

**INTERNATIONAL ECOLOGICAL
CLASSIFICATION STANDARD:**

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Ecological Systems of Texas' East Central Texas Plains

08 October 2009

by

NatureServe

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This subset of the International Ecological Classification Standard covers terrestrial ecological systems attributed to the Texas. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to [Judy Teague <judy_teague@natureserve.org>].



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Citations:

The following citation should be used in any published materials which reference ecological system and/or International Vegetation Classification (IVC hierarchy) and association data:

NatureServe. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 08 October 2009.

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FOREST AND WOODLAND

CES205.896 EAST-CENTRAL TEXAS PLAINS PINE FOREST AND WOODLAND

This system, dominated by *Pinus taeda*, is endemic to central Texas. Locally this is known as the "Bastrop Pines." Examples may share similarities, in terms of the vegetation, with Coastal Plain pine-hardwood systems to the east (TNC Ecoregions 40 and 41) but differ in the fact that this system contains only loblolly pine which is generally considered successional in the more eastern systems. The vegetation includes a range of communities (that have yet to be defined) that range from very dry to xeric uplands to dry and even mesic areas with different suites of hardwood associates. The *Pinus taeda* of this region is genetically different than strains to the east; it has much greater drought tolerance. It is possible that this area was one of the epicenters of early southern pine colonization of the Coastal Plain based on fossil pollen evidence.

CES205.679 EAST-CENTRAL TEXAS PLAINS POST OAK SAVANNA AND WOODLAND

This system is primarily found within eastern Texas, lying in a broad band west of the Upper West Gulf Coastal Plain and Gulf Coast Prairies and Marshes ecoregions, ranging from Live Oak and Atascosa counties in the south and trending in a northeasterly band to the Red River along the Oklahoma-Texas border. It exhibits some floristic and physiognomic variation across this northeast-southwest gradient. Its range is roughly co-incident with (parts of) the "East Central Texas Plains" (Level III Ecoregion 33) of EPA (Griffith et al. 2004). It is distinguished from the surrounding prairie by the higher density of trees and diversity of woody species. The system differs from the floristically similar Crosstimbers Oak Forest and Woodland (CES205.682) in that it generally occurs on Tertiary (primarily Eocene) geologic formations on the East-Central Texas Plains, while the related Crosstimbers ecological system occupies Cretaceous and older formations of the interior plains (EPA Level III Ecoregion 29). Floristically, Post Oak Savanna (at least north of the Colorado River) contains species of more eastern affinities such as *Callicarpa americana*, *Sassafras albidum*, *Cornus florida*, *Vaccinium arboreum*, *Ulmus alata*, and particularly *Ilex vomitoria*, the latter species being absent from Crosstimbers Oak Forest and Woodland (CES205.682). Post Oak Savanna generally occurs on sandy or loamy soils, often underlain by a claypan subsoil. Rainfall ranges from about 120 cm in the northeastern part of the range to about 70 cm in the southwest, where it becomes increasingly erratic. Therefore moisture is often limiting during part of the growing season. The system was historically characterized as having significant areas of graminoid cover with species composition resembling that of nearby prairie systems, punctuated by short, stunted woodlands and forests dominated by *Quercus stellata* and *Quercus marilandica*. Other species, such as *Carya texana*, *Quercus incana* (on more xeric sites), *Quercus fusiformis*, *Ulmus alata*, *Juniperus virginiana*, and *Prosopis glandulosa*, can also be present. In some sites, particularly in the south, *Quercus fusiformis* may codominate the woodlands. Shrubs may attain significant cover in the understory, with species including *Ilex vomitoria* (often dominant), *Callicarpa americana*, *Vaccinium arboreum*, *Sideroxylon lanuginosum*, *Ilex decidua*, *Toxicodendron radicans*, and *Symphoricarpos orbiculatus*. Where light penetration allows the development of an herbaceous understory or in areas with reduced woody canopy, the understory contains species typical of the surrounding prairies, in particular *Schizachyrium scoparium*, but also including *Andropogon gerardii*, *Bothriochloa laguroides* ssp. *torreyana*, *Paspalum plicatum* (to the south), *Sorghastrum nutans*, and *Sporobolus cryptandrus*. Drought, grazing, and fire are the primary natural processes that affect this system. Much of this system has been impacted by conversion to improved pasture or crop production. Overgrazing and fire suppression have led to increased woody cover on most extant occurrences and the invasion of some areas by problematic brush species such as *Juniperus virginiana* var. *virginiana* and *Prosopis glandulosa* in the southern part of the system's range. These factors have also led to decreases in native grass cover allowing for annual grasses and forbs to invade.

This system is located on irregular plains comprised of sandy to loamy Alfisols, generally associated with Tertiary (primarily Eocene) formations of the East Central Texas Plains (Level III Ecoregion 33) of EPA (Griffith et al. 2004). These soils range from shallow to moderately deep and are often underlain by claypan subsoils. Rainfall ranges from about 120 cm in the northeastern part of the range to about 70 cm in the southwest, where it becomes increasingly erratic.

CES203.378 WEST GULF COASTAL PLAIN PINE-HARDWOOD FOREST

This West Gulf Coastal Plain ecological system consists of forests and woodlands dominated by *Pinus taeda* and/or *Pinus echinata* in combination with a host of dry to dry-mesic site hardwood species. This type was the historical matrix (dominant vegetation type) for large portions of the Upper West Gulf Coastal Plain (TNC ecoregion 40) where it replaced *Pinus palustris*-dominated vegetation. In this region of southern Arkansas, northwestern Louisiana, and parts of eastern Texas, this type was historically present on nearly all uplands in the region except on the most edaphically limited sites (droughty sands, calcareous clays, and shallow soil barrens/rock outcrops). Such sites are underlain by loamy to fine-textured soils of variable depths. These are upland sites on ridgetops and adjacent sideslopes, with moderate fertility and moisture retention. This type was also present in more limited areas of the West Gulf Coastal Plain (TNC ecoregion 41), where it was confined more typically to sideslopes and other locations not dominated by *Pinus palustris*.

In southern Arkansas, northwestern Louisiana, and parts of eastern Texas, this type was historically present on nearly all uplands in the region except on the most edaphically limited sites (droughty sands, calcareous clays, and shallow soil barrens/rock outcrops). Such sites are underlain by loamy to fine-textured soils of variable depths. These are upland sites on ridgetops and adjacent sideslopes, with moderate fertility and moisture retention.

CES203.056 WEST GULF COASTAL PLAIN SANDHILL OAK AND SHORTLEAF PINE FOREST AND WOODLAND

This ecological system occurs west of the Mississippi River primarily outside the natural range of longleaf pine and less commonly within. Like other sandhill systems of the Gulf and Atlantic coastal plains, this type is found on uplands underlain with deep, coarse sandy soils. These sites are typified by low fertility and moisture retention, which contribute to open tree canopies with usually <60% canopy closure. Sparse understory vegetation and abundant patches of bare soil are indicative of this system. Vegetation indicators are species tolerant of droughty sites, especially *Quercus incana* and *Quercus arkansana*, but also *Quercus marilandica* and *Quercus stellata*. *Pinus palustris* is absent (or perhaps at low frequency within its range); *Pinus echinata* is usually present. This system supports a large concentration of vascular plant endemics, near endemics, and a number of plant species with high fidelity to sandhills in the region. Elsewhere in the Atlantic and Gulf coastal plains, including most of the adjacent ecoregion (41), these site conditions are closely associated with longleaf pine. This system type is found on droughty uplands underlain with deep, coarse sandy soils. These sites are typified by low fertility and moisture retention. Fire is believed to have been a critical natural disturbance process which affected the vegetation structure and likely the species composition of communities in this system. A variety of fire-return intervals have been estimated for *Pinus echinata* vegetation. Garren (1943) proposed an 8- to 10-year return interval, Landers (1989) inferred a regime of 10 per century, and Martin and Smith (1993) estimated a 5- to 15-year interval, however, none of these estimates were specific to *Pinus echinata* on sandhills. Many such sites in the region lack well-developed and continuous fine fuels necessary to ignite and spread fires, possibly due to site infertility and droughtiness (R. Evans pers. obs., L. Smith pers. comm.).

SHRUBLAND

CES303.041 EDWARDS PLATEAU LIMESTONE SHRUBLAND

This ecological system occurs as a matrix on relatively thin-soiled surfaces of plateaus of the massive limestones such as the Edwards limestone. These short to tall shrublands are variable in density depending on the relative amount of, and depth to, bedrock. *Quercus sinuata* var. *breviloba* is an important component of the system, with some areas dominated by *Quercus fusiformis*. *Juniperus ashei* is often an important component of this system. In the west, *Pinus remota* may also contribute to a scattered emergent overstory. Other shrub species may include *Rhus virens*, *Rhus lanceolata*, *Cercis canadensis* var. *texensis*, *Forestiera pubescens*, *Forestiera reticulata*, *Fraxinus texensis*, *Ungnadia speciosa*, *Sophora secundiflora*, *Diospyros texana*, *Salvia ballotiflora*, *Mimosa borealis*, *Condalia hookeri*, *Rhus trilobata*, *Opuntia engelmannii*, and *Mahonia trifoliolata*. This system also includes *Quercus mohriana*- or *Quercus vaseyana*-dominated shrublands that are more common to the west, often sharing dominance with *Juniperus pinchotii*. Herbaceous cover may be patchy and is generally graminoid with species including *Schizachyrium scoparium*, *Bouteloua curtipendula*, *Bouteloua rigidisetata*, *Bouteloua trifida*, *Hilaria belangeri*, *Bothriochloa laguroides* ssp. *torreyana*, *Nassella leucotricha*, *Erioneuron pilosum*, *Aristida* spp., and others. Disturbances such as fire may be important processes maintaining this system. However, it appears to persist on thin-soiled sites. In the western portions of the Edwards Plateau, more xeric conditions lead to the slow succession of sites to woodlands, resulting in long-persisting shrublands. This system occurs on thin soils over limestone in the Edwards Plateau of Texas.

This system occurs in a steady state on thin-soiled xeric sites. Shrub cover can be 100% in patches, but overall cover may be 40-50%. Patches of dense shrubs may be interspersed with bare rock and grasslands over shallow soil. Farther west this system grades into other shallow-soiled shrubland systems.

CES301.983 TAMAULIPAN MIXED DECIDUOUS THORNSCRUB

This thornscrub ecological system occurs throughout much of northeastern Mexico and southern Texas. It occurs on a variety of substrates and landforms. Dominant species include *Acacia roemeriana*, *Leucophyllum frutescens*, and *Prosopis glandulosa*. Other species present to codominant include *Acacia berlandieri*, *Acacia farnesiana*, *Amyris madrensis*, *Amyris texana*, *Celtis pallida*, *Parkinsonia texana*, and cacti such as *Opuntia engelmannii* var. *lindheimeri*.

HERBACEOUS

CES205.897 EAST-CENTRAL TEXAS PLAINS XERIC SANDYLAND

This extremely xeric system of the east-central Texas Plains (EPA ecoregion 33; post oak savanna region) is found primarily on the Carrizo geologic formation, but also on other Eocene strata such as Queen City and Sparta. The combination of these very droughty soils with low levels of rainfall create extreme edaphic conditions and a locally unique environment which supports a number of endemic plant taxa. There are a number of endemics associated with this system. The vegetational component of this system includes open herbaceous-dominated sand "prairies" or "barrens" to open oak-dominated woodlands. A large number of narrowly distributed, endemic species are associated with this system, including *Abronia macrocarpa*, *Allium elmendorfii*, *Brazoria truncata* var. *pulcherrima* (= *Brazoria pulcherrima*), *Brazoria truncata* var. *truncata*, *Chaetopappa imberbis*, *Cryptantha texana*, *Dalea obovata*, *Galactia canescens*, *Hymenopappus carrizoanus*, *Lechea san-sabeana*, *Lesquerella grandiflora*, *Liatris elegans* var. *carizzana*, *Polanisia erosa* ssp. *breviglandulosa*, *Polygonella parksii*, *Prunus texana*, *Senecio ampullaceus*, *Sphaeralcea lindheimeri*, *Tephrosia lindheimeri*, and *Tetragonotheca repanda*.

This extremely xeric system is found primarily on the Carrizo geologic formation, but also on other Eocene strata such as Queen City and Sparta. The combination of these very droughty soils with low levels of rainfall create extreme edaphic conditions and a locally unique environment which supports a number of endemic plant taxa.

CES301.985 TAMAULIPAN SAVANNA GRASSLAND

This Tamaulipan ecological system is dominated by perennial grasses with sparse overstory of mesquite or oak trees and thornscrub. Dominant grasses are *Cynodon* spp. This system was once a common matrix system, but has largely been converted to desert scrub and exists as remnant patches. Degraded subtropical forests and woodlands may have similar structure but are not included in this system because different ecological processes maintain them.

CES205.684 TEXAS BLACKLAND TALLGRASS PRAIRIE

This system is found primarily in the Blackland Prairie region of Texas but can range into southern Oklahoma. It is typified by the presence of dark alkaline Vertisol soils over calcareous parent material interspersed with patches of acidic, sandy loam Alfisols and Mollisols. Microtopography such as gilgai and mima mounds can occur and are important microhabitats that lead to a high degree of plant diversity in this system. *Schizachyrium scoparium* and *Sorghastrum nutans* are the most frequent species with *Andropogon gerardii* as a possible associate, especially on the patches of Mollisol soils. *Tripsacum dactyloides* and *Panicum virgatum* are common associates on the Vertisol soils, especially on the gilgai microtopography. Fire and grazing constitute the major natural dynamics influencing this system. Infrequent, but intense, fires prevent woody species from establishing. Fire suppression and over grazing have allowed woody species to invade, and heavy grazing has allowed species such as *Buchloe dactyloides* and *Bouteloua rigidisetata* to invade.

This system is restricted to the Blackland Prairie region, part of the Crosstimbers and Southern Tallgrass Prairie Ecoregion, in Texas and possibly adjacent southern Oklahoma.

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The Main Belt of the Blackland Prairie is divided into Vertisol, Alfisol and Mollisol regions. The Vertisol region is characterized by the presence of dark clay alkaline soils over limestone marl parent material, while the Eastern Marginal prairies are characterized by variously textured Alfisols over sandstone parent material. Alkaline clay and clay loam Mollisols are found on the Austin Chalk formation on fragmented Cretaceous limestone. Two outlier prairies, the Fayette (EPA 32b) and San Antonio Prairies (EPA 33c), are underlain by both Vertisols and Alfisols. Each variation in soil texture and pH supports its characteristic community.

WOODY WETLAND

CES205.710 SOUTHEASTERN GREAT PLAINS FLOODPLAIN FOREST

This ecological system is found in the floodplains of medium and larger rivers of the East Central Texas Plains, Texas Blackland Prairie Regions, Crosstimbers, and the southeastern edge of the Central Great Plains (Level 3 Ecoregions 33, 32, 29 and 27 respectively, *sensu* Griffith et al. (2004)). Alluvial soils and sedimentation processes typify this system. Periodic, intermediate flooding and deposition (every 5-25 years) dominates the formation and maintenance of this system. Dominant communities within this system range from floodplain forests to wet meadows to gravel/sand flats; however, they are linked by underlying soils and the flooding regime. Canopy dominants may include *Carya illinoensis*, *Ulmus crassifolia*, *Ulmus americana*, *Celtis laevigata*, *Quercus nigra*, *Platanus occidentalis*, *Acer negundo*, *Quercus macrocarpa*, *Morus rubra*, *Fraxinus pennsylvanica*, *Salix nigra*, and *Sapindus saponaria* var. *drummondii* (= *Sapindus drummondii*). Overgrazing and/or overbrowsing may influence recruitment of overstory species and composition of the understory and herbaceous layers. Shrub species may include *Callicarpa americana*, *Ilex decidua*, *Ilex americana*, *Sideroxylon lanuginosum*, *Diospyros virginiana*, *Juniperus virginiana*, *Cornus drummondii*, and *Viburnum rufidulum*, which may occur as dense patches following disturbance, but are otherwise generally fairly sparse. Vines such as *Berchemia scandens*, *Campsis radicans*, *Vitis* spp., *Parthenocissus quinquefolia*, and *Ampelopsis arborea* may be conspicuous. Herbaceous cover includes *Elymus virginicus*, *Verbesina virginica*, *Chasmanthium latifolium*, *Chasmanthium sessiliflorum*, *Tripsacum dactyloides*, *Symphotrichum drummondii* var. *texanum*, *Geum canadense*, *Sanicula canadensis*, *Panicum virgatum*, *Galium* spp., and *Carex* sp. Herbaceous cover may be quite high, especially in situations where shrub cover is low. The environment and vegetation of this system become generally and correspondingly drier from east to west with moister representatives (such as communities containing *Quercus phellos*, *Quercus pagoda*, *Quercus alba*, and *Quercus lyrata*) occurring along the eastern and northeastern margins of the range. Representatives of this system may vary in the openness of the habitat and physiognomy.

This system occupies relatively broad flats at low topographic positions, along large streams where alluvial deposition dominates. It is found in the floodplains of medium and larger rivers of the East Central Texas Plains, Texas Blackland Prairie Regions, Crosstimbers, and the southeastern edge of the Central Great Plains (Level 3 Ecoregions 33, 32, 29 and 27 respectively, *sensu* Griffith et al. (2004)). Soils are primarily alluvial and range from sandy to dense clays.

CES205.709 SOUTHEASTERN GREAT PLAINS RIPARIAN FOREST

This ecological system occurs in various situations along small and intermittent streams in the East Central Texas Plains, Texas Blackland Prairie Regions, Crosstimbers, and the southeastern edge of the Central Great Plains (Level 3 Ecoregions 33, 32, 29 and 27, respectively, *sensu* Griffith et al. (2004)). Some trees that may be present in stands of this system include *Celtis laevigata* var. *laevigata*, *Celtis laevigata* var. *reticulata*, *Platanus occidentalis*, *Quercus nigra*, *Quercus phellos*, *Amorpha fruticosa*, *Forestiera acuminata*, *Acer saccharinum*, *Sapindus saponaria*, *Salix nigra*, *Fraxinus pennsylvanica*, *Gleditsia triacanthos*, *Carya illinoensis*, and *Ulmus crassifolia*. The environment and vegetation of this system become generally and correspondingly drier from east to west with moister representatives (such as communities containing *Quercus nigra*) occurring in the eastern parts of the range. Representatives of this system typically occur in stream-scoured situations and vary in the openness of the habitat and physiognomy.

This system occurs on minor intermittent streams and tributaries throughout the East Central Texas Plains, Texas Blackland Prairie Regions, Crosstimbers, and the southeastern edge of the Central Great Plains (Level 3 Ecoregions 33, 32, 29 and 27 respectively, *sensu* Griffith et al. (2004)). It is found along medium to very small, intermittent to ephemeral drainages. This type is ubiquitous throughout, but species composition and flood regimes are variable and are thought to be dependent on soil and geologic substrates. Generally, these are less thick alluvium than in floodplain terraces. These are flashy streams, and flooding rather than fire will be the dominant process in this system. Fuels in this system are variable, and fire-return interval is partially determined by that of the adjacent and surrounding matrix upland system, where fuels are present.

CES203.488 WEST GULF COASTAL PLAIN LARGE RIVER FLOODPLAIN FOREST

This system represents a geographic subset of Kuchler's (1964) Southern Floodplain Forest found west of the Mississippi River. Examples may be found along large rivers of the West Gulf Coastal Plain and Upper West Gulf Coastal Plain, especially the Trinity, Neches, Sabine, and others. Several distinct plant communities can be recognized within this system that may be related to the array of different geomorphic features present within the floodplain. Some of the major geomorphic features associated with different community types include natural levees, point bars, meander scrolls, oxbows, and sloughs. Vegetation generally includes forests dominated by bottomland hardwood species and other trees tolerant of flooding, including bald-cypress and water tupelo. However, herbaceous and shrub vegetation may be present in certain areas as well.

Some of the major geomorphic features associated with different community types within this system include natural levees, point bars, meander scrolls, oxbows, and sloughs (Sharitz and Mitsch 1993).

CES203.487 WEST GULF COASTAL PLAIN SMALL STREAM AND RIVER FOREST

This is a predominantly forested system of the West Gulf Coastal Plain associated with small rivers and creeks. In contrast to West Gulf Coastal Plain Large River Floodplain Forest (CES203.488), examples of this system have fewer major geomorphic floodplain features. Those features that are present tend to be smaller and more closely intermixed with one another, resulting in less obvious vegetational zonation. Bottomland hardwood tree species are typically important and diagnostic, although mesic hardwood species are also present in areas with less inundation, such as upper terraces and possibly second bottoms. As a whole, flooding occurs annually, but the water table usually is well below the soil surface throughout most of the growing season. Areas impacted by beaver impoundments are also included in this system. This system is associated with small rivers and creeks in the West Gulf Coastal Plain.

HERBACEOUS WETLAND

CES203.194 WEST GULF COASTAL PLAIN HERBACEOUS SEEP AND BOG

This wet, fire-maintained, hillside seepage system occurs in the Gulf Coastal Plain west of the Mississippi River where it is documented in eastern Texas, western Louisiana, and adjacent areas of southern Arkansas. This oligotrophic wetland is maintained by seepage at the zone between an overlying, permeable sandy layer and a lower layer of relatively impermeable material such as sandstone or clay. The vegetation of intact examples is dominated by a dense, species-rich graminoid-forb layer less than 1 m tall with continuous to nearly continuous cover, typically 80-90%. This type is intended to encompass the range of variation present in West Gulf Coastal Plain seepage bogs, although various authors have recognized a number of different subtypes. One of the most distinct variants that is included here for now is the "muck bog" of the Post Oak Savanna and Cross Timbers regions. It differs in a number of ways from most other examples of this system and may need to be recognized as a distinct ecological system. This system occurs in the Gulf Coastal Plain west of the Mississippi River where it is documented in eastern Texas, western Louisiana, and adjacent areas of southern Arkansas. There are rare examples of this (or a related system) found in the Post Oak Savanna and Crosstimbers regions of Texas.

This oligotrophic wetland is maintained by seepage at the zone between an overlying, permeable sandy layer and a lower layer of relatively impermeable material such as sandstone or clay.

MIXED UPLAND AND WETLAND

CES203.278 WEST GULF COASTAL PLAIN PINE-HARDWOOD FLATWOODS

This ecological system represents predominantly mesic to dry flatwoods of limited areas of inland portions of the West Gulf Coastal Plain. These areas are usually found on Pleistocene high terraces that are located above current floodplains. Hydrology is controlled by local rainfall events and not overbank flooding. Soils are fine-textured, and hardpans may be present in the subsurface. The limited permeability of these soils contributes to shallowly perched water tables during portions of the year when precipitation is greatest and evapotranspiration is lowest. Soil moisture fluctuates widely throughout the growing season, from saturated to very dry, a condition sometimes referred to elsewhere as xerohydric. Saturation occurs not from overbank flooding but typically whenever precipitation events occur. Local topography is a complex of ridges and swales, often in close proximity to one another. Ridges tend to be much drier than swales, which may hold water for varying periods of time. Within both ridges and swales, there is vegetation variability relating to soil texture and moisture and disturbance history. The driest ridges support *Pinus taeda* and *Quercus stellata*; more mesic ridges have *Pinus taeda* with *Quercus alba* and species such as *Symplocos tinctoria* and *Viburnum dentatum*. Fire may have been an important natural process in some examples of this system (T. Foti pers. comm.). Embedded swales tend to support hardwood forests or swamps, often heavily oak-dominated with species tolerant of some inundation, such as *Quercus phellos* and *Quercus laurifolia*, with sparse coverage of wetland herbs such as *Carex glaucescens*. Some swales support unusual pockets of *Fraxinus caroliniana* and *Crataegus* spp. These latter vegetation types are linked to West Gulf Coastal Plain Nonriverine Wet Hardwood Flatwoods (CES203.548). In Arkansas (at least), this system is most closely affiliated with these Soil Associations: "Adaton-Felker-Gore" (MUID=AR035); "Wrightsville-Acadia-Louin" (MUID=AR036); "Amy-Pheba-Savannah" (MUID=038); "Amy-Pheba-Guyton" (MUID=AR040); "Smithdale-Savannah-Sacul" (MUID= AR041); "Sacul-Savannah-Sawyer" (MUID= AR042); "Calloway-Henry-Grenada" (MUID=AR044); "Wrightsville-Kolin-Gore" (MUID=AR063); "Bussy-Tillou-Guyton" (MUID=AR069). Apparently, this system occurs within the historic range of longleaf pine [see USFS ecomap attributions]. Within this range, more information is needed to identify the toposequence between longleaf pine-dominated flatwoods/savannas/uplands and hardwood/loblolly-dominated flatwoods. The distribution of this system in the South Central Plains Flatwoods and Southern Tertiary Uplands (EPA 35e and f) needs to be better defined.

Areas occupied by this system are usually found on nonriverine, Pleistocene high terraces. Soils are fine-textured and hardpans may be present in the subsurface. The limited permeability of these soils contributes to shallowly perched water tables during portions of the year when precipitation is greatest and evapotranspiration is lowest. Soil moisture fluctuates widely throughout the growing season, from saturated to very dry, a condition sometimes referred to elsewhere as xerohydric. Saturation occurs not from overbank flooding but typically whenever precipitation events occur. Local topography is a complex of ridges and swales, often in close proximity to one another. Ridges tend to be much drier than swales, which may hold water for varying periods of time.

B. Hoagland (pers. comm. 2006) indicates it is found in McCurtain County, OK. J. Singhurst (pers. comm. 2006): "The flatwood polygons in an arc heading northwest along the south side of the Red River west of Texarkana are all mounded flatwoods dominated by *Quercus stellata*, *Quercus falcata*, *Quercus marilandica*, *Vaccinium arboreum*, *Crataegus* spp., and a few scattered *Quercus alba*, *Carya alba*, and *Pinus* spp. Herbaceous flora includes *Chasmanthium laxum*, *Danthonia* spp., and *Carex* spp. Wetter sites have *Quercus phellos* and *Quercus nigra*. Between the mounds of dry flatwood sites, sometimes rather restricted grasses such as *Glyceria arkansana* are present in seasonal pond areas. In some places between the mounds, slight seepage does accumulate, with *Sphagnum*, *Rhynchospora* spp., *Aletris aurea*, *Polygala* spp., *Juncus* spp., etc. At the base of the mounds, sites can be mesic even though there is only a change from 1 to 2 meters in elevation, with plants such as *Polygonatum biflorum*, *Triosteum angustifolium*, *Erythronium albidum*, *Podophyllum peltatum*, *Trillium viridescens*, etc. A couple of other unusual species restricted to these sites in Texas includes *Pseudognaphalium canescens* (= *Gnaphalium wrightii*) and *Parthenium hispidum* (this later plant, I believe, is also a prairie species). [In relation to] SSURGO soils, [t]he soils for northeast Texas would be mapped as Wrightsville.... I am aware of sites in Cass, Fannin, Lamar, Red River, Bowie, Franklin, Titus, and Harrison counties (Harrison County is an extension of a few polygons you have in Caddo Parish, Louisiana). There are dry flatwoods in very northwestern Caddo Parish, Louisiana, near Vivian. There are some other dry flatwoods in Van Zandt and Henderson County west of Tyler, Texas. I am mostly familiar with the northeast Texas sites. But there should also be some in southeast Texas, so I will have to quiz a couple of folks about these areas you have through the Big Thicket area. I am assuming that Latimore Smith may be able to help me define dry flatwoods in this area of Texas. Most of this country is lower wet flatwoods and wet savannas. There are extensive areas of mounded soils that have dry flatwoods taxa on the mounds, but I would be curious how the Lower WGCP sites are defined/separated from the Upper WGCP sites. They are floristically different. Latimore will have a good handle on these types, and if I can see how he defines dry flatwoods or what areas he is defining for very southwestern Louisiana, I would be willing to assist here also."

We need both flatwoods types. Wet hardwood flatwoods do often occur within xero-hydric pine-oak flatwoods, but they also occur within bottomlands, uplands, and mesic hardwoods. The dominant species are not the same; actually there is little overlap. Structure is

different: forest vs. woodland. The fire regime is different: short interval, low intensity-low severity vs. medium to long interval, low intensity-high severity. The wet type is small to large patch; the dry pine-hardwood system is matrix (D. Zollner pers. comm. 2006).

BARREN

CES203.398 SOUTHEASTERN COASTAL PLAIN CLIFF

This ecological system consists of steep to vertical or overhanging outcrops of unconsolidated sediment or rock in the Gulf and Atlantic Coastal Plain. They occur on lower bluffs adjacent to rivers or streams. The vegetation is generally sparse, limited to plants growing on bare substrate, small ledges, and other favorable microsites. The flora is a mix of herbs, shrubs, vines, tree seedlings, and some larger trees, with bryophytes potentially dominant in some examples. It typically includes opportunistic species of open and disturbed areas, along with species from adjacent forest communities and other species of wet and dry open areas. Dense shrubby or woodland vegetation may occur on the edges. Occasional examples may have denser bryophyte vegetation. More information is needed on the associations that belong to this system. Compared to cliffs of other regions, the soft Coastal Plain cliffs tend to be more frequently disturbed and more dynamic. Soil development and primary succession would quickly replace any examples that are not periodically disturbed and renewed by slumping, generally caused by undercutting by streams. Smaller slumps and active erosion by upland runoff may also disturb the communities. This is the primary rock outcrop system of the Coastal Plain, but small shaded outcrops of limestone or sandstone may be included in other systems.

These cliffs occur on steep to vertical or overhanging outcrops of Coastal Plain substrates, usually sand, clay, or sandstone. Outcrops typically occur along rivers or streams, where undercutting causes slumps that periodically renew the bare substrate. Most of these cliffs are dry, but small zones of seepage are often present, especially at the top. One association represents small clay cliffs that are kept wet by seepage. Lower portions of cliffs may periodically flood.