3 Seasonally Wet Soils of Louisiana[1]

Introduction

Nine sites were selected for instrumentation in Louisiana as part of the VIII International Soil Correlation Meeting emphasizing Management of Wet Soils (ICOMAC) sponsored by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) with continued funding from the NRCS's Global Warming Project. Figure 1 shows a map of Louisiana with the study area highlighted. Table 1 lists all nine soil series and their taxonomic classification. Table 2 presents the location, geological unit, and land use of the study soils.

This report contains selected data on six of these soils from 1989 through 1993. Detailed data are presented for only a few soils to provide representative examples of the kinds of data being obtained and to highlight some significant findings. Study sites were representative of three land resource areas: (a) recent Mississippi River deposits, (b) Red River deposits, and (c) Pleistocene coastal plain deposits and two sites that have a thin Peoria loess cap.

Site Instrumentation and Measurements

Each site was fenced with galvanized wire that enclosed a 10- by 10-m square plot next to the place where the pit for soil characterization was excavated. Rainfall was measured with a rain gauge. The accumulated rainfall records as well as the other measurements were taken every 2 weeks, or whenever required. Rainfall data were complemented by daily rainfall records from Livingston (Livingston Parish) and Moss Bluff (Calcasieu Parish) meteorological stations.

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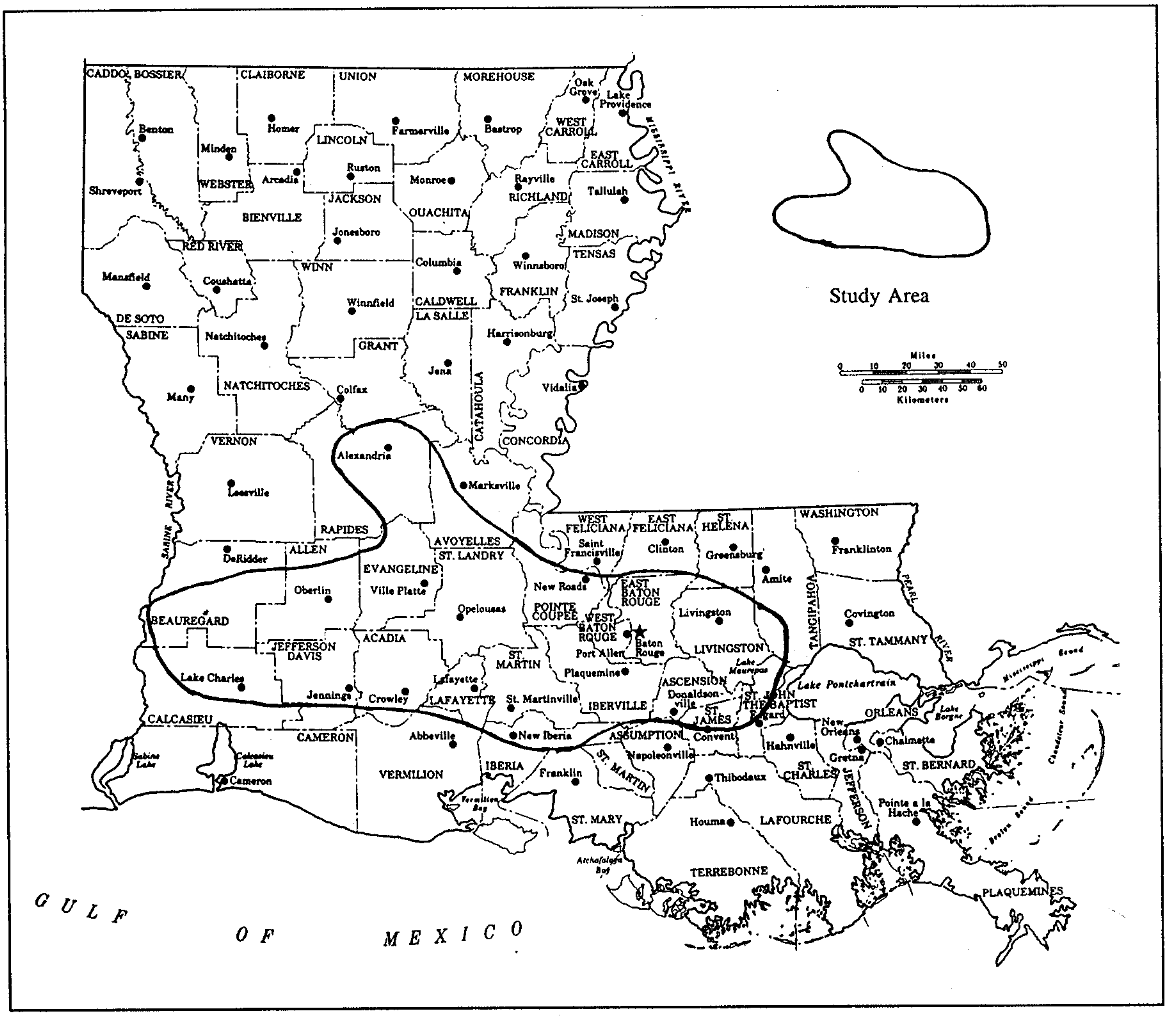

Figure 1. Map of Louisiana outlining study area

Water table depths were determined with piezometers. Piezometers were constructed from 1.9-cm OD polyvinyl chloride pipe (Szögi and Hudnall 1992). Pipes were installed in triplicate at depths of 0.25, 0.50, 1.00, and 2.00 m. Water levels in the piezometers were measured by the "hot air method" (Reeve 1986).

Water tension was measured in triplicate with jet-filled tensiometers (Soil Moisture Corporation, Santa Barbara, CA) placed into the soils at three different depths (0.25, 0.50 and 1.00 m). The original gauges were substituted by a Swagelok brass fitting (Swagelok Company, Solon, OH) connected to a rubber septum by a 1.5-cm piece of nylon tubing. Soil suction was measured through the septum with a tensiometer (Soil Measurement Systems, Tucson, AZ).

Reduction was characterized by measuring redox potentials directly with permanently installed platinum electrodes and indirectly by the presence of

Table 1
Classification of the Soils

Soil Series	Taxonomic Classification
Commerce	Fine-silty, mixed, hyperthermic Aeric Endoaquepts
Sharkey	Very-fine, montmorillonitic, hyperthermic Chromic Epiaquerts
Fausse	Very-fine, montmorillonitic, nonacid, hyperthermic Typic Fluvaquents
Verdun	Fine-silty, mixed, hyperthermic Albic Glossic Natraqualfs
Crowley	Fine, montomorillonitic, hyperthermic Typic Albaqualfs
Lebeau	Very-fine, montmorillonitic, hyperthermic Aeric Epiaquerts
Moreland	Fine, mixed, thermic Typic Epiaquerts
Beauregard	Fine-silty, siliceous, hyperthermic Plinthic Paleaquults
Brimstone	Fine-silty, mixed, hyperthermic Typic Natraqualfs

reduced iron tested with dyes in the field. Platinum electrodes were fabricated according to Szögi and Hudnall (1992). The electrodes were tested in the laboratory in a pH-buffered quinhydrone solution (Jones 1966). Electrodes were installed in the field at 0.50- and 1.00-m depths in triplicate, in order to monitor the redox potential in the soil moisture control section and at diagnostic depths used in *Soil Taxonomy* (Soil Survey Staff 1975).

Redox potentials taken in the field were adjusted by adding +244 mV in order to base redox potentials on the standard hydrogen reference electrode (SHE) for Eh readings. A few redox measurements were taken with platinum electrodes in the topsoil of every soil when they were saturated for several weeks to complement the information on soil reduction. A soil was considered to be reduced with respect to iron when the redox potential was below 150 mV. Interpretation was made without pH correction and was based on redox ranges given by Patrick and Mahapatra (1968) and Turner and Patrick (1968).

Two staining tests were performed: (a) a 0.2-percent α,α'-dipyridyl solution in 10-percent acetic (Bouma 1989), and (b) a 0.2-percent α,α'-dipyridyl solution buffered with 1 M ammonium acetate (Childs 1981). The dye was dropped onto freshly broken surfaces of field samples taken at 0.25-, 0.50-, and 1.00-m depths. A positive reaction indicating the presence of reduced iron was obtained when a strong pink color developed almost immediately.

Table 2
Soil Series, Location by Parish, Geological Unit, Land Resource Region, and Land Use

Soil Series	Parish	Geological Unit	LRR/MLRA[1]	Land Use
Commerce	Iberville	Holocene	O/131	Meadow
Sharkey	Iberville	Holocene	O/131	Meadow
Fausse	West Baton Rouge	Holocene	O/131	Bottomland Hardwoods
Verdun	Livingston	Pleistocene	P/134	Pine, Pulpwood
Crowley	Acadia	Pleistocene	T/150A	Cropland, Rice, and Soybeans
Lebeau	St. Landry	Pleistocene	O/131	Cropland, Rice, and Crawfish
Moreland	Rapides	Pleistocene	O/131	Pasture and Cropland
Beauregard	Beauregard	Pleistocene	T/152B	CRP
Brimstone	Calcasieu	Pleistocene	T/150A	Cropland, Rice, Wheat, Soybeans, and Crawfish

[1] LRR = Land Resource Region, MLRA = Major Land Resource Area. O = Mississippi Delta cotton and feed grains region; P = South Atlantic and Gulf Slope cash crops, forest, and livestock region; T = Atlantic and Gulf Coast Lowland forest and crop region. 131 = Southern Mississippi Valley Alluvium, 134 = Southern Mississippi Valley Silty Uplands, 150A = Gulf Coast Prairies, 152B = Western Gulf Coast Flatwoods.

Water from each piezometer was pumped out, and the pH of the water samples was measured immediately with a pH meter. The pH of the water was considered to be the soil pH, assuming near equilibrium between the soil solution and the solid phase (Breemen and Brinkman 1978). Soil temperature was measured at a 0.50- and 1.00-m depth from samples taken with a push probe and measured immediately in the field with a stem thermometer.

Soil morphology was obtained through a detailed description of each horizon from exposed profiles at the time the soil was sampled for detailed chemical, physical, and mineralogical characterization. Profile descriptions were used to test regional hydric soil field indicators.

Results

Commerce soil

Soil characteristics. This nearly level loamy soil is on the high parts of the natural levees of the Mississippi River and its distributaries. It formed in loamy alluvium. Slope gradients are less than 1 percent. Typically, the surface layer is dark grayish brown silt loam about 38 cm thick. The subsoil to a depth of 116 cm is grayish brown silt loam with redoximorphic features in shades of brown. The underlying material is silty clay loam and silty clay with dark brown redoximorphic features.

Saturation. Rainfall and water table data from the 2-m piezometers are presented in Figure 2. The water table tracked the rainfall distribution during 1989, but not during 1990. This site was close to the Mississippi River, and the lower sandy units of this profile were hydrologically connected to the river. The river stage for 1989 was low because of unusually low rainfall. During 1989, the water table responded to rainfall.

During 1990, the river stage was high during February and March. Rainfall was normal during January, and the soil was saturated during these months (see tensiometer data, Figure 3). During April, as the river stage began to fall, the water table also began a steady drop. The soil began to drain of free water in response to the lowering water table (Figure 2).

Tensiometer data (Figure 3) showed that the soil was saturated above 50 cm for 52 percent of the observations, and it was above 100 cm for 85 percent of the observations (Table 3). These data support endoaquic saturation.

Reduction. Observed groundwater depths matched the Eh measurements of Figure 4. pH-corrected Eh thresholds (Patrick and Mahapatra 1968; Turner and Patrick 1968; Patrick 1980) for Commerce soil were moderately reduced below 314 mV, reduced below 164 mV, and highly reduced below −136 mV. Figure 4 shows that most of the time redox potentials at 100-cm depth were in the reduced (< 164 mV) and moderately reduced (< 314 mV)

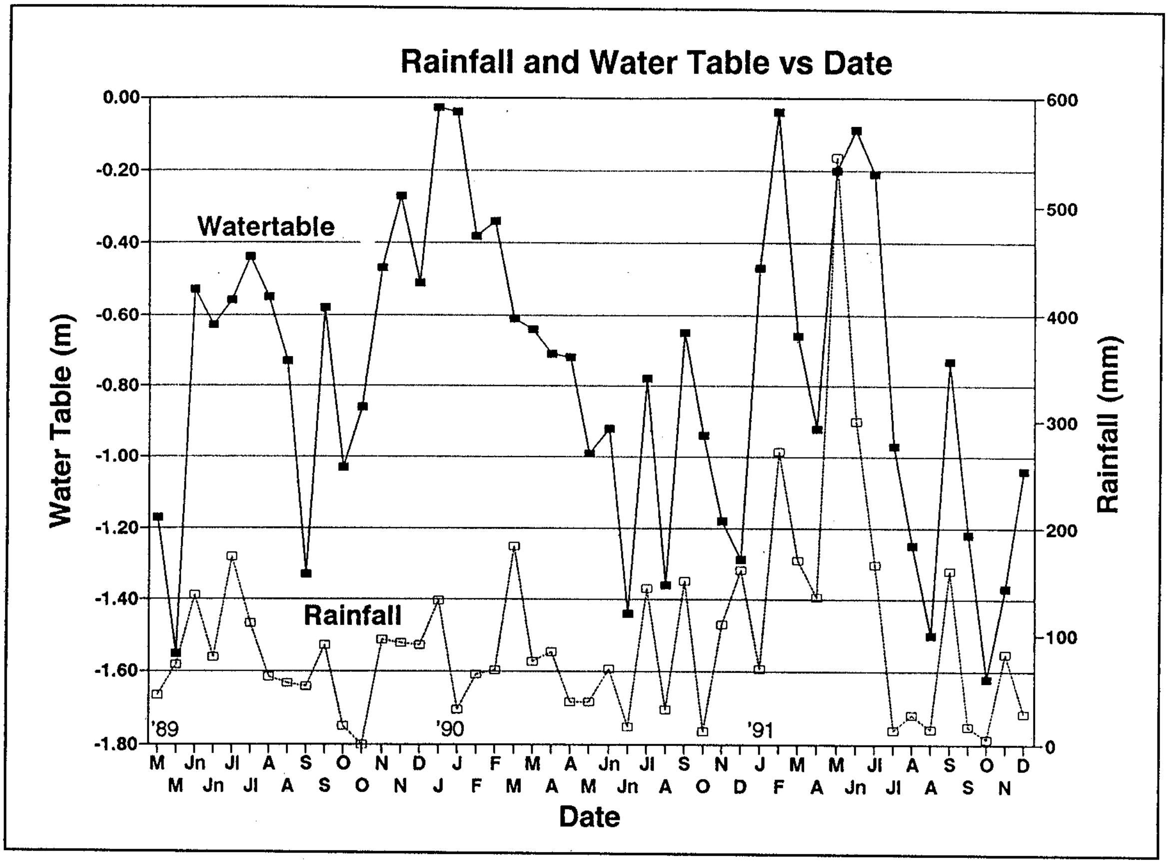

Figure 2. Rainfall and water table data for Commerce silt loam

ranges. Redox potentials at 50-cm depth fluctuated among the four ranges (oxidized, moderately reduced, reduced, and highly reduced) following the changes in water table depth and saturation. Some of the more intense changes in reduction at 50 cm are explained by the presence of organic matter (percent carbon was higher in the upper horizons), absence of oxygen supply due to the rising water table, and the presence of anaerobic organisms.

The reduction tested with α,α'-dipyridyl was better correlated with water table fluctuations at 50 and 100 cm than at 25 cm. The number of observations with positive dye reaction was much higher than the number of observations of saturation at 25 cm. This fact can be explained by the following: (a) the long equilibration time of the tensiometers could not account for rapid changes of soil moisture in the first 25 cm, and (b) the soil was reduced at microsites when it was wet but not saturated. The situation was reversed at 100 cm. The percentage of observations with saturation was higher than the percentage with positive dye reaction.

The influence of the river stage was also displayed in the Eh data. During most of 1989, the water table was a function of rainfall. As the water moved downward, 0_2 was depleted, and the Eh at 50 cm dropped below -100 mV

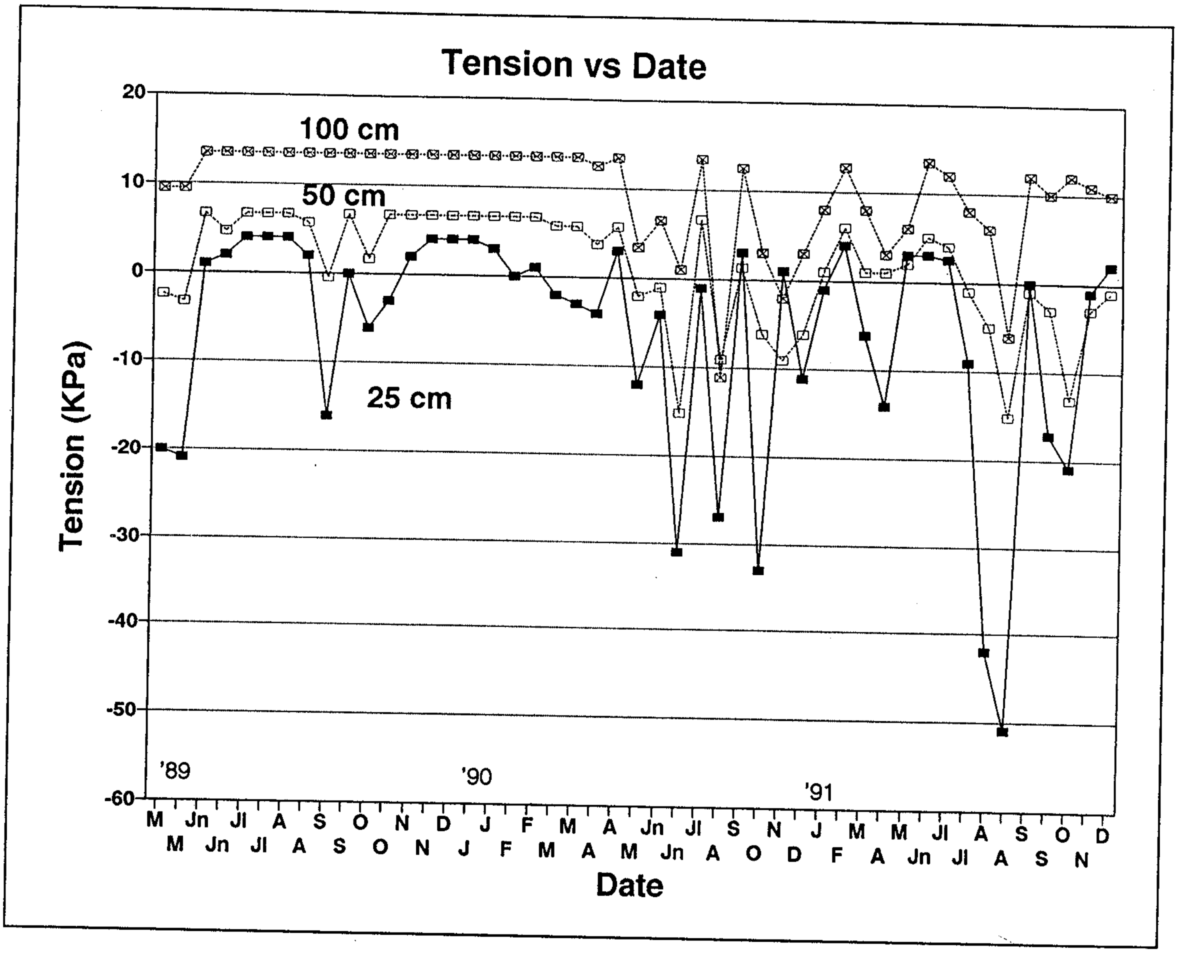

Figure 3. Tensiometric data from 25, 50, and 100 cm for Commerce silt loam

Table 3
Percentage of Observations With Reduced Conditions, Saturation, and/or Water Tables Above Selected Depths in Commerce Silt Loam

	Depth, cm		
Condition	**25**	**50**	**100**
Reduced[1]	52.0	64.0	80.0
Saturated[2]	26.0	51.9	85.2
Piezometer[3]	8.3	29.2	83.3
Borehole[4]	8.3	31.0	79.2

[1] Positive reaction to *α,α'*-dipyridyl.
[2] Zero or positive tension.
[3] Free water in piezometer above a given depth.
[4] Free water in the borehole above a given depth.

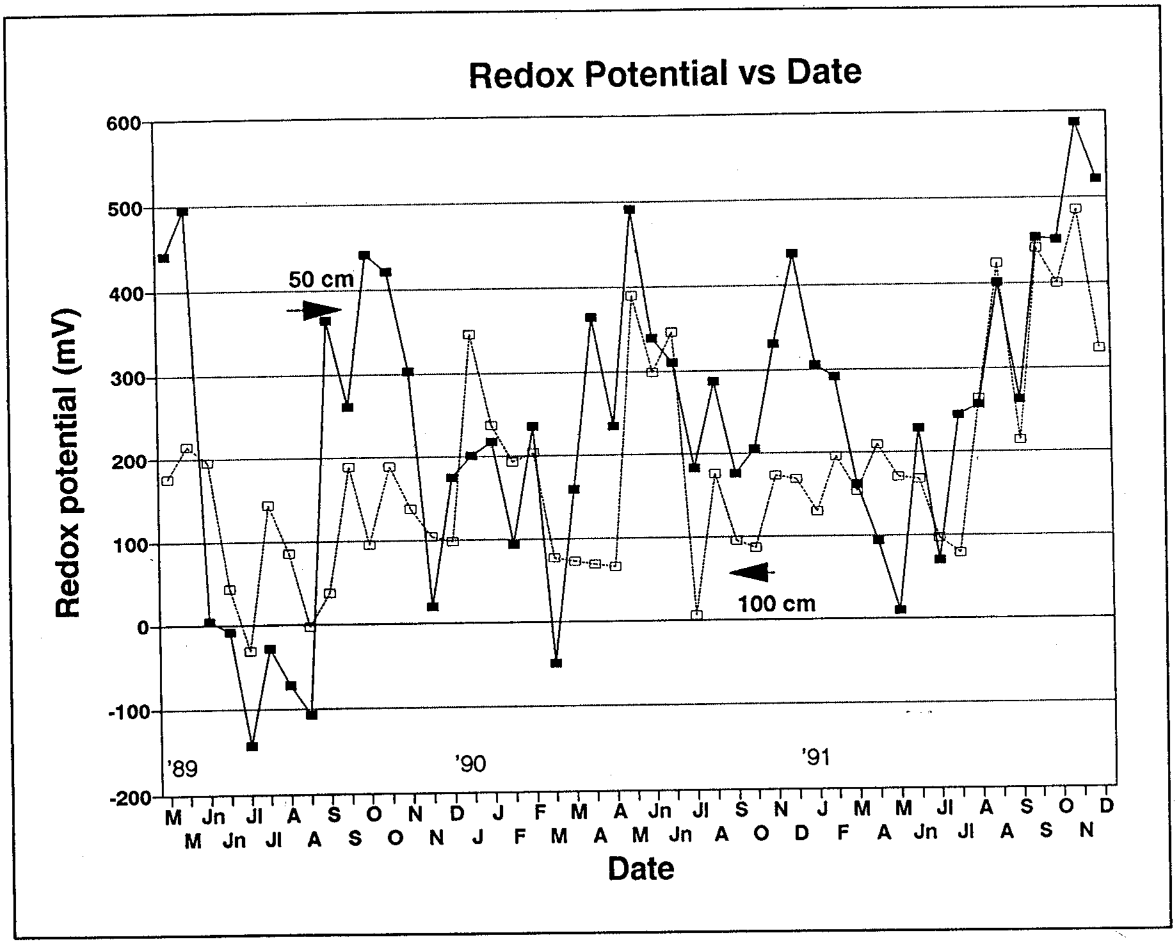

Figure 4. Redox potential data from 50 and 100 cm for Commerce silt loam

during periods of peak of rainfall. However, during late 1989 and 1990 when the water table was being controlled by the river stage, Ehs were higher. The belief is that water flowing laterally from the river was oxygenated. Since there was little or no energy nor microbes in these hydrological layers, the water remained oxygenated.

Redoximorphic features. In the upper 50-cm zone (Ap1, Ap2, and Bw1 horizons) of the Commerce soil, macromorphic features included dominant matrix colors of 4/2 and 5/2 with few to common iron stains in root channels and on vertical and horizontal ped faces. In the 50- to 100-cm zone (Bw2 and Bg1 horizons), macromorphic features included dominant matrix colors of 5/2 with common iron and manganese segregation. In the 100- to 200-cm zone (Bg2, Bg3, and Bssgb horizons), macromorphic features included dominant matrix colors of 5/1 with common 4/3 and 4/4 iron-manganese segregations.

Hydric soil characteristics. The ponded phase of the Commerce is on the hydric soils list, but all other Commerce soils are not hydric. The critical depth for this Entisol is 40 to 50 cm. This pedon met the criteria for aquic conditions within that depth and is therefore placed into the Aquents. The

Commerce soils are somewhat poorly drained. The hydric criteria require that the somewhat poorly drained soils have a frequently occurring water table within 15 cm of the surface for a period of at least 2 weeks during the growing season. There are some Commerce soils that, if hydric soil indicators are used (value 4 and 5, chroma 1 and 2), would be hydric (Indicator F3, Depleted Matrix, Natural Resources Conservation Service Staff 1995). Commerce is a borderline soil which in some landscapes is sufficiently wet and reduced to be hydric, and in others is higher on the landscape and/or is drained and is not hydric.

Sharkey soil

Soil characteristics. This level, clayey soil is at the lower parts of the natural levees of the Mississippi River and its distributaries. Slope gradients are less than 1 percent. Typically, the surface layer is dark grayish brown clay about 30 cm thick with yellowish brown redox concentrations. The next layers, extending to a depth of 212 cm, are gray and greenish gray clay with redox concentrations in shades of brown.

Saturation. Water tables were very similar to those of the Commerce soil, except that they were higher during 1989. The water table was controlled by rainfall during 1989 but was controlled by the river stage during 1990. This site was lower than the river. The well located a few meters from this site was an artesian well when the river stage was high. Tensiometer data closely resembled the borehole data. Saturation at 25 cm fluctuated in response to the changing water table. Table 4 shows that even though there was an observed water table 30.4 percent of the time at 25 cm, the soil was saturated 65.4 percent. This soil is very fine and these data reflect the capillary rise.

Reduction. Eh data and reduction with α,α'-dipyridyl (Table 4) were in close agreement. There was sufficient organic carbon. A positive reaction was expected with α,α'-dipyridyl most of the time. The only time that it was not was during the dry spring of 1989. During most of the monitoring period, the Eh at both 50 and 100 cm was less than 150 mV, or below that necessary for iron to reduce. When rainfall occurred after a brief dry period, reduction at both 50 and 100 cm was very intense.

Redoximorphic features. In the upper 50-cm zone (Ap, A, and Bss1 horizons), macromorphic features included dominant matrix colors of 10YR 4/2 and 4/1 with 4/4 iron stains and common, distinct 10YR 4/4 redoximorphic concentrations as soft masses and pore linings. In the zone between 100 and 200 cm (Bssg1, Bssg2, and BCg horizons), macromorphic features included dominant matrix colors of 5GY 5/1 with common, distinct 5/6 redox concentrations.

Hydric soil characteristics. All Sharkey soils are considered to be hydric. The sampled soil was saturated to the surface during the majority of the

Table 4
Percentage of Observations With Reduced Conditions, Saturation, and/or Water Tables Above Selected Depths in Sharkey Clay

	Depth, cm		
Condition	**25**	**50**	**100**
Reduced[1]	95.5	95.5	100
Saturated[2]	65.4	76.9	84.6
Piezometer[3]	50.0	72.7	95.5
Borehole[4]	30.4	60.1	91.3

[1] Positive reaction to *α,α'*-dipyridyl.
[2] Zero or positive tension.
[3] Free water in piezometer above a given depth.
[4] Free water in the borehole above a given depth.

monitoring period. Because Sharkey is poorly drained and permeability is <15 cm/hr, its meets hydric criteria by having a water table within 45 cm of the soil surface for at least 14 consecutive days. The soil also had a 10-cm layer within the upper 30 cm that had values and chromas within the range for the Depleted Ochric Horizon field indicator (F11).

Verdun soil

Soil characteristics. Verdun silt loam soils are level, somewhat poorly drained, and contain high levels of sodium within the subsoil. They are on broad flats on the terrace uplands. The soils are subject to rare flooding. Slopes are less than 1 percent.

Verdun soil has a surface layer of dark grayish brown, strongly acid silt loam about 10 cm thick. The subsurface layer is light brownish gray, medium acid silt loam about 20 cm thick. The subsoil to a depth of about 175 cm is grayish brown, moderately alkaline silty clay loam in the upper part, and yellowish brown, strongly alkaline silt loam in the lower part.

Saturation. Water table depths were based on measurements taken from piezometers only. The unlined borehole was affected by "bypass flow." The perched water table was difficult to follow. It occurred during summer, fall, and spring for very short periods (less than 2 weeks). It was rapidly depleted by the consumptive use of the vegetation. The pine trees also made use of the deeper ground water table. Matric potentials at 25 and 50 cm fluctuated with wetting and drying cycles within the top soil horizons (0- to 70-cm depth) during spring, summer, and fall in 1989. During the winter of 1990, the entire profile was saturated due to excess rainfall and low evapotranspiration rates. Therefore, the two water tables merged at that time. A perched water table occurred only when the rainfall was uniformly distributed and was greater than 75 mm.

Reduction. The interpretation of Eh measurements was difficult for this soil since at 50 cm the pH was 4.7 and at 100 cm the pH was near neutrality (6.5 to 7). The pH tended to change toward the neutral point after flooding. The pH of water samples averaged 7.4 (C.V. = 6.1) and never fell below 6.6 at any depth. The Eh measured at 50 cm must be evaluated according to changes in pH. When the soil was dry the pH was near 4.7, changing to near neutrality when the soil was saturated. These two situations were governed by the occurrence of the perched water table. The Eh at 50 cm was in the oxidizing to moderately reduced range during the few dry periods when suction was >100 kPa . Upon saturation the soil was reduced and a positive staining test was obtained (Table 5). The Eh was low enough to allow for the reduction of iron only when there was a perched water table.

Table 5
Percentage of Observations With Reduced Conditions, Saturation, and/or Water Tables Above Selected Depths in Verdun Silt Loam

	Depth, cm		
Condition	25	50	100
Reduced[1]	43.5	43.5	86.9
Saturated[2]	41.7	45.8	56.0
Piezometer[3]	38.1	33.3	61.9
Borehole[4]	42.9	47.6	66.7

[1] Positive reaction to *α,α′*-dipyridyl.
[2] Zero or positive tension.
[3] Free water in piezometer above a given depth.
[4] Free water in the borehole above a given depth.

Redoximorphic features. In the upper 50-cm zone (Ap, E1, and E2 horizons), macromorphic features included dominant matrix colors of 5/2 and 7/2 with few, fine iron-manganese concretions. In the 50- to 100-cm zone (E/Bt and Btn/E horizons), macromorphic features included 6/2 matrix with 6/2 material in the tongues. There were common fine and medium 2/1 iron-manganese masses and discontinuous 2/1 iron-manganese stains. In the 100- to 200-cm zone (Btkn1, Btkn2, and Btn1 horizons), macromorphic features included areas of 6/2 colors, 2/1 iron-manganese stains and masses, and few irregularly shaped carbonate segregations and masses.

Hydric soil characteristics. The Verdun soil is not hydric even though it is an Aqualf. Verdun is somewhat poorly drained, and the data show that the soil never had a water table within 15 cm of the soil surface for at least 2 consecutive weeks during the growing season. If the hydric soil indicators are applied, this soil is nonhydric because the thick E horizon lacks common or many distinct or prominent redox concentrations as soft masses or pore linings.

Lebeau

Soil characteristics. Lebeau clay, occasionally flooded soils are level, poorly drained, clayey soils of back swamps and the lowest parts of natural levees of old distributary channels of the Red River. It is subject to flooding for brief to long periods. Slopes are less than 1 percent. Typically, the surface layer is dark brown, mildly alkaline clay about 15 cm thick. The subsoil is dark reddish brown, mottled, moderately alkaline clay.

Saturation. This site was instrumented in January 1990. The site was in a rice-crawfish-rice management system. When the soil dries, large quantities of water are required to reflood it because of extensive cracking. The owner very rarely drains the soil for more than 2 to 3 weeks twice each year. The soil had been saturated to a depth of 1 m after flooding in February 1990. The field was drained in May for plowing and seed bed preparation. During this time, the soil became slightly dry and extensively cracked.

The Lebeau soil when managed this way wets from the top down. This was reflected in the 200-cm piezometer data of June and July. The cracks are believed to close from the surface downward. The cracks serve as water conduits to lower depths. Hydraulic conductivity is so slow that little water moves through the matrix. The water level in piezometers reflects the hydrostatic head in the cracks that are intercepted by the piezometers. This soil was never saturated below 75 cm.

Water table levels tracked the rainfall data. The water table dropped below 2 m during May while the field was drained. The high level within the 200-cm piezometer was a response to open cracks.

Reduction. When the soil had been flooded for several weeks, a reaction with α,α'-dipyridyl was observed within the top 25 cm. When the soil was drained and allowed to dry, a positive reaction was observed at a deeper depth a few days immediately after reflooding. This phenomenon was observed for nearly all the soils studied.

Platinum electrodes have been installed since July 1990, and Eh values have never dropped below 100 mv. Hydraulic conductivity is essentially zero, except along slickensides. Even though the soil may be anaerobic, there is no soluble carbon to furnish energy to the microbes, thus no Fe reduction. Also, the dominant iron mineral is hematite, which requires more energy to break the Fe-O bonds. No positive reaction with α,α'-dipyridyl was expected below 100 cm. The pH of the soil was near neutral with free $CaCO_3$ and gypsum. Eh must be below 150 mV for iron to reduce. The belief is that this soil is reduced, but one cannot demonstrate reduction with α,α'-dipyridyl.

Redoximorphic features. In the 0- to 50-cm zone (Ap, Bw, and Bkss horizons), macromorphic features included 4/2 matrix color in the surface with 4/4 mottles and black iron-manganese stains, and 4/2 and 5/1 redox depletions in the Bw and Bkss horizons with 5/8 and 4/1 iron stains in root channels and pores. In the 50- to 100-cm zone (Bkss and Bkssb horizons), macromorphic features included 5/1 and 4/1 iron concentrations in the upper portion.

Hydric soil characteristics. This soil was difficult to classify as hydric using either the hydric soil criteria or field indicators. The Lebeau soil is formed from Permian-aged sediments deposited in back swamps of the older distributaries of the Red River. The sediments are calcareous and may contain appreciable quantities of gypsum. When managed under rice cultivation, it is possible to mix the upper 20 cm and incorporate organic matter that is moved via the cracks to lower portions of the profile. In a few pedons, redoximorphic features are noted (10YR 5/2 depletions), but these are not present unless the soil has been cultivated. Is the alteration by man to be used to satisfy hydric criteria? This situation has not been addressed.

Lebeau is on the hydric soils list. Two criteria are used to place it there: criterion 4 (soils that are frequently flooded for long or very long duration during the growing season) and criteria 2b3 (soils that are poorly drained with a frequently occurring water table within 45 cm of the soil surface for at least 14 days during the growing season). These soils are frequently flooded, but piezometric and tensiometric data did not support a water table within 45 cm of the soil surface, not even when they were continuously flooded for rice production.

Land Resource Region (LRR) O was not included for testing draft indicator TF3 for soils with red parent materials. This soil may qualify under natural conditions, but these conditions have not been observed in cultivated fields. Redox concentrations as pore linings have not been observed under any conditions. Soils developed within red parent materials continue to present major problems for both soil taxonomy and hydric soils.

Beauregard soil

Soil characteristics. This very gently sloping, moderately well-drained soil is on broad slightly convex upland ridges. Slopes are long and smooth. Typically, the surface layer is dark gray, strongly acid silt loam about 15 cm thick. The subsoil layer is about 15 cm thick. It is pale brown, strongly acid silt loam. The subsoil to a depth of 165 cm is yellowish brown, strongly acid silt loam in the upper part; yellowish brown, light brownish gray, and light gray strongly acid silt loam in the middle part; and light gray, strongly acid silty clay loam in the lower part. Red mottles and plinthite nodules are common in the middle and lower parts of the subsoil.

Saturation. Both the water table from the piezometers and the open borehole fluctuated in response to rainfall events. Tensiometer data show that the soil was saturated for short periods at or above 50 cm about 25 percent of the monitoring period (Table 6). The tensiometer data track the piezometer very closely. Because this soil is fine-silty, water movement through the soil is good. There was little or no lag time between the tensiometers, piezometers, and the open borehole. The water seemed to be perched on a restrictive layer at 180 cm.

Table 6
Percentage of Observations With Reduced Conditions, Saturation, and/or Water Tables Above Selected Depths in Beauregard Silt Loam

	Depth, cm		
Condition	**25**	**50**	**100**
Reduced[1]	17.4	13.0	21.7
Saturated[2]	17.7	25.0	43.5
Piezometer[3]	4.5	27.3	50.0
Borehole[4]	8.7	26.1	47.8

[1] Positive reaction to *α,α′*-dipyridyl.
[2] Zero or positive tension.
[3] Free water in piezometer above a given depth.
[4] Free water in the borehole above a given depth.

Reduction. As had been observed for most of the soils in this study, when there was an intense rainfall event following a long dry period, the soil underwent extreme reduction. When the soil was dry and the water table rose slowly, the soil underwent gradual reduction, but the Eh did not become as low as in the previous situation. The pH was about 5.5 from 15 to 180 cm. Iron will reduce at an Eh of about 235 mV. A positive reaction to α,α′-dipyridyl at 25 cm was observed on 17.4 percent of the observations. The soil met criteria for aquic conditions because of the positive reaction to the ferrous iron test during the early part of the growing season. This criterion may not be valid, however, because most seasonally wet soils will give a positive reaction to α,α′-dipyridyl during the growing season. There should be a duration requirement if this criterion is to be part of *Soil Taxonomy* (Soil Survey Staff 1990).

Redoximorphic features. For the 0- to 50-cm zone (Ap1 and Ap2 horizons and the upper portion of the Bt horizon), macromorphic features included 4/2 and 6/3 matrix colors with few to common medium iron-manganese concretions. For the 50- to 100-cm zone (Bt and Ev/Btv1 horizons), macromorphic features included 6/3 matrix in the Bt horizon, and 6/2 matrix in the Ev portion and 6/2 mottles in the Btv portion of the Ev/Btv1 horizon. There were few iron-manganese concretions and soft masses and common coarse rounded plinthite segregations.

Hydric soil characteristics. This soil is not on the hydric soils list because it is considered to be moderately well drained. It is also not hydric by field indicators because the matrix is dominated with 3 chroma colors. However, this soil developed within Coastal Plain sediments rich in iron-containing minerals. Soils on side slopes typically have 2.5YR and 5YR colors in the subsoil. The data show that this soil was saturated and reduced for more than 14 consecutive days during the growing season within 50 cm of the soil surface. The Beauregard soil is a highly weathered soil (Ultisol). Some of the redoximorphic features may be relict. It is difficult to explain the predominance of redoximorphic features throughout the soil unless it undergoes intense periods of saturation and reduction. This soil is an excellent example of one that has aquic conditions, but is not hydric.

Brimstone soil

Soil characteristics. This soil is level and poorly drained. It is on broad flats on the terrace uplands. Slopes range from 0 to 1 percent. Typically, the surface layer is dark grayish brown, slightly acid silt loam about 15 cm thick. The subsurface layer is grayish brown, slightly acid silt loam about 30 cm thick. The subsoil extends to a depth of about 175 cm. It is light brownish gray and grayish brown, mottled, neutral silt loam in the upper part; grayish brown, mottled, mildly alkaline silty clay loam in the middle part; and light olive gray, mottled, moderately alkaline silty clay loam in the lower part.

Saturation. The Brimstone soil was saturated approximately 30 percent of the time within the upper 25 cm, 26 percent above 50 cm, and 39 percent above 100 cm (Table 7). The water table responded to rainfall events. There were periods when the upper 50 cm was saturated with dry layers below. The soil wets from the top downward with very little lag time between the 25- and 50-cm depths. There was a lag at the 100-cm depth, which is within the natric (Btng1) horizon.

Reduction. There was a positive α,α'-dipyridyl reaction 64 percent of the time at 25 cm, 41 percent at 50 cm, and 36 percent at 100 cm (Table 7). This soil was unique in that a positive dry reaction was obtained more often than the soil was saturated. The Eh data show that the soil is one of extremes. It was not uncommon for the soil to drop several millivolts when the soil was saturated for a short time. The upper 50 cm were always more reduced than at 100 cm. This may be due to the exchangeable sodium and/or the soluble chloride and sulfate anions. The pH of the upper 50 cm was moderately acid to neutral. Under saturated conditions, it was likely to be moderately acid (pH = 5.5) and iron would reduce at an Eh of about 235 mV. The soil was moderately alkaline (pH = 7.8) at 100 cm, and a Eh of about 85 or less would be required for iron reduction. Eh values were

Table 7
Percentage of Observations With Reduced Conditions, Saturation, and/or Water Tables Above Selected Depths in Brimstone Silt Loam

	Depth, cm		
Condition	25	50	100
Reduced[1]	63.6	40.9	36.4
Saturated[2]	30.4	26.1	39.1
Piezometer[3]	18.2	31.8	31.8
Borehole[4]	27.3	31.8	40.9

[1] Positive reaction to α,α'-dipyridyl.
[2] Zero or positive tension.
[3] Free water in piezometer above a given depth.
[4] Free water in the borehole above a given depth.

never that low at 100 cm, and yet a positive dye reaction was obtained. The dye was prepared in 10-percent acetic acid, and the dye itself lowered the pH to allow the positive test. An α,α'-dipyridyl solution prepared in 1 N neutral (pH = 7) NH_4OAc is now used, and results more consistent with the Pt electrodes are being obtained.

Redoximorphic features. For the 0- to 50-cm zone (Ap, Eg, and E/Btng horizons), macromorphic features included 5/3 matrix color, few fine 7/2 silt pockets and 6/8 iron stains in root channels and pores (Ap horizon); 6/2 matrix with 4/6 iron stains (Lepidocrocite) in the Eg horizon; and 6/2 matrix with many 7/1 silt pockets, 4/6 ferritans (Lepidocrocite) and patchy manganese or iron-manganese stains on vertical faces of peds. In the 50- to 100-cm zone (Btng/E and Btng1 horizon), macromorphic features included 6/2 matrix, 4/2 continuous clay films, and few medium rounded soft masses of iron-manganese. There were few 7/1 and 7/2 silt pockets.

Hydric soil characteristics. The Brimstone soil is poorly drained and is on the hydric soils list. The natric horizon restricts drainage, and the soil was saturated and reduced with redoximorphic features within 25 cm of the soil surface. The perched water table was within 45 cm of the soil surface. There was little doubt that this soil was hydric. The soil had a preponderance of crawfish krotovinas throughout the upper 1 m. These burrows restricted water movement and may be more restrictive than the natric properties. The soil qualified as hydric under hydric soil indicator F3, Depleted Matrix. There was a proposed testing of soils with natric horizons in LLR D. This soil was located in LLR T, but it was tested against the proposed indicator. It failed because the upper boundary of the natric horizon was deeper than 30 cm.

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