USDA Natural Resources Conservation Service

Ecological site F152BY002TX
Sodic Flats

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 152B–Western Gulf Coast Flatwoods

Major Land Resource Area (MLRA) 152B, Western Gulf Coast Flatwoods, is in eastern Texas and western Louisiana. Locally termed the Flatwoods, the area is dominated by coniferous forest covering 5,681 square miles (14,714 square kilometers). The region is a hugely diverse transition zone between the northern and eastern mixed forests and southern and western coastal prairies and grasslands.

Classification relationships

Major Land Resource Area (MLRA) (USDA-Natural Resources Conservation Service, 2006)

Ecological site concept

The Sodic Flat ecological site has very deep, poorly drained soils influenced by salt and bioturbation. The churning of the soil is typically caused by crawfish; coupled with the presence of salts, only plants adapted to these unique conditions survive and grow.

Associated sites

F152BY007TX	**Poorly Drained Loamy Upland** Soils are loamy and have no salt concentrations or bioturbation.
F152BY005TX	**Seasonally Wet Loamy Upland** Soils are loamy and have no salt concentrations or bioturbation.
F152BY006TX	**Well Drained Loamy Upland** Soils are loamy, well drained, and have no salt concentrations or bioturbation.

Similar sites

F152BY007TX	**Poorly Drained Loamy Upland** Soils are loamy and have no salt concentrations or bioturbation.

Table 1. Dominant plant species

Tree	(1) *Pinus palustris* (2) *Pinus taeda*
Shrub	Not specified
Herbaceous	(1) *Drosera brevifolia* (2) *Xyris*

Physiographic features

The ecological site includes areas on flats on uplands. Slope is 0 to 1 percent. Elevation ranges from 10 to 151 feet. From November to May, the depth to the top of water table will be 0 to 9 inches. The water table will deepen during the warmer months of the year.

Table 2. Representative physiographic features

Landforms	(1) Coastal plain > Flat
Runoff class	High
Flooding frequency	None
Ponding frequency	None
Elevation	3–46 m
Slope	0–1%
Water table depth	0–23 cm
Aspect	Aspect is not a significant factor

Climatic features

The Western Gulf Coast Flatwoods (MLRA 152B) is within the humid subtropical climate zone. The region boasts one of the highest rainfall averages in the southern United States, over 60 inches (152 centimeters) annually. This is due to the gulf currents that carry humid air to the region, where it condenses and precipitates. Rainfall averages are fairly consistent month by month, ranging from the lowest of 3.5 inches (8.9 centimeters) in March and the highest of 5.6 inches (14.3 centimeters) in June.

The area is prone to severe thunderstorms and tornadoes when the proper conditions exist, generally in the springtime. Sometimes excessive rainfall occurs, leading to flooding. Hurricanes also strike the region, generally in late summer or early fall. These extreme weather events can be quite destructive, toppling trees, and serves to naturally reset the vegetation to primary succession. The higher humidity of the region amplifies the feeling of heat during the summer. Prolonged droughts and snowfall events are rare.

Table 3. Representative climatic features

Frost-free period (average)	249 days

Freeze-free period (average)	289 days
Precipitation total (average)	1,600 mm

Climate stations used

- (1) WILDWOOD [USC00419754], Kountze, TX
- (2) LIBERTY [USC00415196], Liberty, TX
- (3) LUMBERTON [USC00415435], Silsbee, TX
- (4) TOWN BLUFF DAM [USC00419101], Jasper, TX
- (5) DE QUINCY [USC00162361], Dequincy, LA
- (6) DE RIDDER [USC00162367], Deridder, LA
- (7) ELIZABETH [USC00162800], Oakdale, LA
- (8) OBERLIN FIRE TWR [USC00166938], Oberlin, LA
- (9) CLEVELAND [USC00411810], Cleveland, TX
- (10) ORANGE 9 N [USC00416680], Orange, TX

Influencing water features

While no ponding or flooding occurs, the soils within the ecological site have a seasonally high water table from November to May and all are hydric. The sites have potential for being wetlands, but specific determinations will need to take place in the field by observing water, plants, and soils.

Wetland description

This site has hydric soils. Onsite investigation is necessary to determine exact local conditions.

Soil features

The soils of this site consist of very deep, poorly drained soils formed from fluviomarine deposits. The soils typically have loam or silty loam surface textures and clay loam or silty clay loam subsurface textures. Soils within this ecological site include Nona, Plank, and Vidor. Nona and Plank within the taxonomic class of Natric Vermaqualf and Vidor a Vermic Natraqualf. The term natric refers to salt concentrations within the soil and vermic refers to bioturbation caused by animals, typically crawfish.

Table 4. Representative soil features

Parent material	(1) Fluviomarine deposits–igneous and metamorphic rock
Surface texture	(1) Loam (2) Silt loam
Family particle size	(1) Fine-silty (2) Coarse-silty
Drainage class	Poorly drained
Permeability class	Very slow
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-152.4cm)	20.32–27.94 cm
Calcium carbonate equivalent (0-152.4cm)	0%
Electrical conductivity (0-152.4cm)	0–6 mmhos/cm

Sodium adsorption ratio (0-152.4cm)	2–20
Soil reaction (1:1 water) (0-152.4cm)	3.5–6
Subsurface fragment volume <=3" (Depth not specified)	0–2%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The information in this ecological site description (ESD), including the state-and-transition model (STM), was developed using archeological and historical data, professional experience, and scientific studies. The information is representative of a complex set of plant communities. Not all scenarios or plants are included. Key indicator plants, animals, and ecological processes are described to inform land management decisions.

Introduction – In southeastern Texas and southwestern Louisiana the transition from coastal grasslands to the large expanse of coniferous forest has been deemed the “Flatwoods”. As the name suggests, the region is relatively flat and, with many transitional areas, highly diverse in flora and fauna. Historically, the area was covered by pines with mixed hardwoods, sparse shrubs, and a diverse understory of grasses and forbs. Fire and drainage patterns play a significant role in shaping the plant communities and their development. Fire suppression, drainage alterations, and land conversion have reduced the amount of historical communities in existence today.

Background – Prior to settlement by the Europeans, the reference state for the Sodic Flats were Longleaf Pine/Loblolly Pine Woodlands. Remnants of this presumed historic plant community still exist where natural conditions are intact. Evidence of the reference state is found in accounts of early historic explorers to the area, historic forest and biological survey teams, as well as recent ecological studies in the last 30 years. The age of this woodland community varies, and has a diverse flora.

Settlement Management – As human settlement increased throughout the area, so did the increase in logging and grazing by domestic livestock. The logging became so extensive that by the 1930’s most of the region had been cut-over. Replanting trees to historic communities was not common and early foresters began planting loblolly pine (*Pinus taeda*) for its quick growth. As more people colonized they began suppressing fire, which allowed dense thickets of shrubs to replace the herbaceous understory.

Current Management and State – Today much of the historic forest is gone, replaced by pine plantations, crops, and pastures. The areas that were not converted have been fire-suppressed so long that loblolly pine and fire intolerant hardwoods populate the overstory structure. Currently, federally-managed properties are the best place to view the remnant sites (National Park Service, U.S. Fish and Wildlife Service, etc.). Some private individuals have begun restoring communities through selective tree planting and retention of communities that remain. Other restoration efforts include mimicking natural-disturbance regimes through gap-phase regeneration on plantation sites.

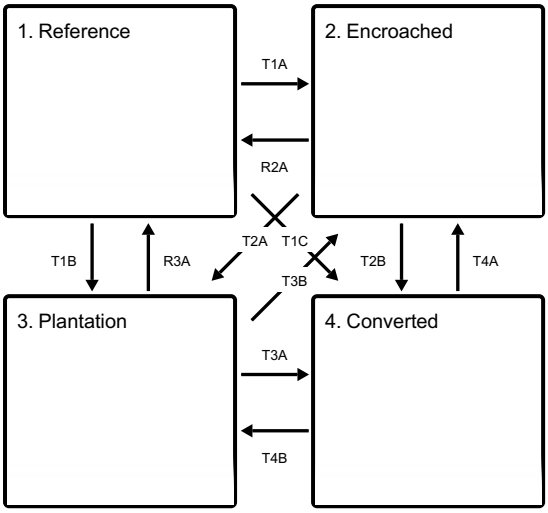
Fire Regimes – Fire was a natural and important disturbance throughout the region. Fire occurred naturally from lightning strikes, by Native Americans for game movement, and eventually early European settlers. Fires throughout the Flatwoods occurred at two different times. Early in the year, they would occur during late winter and early spring, removing senescent vegetation, recycling nutrients and minerals, and spurring new plant growth. Late summer and early fall fires occurred as well, but with a different community effect. Summer fires burned hotter and with more intensity, greatly suppressing the shrub canopy layer. The summer fires also shifted the ecological site transitional state by decreasing grass densities and increasing forb densities. The topography, fuel loads, and other conditions caused patchy burns throughout the region resulting in mosaic patterns of plant communities and a heterogeneous landscape.

Disturbance Regimes – Extreme weather events occur occasionally throughout the region. Tornados uproot trees and open canopies in the spring months. In the late summer and early fall, hurricanes or tropical depressions can make landfall, dumping excessive amounts of rain and toppling trees with high winds. Another cause of large canopy openings is the effects of the southern pine beetle (Dendroctonus frontalis). Starting in the late 1950’s,

beetle outbreaks have occurred every 6 to 9 years (although a major attack has not occurred in some time); usually when the trees are stressed due to multiple environmental factors.

State and transition model

Ecosystem states



T1A - Absence of disturbance, coupled with natural regeneration over time

T1B - Merchantable timber is harvested by clearcut and site is planted to a monoculture of pine trees

T1C - Removal of native vegetation and introduction of improved forage species or annual crops

R2A - Reduction of overstory canopy using fire and selective thinning.

T2A - Merchantable timber is harvested by clearcut and site is planted to a monoculture of pine trees

T2B - Merchantable timber harvested by clearcut, followed by planting of improved forage species or annual crops

R3A - Selective harvest combined with reintroduction of natural disturbances and native species

T3B - Lack of natural/anthropogenic disturbance and natural regeneration over time

T3A - Timber harvest by clearcut, followed by planting improved forage species or annual crops

T4A - Lack of natural/anthropogenic disturbance and natural regeneration over time

T4B - Site is planted to a monoculture of pine trees

State 1 submodel, plant communities

1.1. Longleaf Pine/Loblolly Woodland

State 2 submodel, plant communities

2.1. Pine/Hardwood Forest

State 3 submodel, plant communities

3.1. Plantation

State 4 submodel, plant communities

4.1. Planted Pasture and Row Crop

State 1
Reference

The Sodic Flat ecological site is a Longleaf Pine/Loblolly Pine Woodland. The saltiness of the site, influence by bioturbation, and seasonally perched water table greatly affect the available nutrients, especially with aluminum and magnesium. This stunts the growth of the overstory trees and creates a diverse understory. The result is a park-like appearance. The amounts of fine-fuel litter accumulation allow fires to burn frequently, every 3 to 5 years. All of these factors contribute to the openness of the site, generally 40 to 60 percent canopy cover. In parallel, sites typically have basal areas of 70 to 90 square feet per acre.

Dominant plant species

- longleaf pine (*Pinus palustris*), tree
- loblolly pine (*Pinus taeda*), tree

Community 1.1
Longleaf Pine/Loblolly Woodland

The overstory canopy is dominated by a mixture of longleaf pine and loblolly pine. Hardwoods are occasionally mixed in, but not in an abundance. Unlike other upland sites, shrubs are not prolific. Along with stunted shrubby versions of sweetbay (*Magnolia virginiana*), yaupon (*Ilex vomitoria*) and wax myrtle (*Morella cerifera*) are the only shrubs likely to be seen,. The herbaceous layer is unique in the presence of carnivorous plants, such as sundews (*Drosera brevifolia*). Sundews lure, capture, and digest insects with sticky secretions from their leaves. Members of the yelloweyed grass (Xyris sp.) are also indicators to the Sodic Flats. Sedges (Carex sp.), rushes, (Juncus sp.), pipeworts (Eriocaulon sp.), and low-growing panicums (Panicum sp.) are all common.

State 2
Encroached

A long-term lack of fire and management has caused the community to cross a threshold resulting in the Mixed Forest State (2). The crossing of this threshold represents a closure in the overstory canopy, which limits the productivity of the ground layer. The limited ground layer does not provide enough fuel to harbor a burn with the intensity found in State 1. Fire-intolerant hardwoods have become part of the overstory. The overstory trees are overstocked and limit the growth of neighboring species. The overstocking reduces tree growth and causes stress, making them vulnerable to attacks from insects and/or diseases. Longleaf recruitment may be nonexistent due to

lack of light and bare ground. Loblolly pine will especially take advantage of the current conditions. The plant communities will stay in this constant state and continue to age without disturbance or intervention.

Dominant plant species

- loblolly pine (*Pinus taeda*), tree

Community 2.1
Pine/Hardwood Forest

The understory plant layer only contains remnants of the reference community and possibly no reference community indicator species. Shade-tolerant grasses, such as longleaf woodoats (*Chasmanthium sessiliflorum*), forbs, and greenbriers (Smilax sp.) may be the only ground-layer species. Because the site lacks the diversity of the reference state, the wildlife diversity will be limited to generalist species, species requiring a closed canopy, and those seeking refuge.

State 3
Plantation

The Plantation State is a result of conversion activities. The landowner has maximized silviculture production by planting a monoculture of pine species, usually loblolly pine, but sometimes slash pine (Pinus ellioti) is planted.

Dominant plant species

- loblolly pine (*Pinus taeda*), tree
- slash pine (*Pinus elliottii*), tree

Community 3.1
Plantation

In the immediate years following the initial plantation tree planting, the understory community will resemble the reference state (State 1). During this early growth period, the landowner will typically remove unwanted hardwoods and herbaceous plants to reduce competition with the planted pine trees. As the overstory canopy closes, less understory management is required due to sunlight restrictions to the ground layer.

State 4
Converted

The Pasture and Crop state is a result of conversion activities. The landowner has maximized agriculture production by planting a monoculture of introduced grass species or agricultural row crops.

Dominant plant species

- Bermudagrass (*Cynodon dactylon*), grass
- bahiagrass (*Paspalum notatum*), grass

Community 4.1
Planted Pasture and Row Crop

Typical introduced pasture grass species include bahiagrass (*Paspalum notatum*) and different varieties of bermudagrass (*Cynodon dactylon*). The grasses are grown for livestock production through direct grazing or baling hay for later use. Agricultural row crops are grown for food and fiber production. Many farmers use herbicides to reduce unwanted plant competition which yields a plant community unrepresentative of the reference (State 1) or subsequent vegetative states.

Transition T1A
State 1 to 2

The transition from a Longleaf Pine/Loblolly Pine Woodland (State 1) to the Mixed Forest (State 2) is a result of time and long periods (greater than 10 years) of no fire and/or forest management practices. Without fire to suppress tree seedlings, biomass and diversity is lost from the grass and forb layers of the system.

Transition T1B
State 1 to 3

The transition is due to the land manager maximizing silviculture potential. Merchantable timber is harvested by clearcut. Then, the site is prepared and planted to a monoculture of pine or hardwood trees.

Transition T1C
State 1 to 4

The transition is due to the land manager maximizing agricultural production. Merchantable timber is harvested by clearcut. Then, the site is prepared and planted to either an improved grass or row crops.

Restoration pathway R2A
State 2 to 1

Restoration of this community to the reference state begins with a selective timber harvest. Removing unwanted trees opens up the canopy, allowing sunlight penetration to the ground. Years of overstory growth have limited the fuel necessary to have an effective fire. Time will be needed to encourage understory growth. Once the herbaceous layer has established, more frequent than natural burns (1 to 2 years) may be required to suppress the woody vegetation.

Transition T2A
State 2 to 3

The transition is due to the land manager maximizing silviculture potential. Merchantable timber is harvested by clearcut. Then, the site is prepared and planted to a monoculture of pine trees.

Transition T2B
State 2 to 4

The transition is due to the land manager maximizing agricultural potential. Merchantable timber is harvested by clearcut. Then, the site is prepared and planted to either an improved grass or row crops.

Restoration pathway R3A
State 3 to 1

When restoring a plantation, the land manager can either clearcut the timber and begin as in the previous example. Otherwise, gap-phase regeneration is possible through selective timber harvests. This involves replanting the desired overstory species in small openings within the current structure of the woodland. The benefit is a slow progression of restoration instead of starting from primary succession.

Transition T3B
State 3 to 2

This community transition is caused by neglecting the plantation understory. Without fire, mowing, or herbicides, unwanted understory saplings can begin to grow into the overstory.

Transition T3A
State 3 to 4

The transition is due to the land manager maximizing agricultural production. Merchantable timber is harvested by clearcut. Then, the site is prepared and planted to either an improved grass or row crops.

Transition T4A
State 4 to 2

This community transition is caused by neglecting crop, pasture, or plantation. Without continuation of agricultural or silvicultural management first-successional herbaceous plants will occupy the ground layer, followed by shrubs, and eventually shade-loving, fire-intolerant overstory species.

Transition T4B
State 4 to 3

The transition is due to the land manager maximizing silviculture production. The site prepared and planted to a monoculture of pine trees.

Additional community tables

Table 5. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)	Diameter (Cm)	Basal Area (Square M/Hectare)
Tree							
longleaf pine	PIPA2	*Pinus palustris*	Native	–	–	–	–
loblolly pine	PITA	*Pinus taeda*	Native	–	–	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
grassleaf rush	JUMA4	*Juncus marginatus*	Native	–	–
crabgrass	DIGIT2	*Digitaria*	Native	–	–
needleleaf rosette grass	DIAC	*Dichanthelium aciculare*	Native	–	–
sedge	CAREX	*Carex*	Native	–	–
little bluestem	SCSC	*Schizachyrium scoparium*	Native	–	–
yelloweyed grass	XYRIS	*Xyris*	Native	–	–
crowngrass	PASPA2	*Paspalum*	Native	–	–
panicgrass	PANIC	*Panicum*	Native	–	–
Forb/Herb					
blazing star	LIATR	*Liatris*	Native	–	–
pipewort	ERIOC	*Eriocaulon*	Native	–	–
eryngo	ERYNG	*Eryngium*	Native	–	–
anisescented goldenrod	SOOD	*Solidago odora*	Native	–	–
Shrub/Subshrub					
yaupon	ILVO	*Ilex vomitoria*	Native	–	–
wax myrtle	MOCE2	*Morella cerifera*	Native	–	–
Tree					
longleaf pine	PIPA2	*Pinus palustris*	Native	–	–
sweetbay	MAVI2	*Magnolia virginiana*	Native	–	–
loblolly pine	PITA	*Pinus taeda*	Native	–	–
Vine/Liana					
greenbrier	SMILA2	*Smilax*	Native	–	–

Wood products

These soils occur in the Woodland Suitability Group 3w9. They have moderate potential for woodland management, both pine and hardwood. The 50-year site index for loblolly pine averages 80 feet (approximately 55 feet on a 25-year curve). The site index for bottomland oaks ranges from 65 to 75 feet. The yield from an unmanaged, natural stand of loblolly pine, over a 50-year period, is approximately 230 board feet (Doyle Rule), 1.84 tons, or 75 cubic feet per acre per year. Management can substantially increase this yield. Access and equipment operability on these soils is poor during wet periods due to saturation of the soil. Harvesting and other operations may need to be suspended during such periods, when rutting will occur. Wetness also makes these soils poorly suited for log landings and roads. Low strength makes them moderately suited for road construction material. Road layout should avoid these soils whenever possible. Site preparation operations should be limited to the dry months and planting should be planned for the drier part of the planting season. Use of herbicides for site preparation must also take into consideration the poor drainage on these soils. Applications should not be made during wet periods. Wetness may cause a moderate loss in pine seedling survival. Slash pine may be suited to these soils.

Type locality

Location 1: Hardin County, TX	
UTM zone	N
UTM northing	30.5458611
UTM easting	-94.411444
General legal description	Sundew Trail – Big Thicket National Forest

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Contributors

Tyson Hart

Approval

Bryan Christensen, 9/22/2023

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators

are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	09/20/2021
Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
