\mu g\ g^{-1}$ (ppm)			
0-2	0.3	3.1	7.5	16.2	4.2	6,775	79
25-36	0.4	5.7	10.9	11.4	5.3	11,036	15
120	0.7	5.5	24.9	17.4	12.5	35,916	30

Table 44. Selected properties and heavy metal concentrations of Smithdale silt loam, Upper Coastal Plain Region.

Soil: Smithdale
Classification: fine-loamy, siliceous, thermic Typic Hapludults
Location: Neshoba County; Upper Coastal Plain
Landscape Position: Upland
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches		%			%		$cmol_c kg^{-1}$
0-5	41.5	52.9	5.6	silt loam	2.2	4.7	9.3
25-40	72.8	5.6	21.6	sandy clay loam	0.2	4.8	10.3
75-88	86.7	4.5	8.8	loamy sand	0.1	4.8	4.2

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches				$\mu g\ g^{-1}$ (ppm)			
0-5	0.2	3.1	10.2	7.0	4.1	5,484	106
25-40	0.5	7.8	15.6	11.5	10.7	16,779	48
75-88	0.3	3.7	3.3	5.8	3.6	10,006	15

Table 45. Selected properties and heavy metal concentrations of Savannah silt loam, Upper Coastal Plain Region.

Soil: Savannah
Classification: fine-loamy, siliceous, thermic Typic Fragiudults
Location: Lowndes County; Upper Coastal Plain
Landscape Position: Upland
Land Use: Forest

Selected Physical and Chemical Properties

Depth	Sand	Silt	Clay	Texture	Organic Matter	pH	CEC
inches	%				%		$cmol_c kg^{-1}$
0-2	24.1	68.2	7.7	silt loam	6.1	4.4	12.7
16-22	15.9	62.9	21.2	silt loam	0.4	4.8	9.4
93	31.7	54.4	13.9	silt loam	0.2	5.0	10.2

Selected Heavy Metal Contents

Depth	Cd	Cu	Zn	Pb	Ni	Fe	Mn
inches	$\mu g\ g^{-1}$ (ppm)						
0-2	0.4	4.2	14.0	22.7	7.7	6,371	–
16-22	0.5	7.7	20.5	17.3	13.1	16,029	–
93	0.3	2.5	2.1	8.2	5.4	4,727	–

– Not determined

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