USDA Natural Resources
Conservation Service

Ecological site F153AY080NC
Wet Organic Soil Flats and Depressions

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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.

MLRA notes

Major Land Resource Area (MLRA): 153A–Atlantic Coast Flatwoods

The MLRA notes section provides a brief description of the entire MLRA. This brief description of the entire MLRA is intended to provide some context about the MLRA that this ecological site resides within. A more complete description of the MLRA can be found in Ag Handbook 296 (USDA-NRCS, 2022).

This MLRA is found on the lower coastal plain and is known as the Atlantic Coast Flatwoods. This flat terrain is formed from marine terraces and fluviomarine sediments of Tertiary and Quaternary age. These marine terraces are younger to the east and are progressively older and higher inland to the west. Post formation these terraces have been crossed by widely meandering river and stream channels producing broad shallow valleys with many high order interfluves. All these factors combine to produce relatively flat landscapes that favor high water tables.

Many rivers and streams that flow through this area have headwaters that originate to the west in the upper coastal plain (MLRA 133A, Southern Coastal Plain) and piedmont (MLRA 136, Southern Piedmont) regions. Large river valleys are extremely flat and of great extent. Most surface water that originates from within the MLRA starts as blackwater in very low energy and subtle low-order channels. Most surface water emerges first as broad, very low energy, very low velocity sheet flow before accumulating in these very subtle channels. Local relief is generally less than 35 feet (10 meters), although some short, steep slopes border the stream valleys.

The dominant soil orders in MLRA 153A are Ultisols and Spodosols. The soils in this MLRA have a thermic temperature regime, an aquic or udic moisture regime, and generally have siliceous mineralogy. They are generally very deep, well drained to very poorly drained, and loamy or clayey. The major soil suborders of the MLRA include: 1) Alaquods, which formed in marine sediments on flats and terraces and in depressions, 2) Albaquults, which formed in mixed alluvium and marine sediments on flats and terraces, 3) Haplosaprists, which formed in organic deposits over mixed marine and fluvial deposits, 4) Paleaquults, which formed in marine sediments on flats and in depressions, and 5) Paleudults, which formed in marine sediments on uplands.

MLRA 153A has a lengthy north-south extent. It runs parallel to the Atlantic coast and has a width of approximately 10 to 30 miles. The MLRA extends from the northeastern corner of Florida to southern Virginia. Five states are intersected by the MLRA, including Georgia (30 percent), South Carolina (28 percent), North Carolina (28 percent), Florida (10 percent), and Virginia (4 percent). The MLRA extent makes up about 30,319 square miles (78,527 square kilometers).

Because of climatic differences between the northern and southern reaches of the MLRA, vegetative communities vary with latitude. Overall, the MLRA is dominated by pine-oak forest vegetation. Loblolly pine, longleaf pine, slash pine, sweetgum, red maple, red oak, and white oak are dominant in the uplands. Water tupelo, pond pine, swamp blackgum, laurel oak, swamp chestnut oak, bald cypress, and red maple are dominant on the bottomland. Herbaceous understory species common to the MLRA include cutover muhly, toothache grass, little bluestem, and various panicums.

Major wildlife species of the MLRA include alligator, white-tailed deer, black bear, gray fox, red fox, bobcat, raccoon, skunk, opossum, otter, rabbit, squirrel, turkey, and bobwhite quail. The threatened and endangered gopher tortoise inhabits the southern portion of this MLRA. This area provides crucial habitat for neotropical migrants, migratory waterfowl, and wading birds along the Atlantic Flyway.

(USDA-NRCS, 2022)

LRU notes

Currently, Ecological Site Descriptions (ESDs) for MLRA 153A cover the full north-south range of the MLRA. However, climate variation across the north-south extent warrants the future development of Land Resource Unit (LRU) classifications to support more precise Ecological Site Descriptions.

Classification relationships

MLRA 153A overlaps with two level III EPA ecoregion concepts: 63) the Middle Atlantic Coastal Plain and 75) the Southern Coastal Plain. Under ecoregions 63 and 75 are a number of level IV concepts, of which several apply to MLRA 153A. These include: 63c) Swamps and Peatlands, 63e) Mid-Atlantic Flatwoods, 63h) Carolina Flatwoods, 63n) Mid-Atlantic Floodplains and Low Terraces, 75e) Okefenokee Plains, 75f) Sea Island Flatwoods, 75g) Okefenokee Swamp, and 75i) Floodplains and Low Terraces. (U.S. EPA, 2013)

MLRA 153A overlaps portions of the US Forest Service Outer Coastal Plain Mixed Forest province (232). The MLRA 153A concept roughly corresponds to the western portion of the Atlantic Coastal Flatwoods (232C) and the southcentral portion of the Northern Atlantic Coastal Flatwoods (232I) sections. In combination with MLRA 153B, these two MLRAs correspond very closely to the full extent of sections 232C and 232I. (Cleland et al., 2007)

Based on the USGS physiographic classification system, most of MLRA 153A is in the Sea Island section of the Coastal Plain province, in the Atlantic Plain division. The northern quarter is in the Embayed section of the same province and division. The embayed barrier islands extend from the eastern shore of the Chesapeake Bay in Virginia to north of Charleston, South Carolina (Fenneman et al., 1946). The portion in North Carolina is referred to as the Outer Banks. Large bodies of brackish water, such as Pamlico and Albemarle Sounds, are on the inland side of the barrier islands. The Sea Islands extend from north of Charleston, South Carolina, to Jacksonville, Florida.

The reference community for this particularly site is approximately aligned with High Pocosin (Schafale and Weakely, 1990) and Shrub Bog (FNAI, 2010).

Ecological site concept

This site is characterized by very poorly drained organic soils (Histosols) with long hydroperiods on coastal plain flats and depressions including swamps and pocosins. Long hydroperiod refers to relatively long periods of soil saturation and/or inundation. Depressions may be either open or closed.

This concept represents locations where the soils meet hydric field criteria, meaning that some periods of soil saturation and/or inundation happen during the growing season, but some locations will also periodically dry out during the growing season. Any location where the soils do not meet hydric criteria is covered by a different ESD. This site is wet but mostly free from flood plain processes. It is common for the water table to be at or near (within 12 inches of) the surface 6 to 12 months of the year.

This site supports a variety of vegetation communities including shrub bogs, cedar bogs, pine woodlands, bay woodlands, cypress – tupelo swamps, and graminoid marshes. This ecological site includes some locations associated with pocosin landforms. This ecological site also includes some locations associated with Carolina bay landforms. Drainage is regulated today, but many locations of this site have historically been drained to support agriculture. When not drained, this site may be a source of surface water discharge. Ecological dynamics on this site are largely driven by precipitation, artificial drainage, and fire. Table 1 very briefly lists some of the most dominant vegetation on this site today. More detailed descriptions of community compositions are available in the State and Transition Model.

Associated sites

F153AY010NC	**Dry Sands** Dry sands often comprise a Carolina bay rim adjacent to, and higher on the landscape than a wet organic soil flats and depressions.
F153AY020NC	**Moist Sands** Moist sands often comprise a Carolina bay rim adjacent to, and higher on the landscape than a wet organic soil flats and depressions.

Similar sites

F153AY100NC	**Flooded Organic Soil Flood Plains and Terraces** This site is also very poorly drained organic soils, but it occupies flood plain locations and is subject to flooding process.
F153BY080NC	**Wet Organic Soil Flats and Depressions** This site is on very similar landforms but in an adjacent MLRA where the marine terrace surfaces are younger, less dissected, and more prone to tidal impacts.
F153AY060NC	**Wet Loamy Flats and Depressions** This site occupies similar landforms and is poorly or very poorly drained, but is comprised of loamy mineral soils.
F153AY065NC	**Wet Clay Flats and Depressions** This site occupies similar landforms and is poorly or very poorly drained, but is comprised of clayey mineral soils.
F153AY070NC	**Wet Spodosol Flats and Depressions** This site occupies similar landforms and is poorly or very poorly drained, but is comprised of Spodosols.

Table 1. Dominant plant species

Tree	(1) *Pinus serotina* (2) *Acer rubrum*
Shrub	(1) *Lyonia lucida* (2) *Morella cerifera*
Herbaceous	(1) *Woodwardia virginica* (2) *Sphagnum*

Physiographic features

This ecological site represents flats and depressions of organic soils that are mostly isolated from most flood plain processes. Ponding is the most common inundation process on this ecological site. It is common for the water table at this site to be at or near (within 12 inches of) the surface 6 to 12 months of the year. In general, these flat landforms developed by marine deposition, or ancient fluvial reworking and redeposition.

This ecological site includes some locations associated with swamps and pocosin landforms. Pocosins are a unique landform, but the soils that are mapped on pocosins are also mapped on other landforms. Pocosins are specifically on flat interstream divides. Many of the soils mapped on pocosins are also mapped on depressions. If a site might be classified as a pocosin, please consider the following: The code of federal regulations states that “Pocosin means a wet area on nearly level interstream divides in the Atlantic Coastal Plain. Soils are generally organic but may include some areas of high organic mineral soils” (7CFR 2.12). For the purposes of this Ecological Site Description, pocosin will refer to non-depressional wetland flats on organic soils. Pocosins are a State within the Wet Histosol Flats and Depressions ecological site, but pocosins are specifically on flats and only represent a portion of this ecological site.

The most recognizable characteristic of a pocosin is a raised and domed organic soil elevation cross-sectional profile. Pocosin is a type of raised bog, but raised bogs are not limited to occurring on flats. Raised bogs may occur in depressions, and the organic soil profile may rise above the elevation of the surrounding mineral soil depression (Sharitz et al., 1982). For the purposes of this Ecological Site Description (ESD), we consider a raised bog on a depression to be distinct and separate from a pocosin, which occurs specifically on a flat. The primary purpose of the distinction is proper understanding and management of hydrology.

This ecological site includes some locations associated with Carolina bay landforms. Many of the soils mapped on Carolina bay interiors are also mapped on open depressions and marine terrace or interfluve flats which do not have any bay characteristics, so not all locations represented by this ecological site are Carolina bays.

A Carolina bay is a type of closed depression (USDA-NRCS, 2017). Carolina bay depressions are oval or elliptical and have a long-axis orientated northwest to southeast (figure 1). The most recognizable landform of a Carolina bay is the sand rim, which is often well pronounced on the south and east sides of the depression. While highly recognizable, not all Carolina bays have a sand rim. Furthermore, the mere presence of a sand rim is not sufficient to diagnose current local hydrology, which is essential for determining the type of ecosystem. The most diagnostic landform of a Carolina bay is the oval or elliptical depression below the surrounding landscape surface. While the interior depression is typically shallow, it is lower than the general elevational surface of the surrounding flat, not just lower than the rim. The interior of a Carolina bay can vary significantly from flat to slightly concave, mineral soil to organic soil, and open water to raised peatland. (Ross 2003)

Within geologic time, head cutting headwaters (nick points) may intersect a Carolina bay rim, and the depression may eventually become open (figures 1, 2, and 3). As surface waters begin to flow out of a bay, it becomes an open depression, and it is hydrologically different than a closed depression (figure 2). This is especially true where surface waters flow into and through the landform, and the interior experiences flood plain dynamics (figure 3). Open depressions and flood plain systems within a bay rim may be more appropriately referred to as relict Carolina bays. In large relict Carolina bay interiors, flat topography and distance from an outlet can enable portions of the area to function much like a closed depression, so precise classification of hydrology might be challenging in some locations.

The interiors of some Carolina bays are occupied by lakes, while others are occupied by domed forested peatlands that rarely pond (Ross, 2003). Some bay interiors are dominated by mineral soils that are seasonally saturated, while others support deep muck and are saturated at or near the soil surface for significant portions of the year (Caldwell et al. 2011). Carolina bays are more defined by landform than vegetation. Vegetation communities well suited to a Carolina bay are determined mostly by soil characteristics and hydroperiod. For Carolina bay interiors with multiple different soil types and hydrologic regimes, see also the similar ESDs with descriptions of Carolina bay site types including: Wet Loamy Flats and Depressions (F153AY060NC and F153BY060NC), Wet Clay Flats and Depressions (F153AY065NC and F153BY065NC), Wet Spodosol Flats and Depressions (F153AY070NC and F153BY070NC), and Wet Histosol Flat and Depressions (F153AY080NC and F153BY080NC). At locations where the Carolina bay landform is now open to both inflow and outflow of surface water, you should examine the following ESDs: Flooded Mineral Soil Flood plains and Terraces (F153AY090NC and F153BY090NC), and Flooded Organic Soil Flood plains and Terraces (F153AY100NC and F153BY100NC).

The Carolina bay rim is typically non-hydric and comprised of sandy soils that create a distinct transition to upland conditions at the bay rim. For information about the vegetation communities on Carolina bay rims, see the following associated ecological sites: Dry Sands (F153AY010NC and F153BY010NC) and Moist Sands (F153AY020NC and F153BY020NC).

Table 2 summarizes physiography of the modal soil concepts. Table 3 summarizes physiography of all soils included in this description.

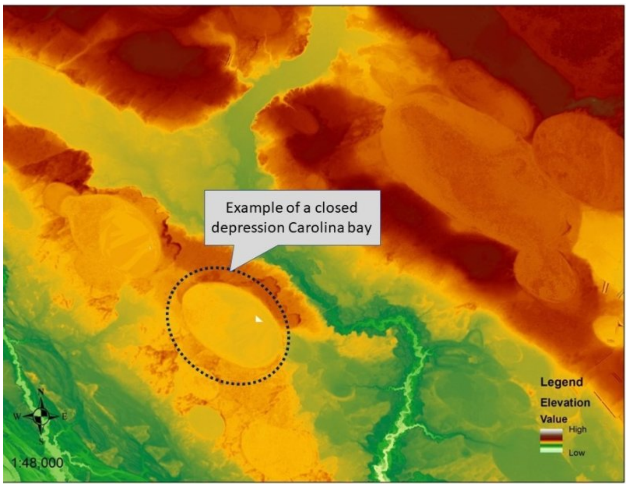


Figure 1. Numerous intact undissected closed depressional Carolina bay landforms in Bladen County, NC of MLRA 153A. The numerous oval and elliptical shaped depressions are all Carolina bay landforms.

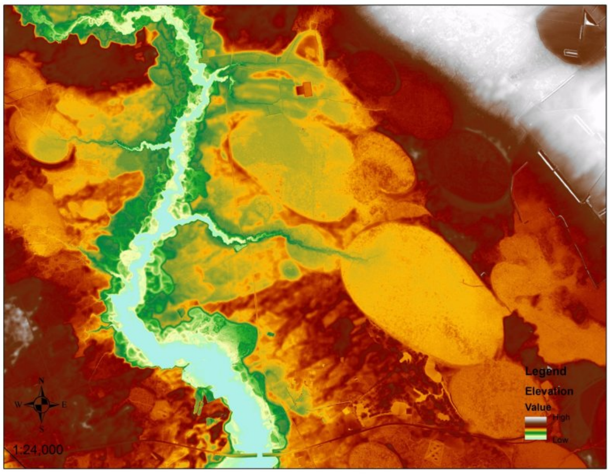


Figure 2. Carolina bay landforms that have been dissected sufficiently to deliver surface water outflows in Bladen County, NC of MLRA 153A. This system now functions as an open depression.

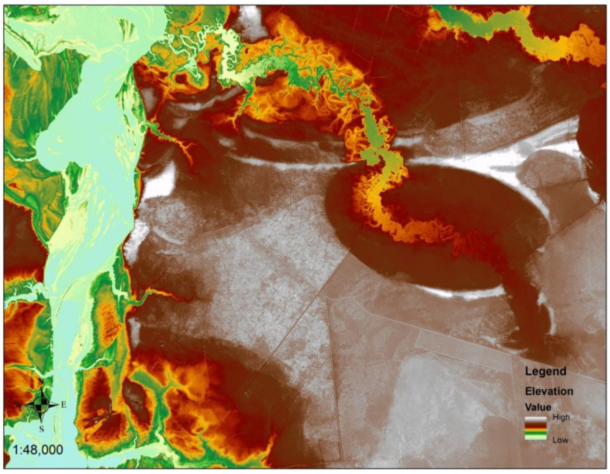


Figure 3. A relict Carolina bay landform in Pender County, NC, of MLRA 153A. This depression is dissected by surface water and now classifies as an open riverine depression. This landform does not fit this site concept. It fits a riparian zone landscape concept.

Table 2. Representative physiographic features

Slope shape across	(1) Concave
Slope shape up-down	(1) Concave

Landforms	(1) Coastal plain > Swamp (2) Depression (3) Pocosin (4) Flat (5) Carolina Bay
Runoff class	Negligible
Flooding duration	Not specified
Flooding frequency	Rare
Ponding duration	Long (7 to 30 days) to very long (more than 30 days)
Ponding frequency	Frequent
Elevation	25–295 ft
Slope	0–1%
Ponding depth	0–36 in
Water table depth	0 in
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Negligible
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to rare
Ponding duration	Very long (more than 30 days)
Ponding frequency	None to frequent
Elevation	25–295 ft
Slope	0–2%
Ponding depth	0–36 in
Water table depth	0–12 in

Climatic features

The climate across MLRA 153A is generally warm, temperate, and humid with some maritime influences near the coast. The maximum precipitation occurs during summer. Rainfall is usually of moderate intensity. Occasionally, extreme weather events (e.g., northeasters, tropical storms, and hurricanes) produce large amounts of precipitation and destructive winds. On rare occasions snowfall occurs in the northern third of the area. The average annual temperature is 59 to 70 degrees F (15 to 21 degrees C), increasing to the south. (USDA-NRCS, 2022)

Table 4. Representative climatic features

Frost-free period (characteristic range)	222-237 days
Freeze-free period (characteristic range)	257-306 days
Precipitation total (characteristic range)	49-52 in
Frost-free period (actual range)	211-241 days
Freeze-free period (actual range)	250-350 days
Precipitation total (actual range)	46-53 in
Frost-free period (average)	229 days
Freeze-free period (average)	286 days
Precipitation total (average)	50 in

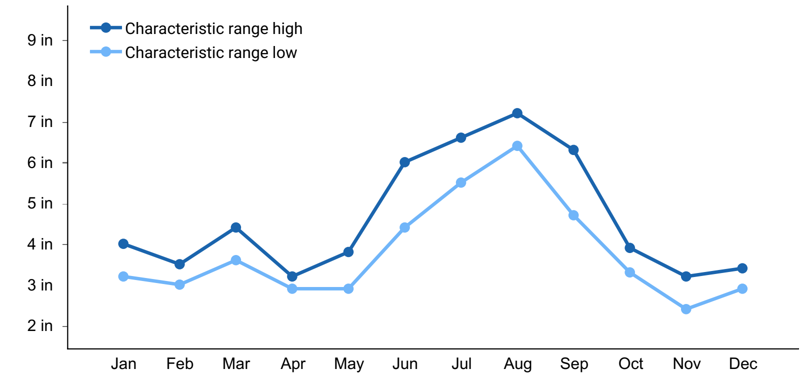


Figure 4. Monthly precipitation range

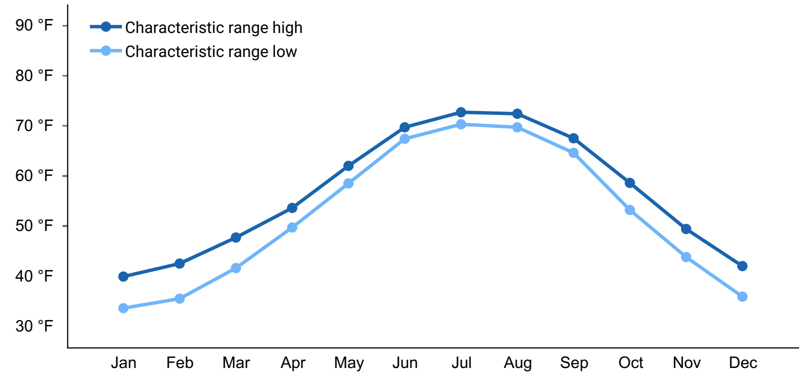


Figure 5. Monthly minimum temperature range

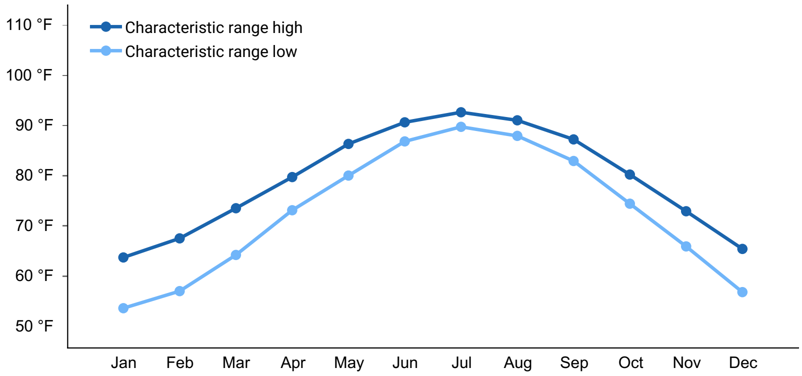


Figure 6. Monthly maximum temperature range

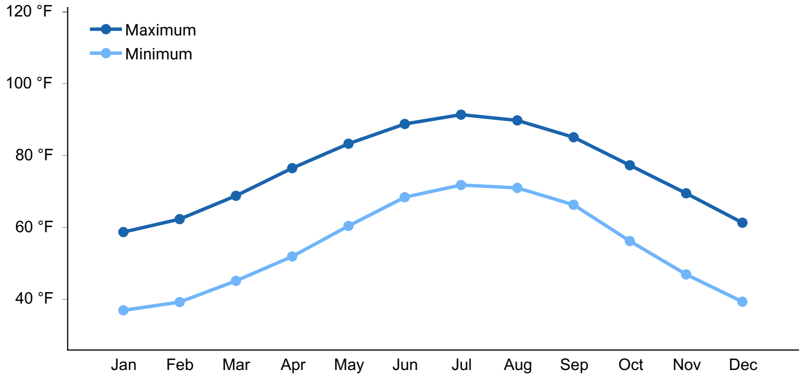


Figure 7. Monthly average minimum and maximum temperature

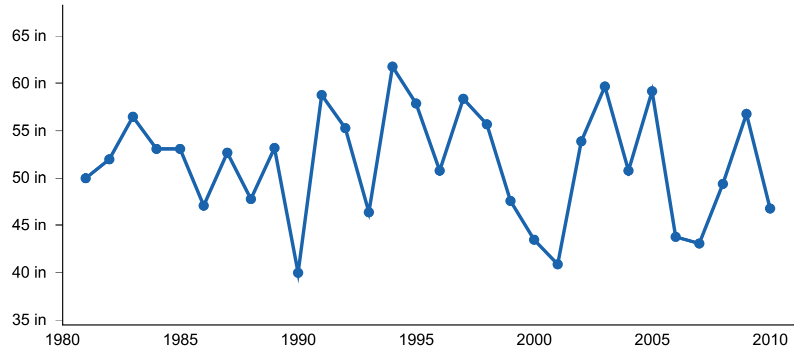


Figure 8. Annual precipitation pattern

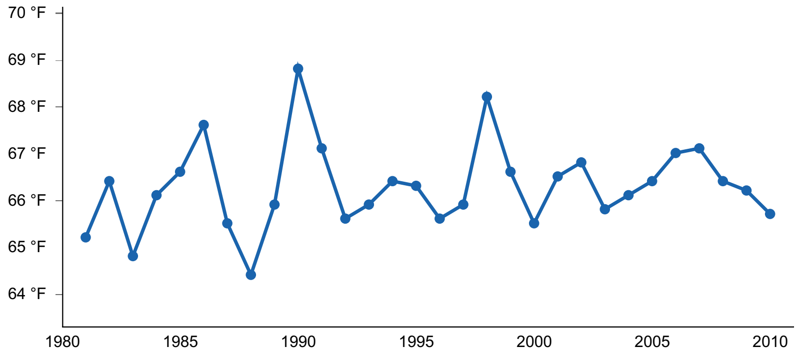


Figure 9. Annual average temperature pattern

Climate stations used

- (1) NEWPORT NEWS INTL AP [USW00093741], Newport News, VA
- (2) NEW BERN CRAVEN CO AP [USW00093719], New Bern, NC
- (3) CHARLESTON INTL AP [USW00013880], Charleston AFB, SC
- (4) FT STEWART [USC00093538], Fort Stewart, GA
- (5) JACKSONVILLE CECIL FLD NAS [USW00093832], Jacksonville, FL

Influencing water features

This MLRA is dominated by a persistent high water table, and, on this site, the water table is typically at or near (within 12 inches of) the surface 6 to 12 months out of the year. This ecological site is mostly isolated from flood plain processes, so water inputs are mostly precipitation and ground water. As the organic soils of this site become supersaturated, they may be a source of surface water outflow. These organic soil flats may be sufficiently high on the landscape that this surface water outflow accumulates into blackwater channelized flow.

Wetland description

Unless drained, Histosols in the southeast are hydric soil by definition. This site represents locations where the soils meet hydric field criteria, but, in order to classify as a wetland, a location must meet soils, hydrology, and vegetation criteria. Furthermore, field verification of hydric soils criteria is necessary at any individual location. This site represents locations where the soil is seasonally saturated and/or ponded, is not typically flooded, and is not exposed to tidal influences, so any wetlands that occur on this site are palustrine in nature. Any location where the soils are not hydric is covered by a different ESD.

Soil features

The soils of this site are all Histosols meaning that they all have thick organic surface soil horizons, greater than 40 to 60 cm (16 to 24 inches) formed over deep marine and fluviomarine mineral sediments. They are deep and acidic. They are very poorly drained. This site concept applies where the soils meet hydric criteria, meaning that they are saturated near the surface during a portion of the growing season for a period sufficiently long to produce anaerobic conditions. When dry, the organic horizons can be consumed by fire. When drained, the organic materials will decompose more quickly and will eventually lower the soil surface elevation. This site does not include soils with a shallow organic surface horizon (i.e., histic epipedons).

Soil series on this site include: Dare, Dasher, Dorovan, Istokpoga, Ponzer, Pungo.

Dasher is modal.

Table 5. Representative soil features

Parent material	(1) Organic material (2) Herbaceous organic material
Surface texture	(1) Mucky peat (2) Muck
Drainage class	Very poorly drained
Permeability class	Moderately rapid to rapid
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	10.2–20.1 in
Soil reaction (1:1 water) (0-10in)	3.6–4.4
Subsurface fragment volume <=3" (0-40in)	0%
Subsurface fragment volume >3" (0-40in)	0%

Table 6. Representative soil features (actual values)

Drainage class	Very poorly drained
Permeability class	Moderately rapid to rapid
Soil depth	65–80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	7.9–20.1 in
Soil reaction (1:1 water) (0-10in)	3.5–5.5
Subsurface fragment volume <=3" (0-40in)	0%
Subsurface fragment volume >3" (0-40in)	0%

Ecological dynamics

The most dominant ecological drivers on this site are hydrology, depth of organic soil, extreme weather, and fire. Although it is regulated today, artificial drainage has been extensively applied to manage this site. Once applied, the effects of drainage are persistent. Historically, the use of fire by indigenous civilizations may have also been extensive. Some limited wildfire and prescribed fire occur today, but fire suppression has been the norm since the 20th century. Both fire and drainage can impact the thickness of organic soil.

Persistent and prolonged saturation slows decomposition and allows for the accumulation of organic soil material.

Eventually, organic soil materials accumulate to depths great enough that tree roots are no longer able to reach the relatively nutrient rich mineral soil substrate, and the stature of the woody vegetation becomes diminished. In areas where seasonal drying is greater, organic soil materials do not accumulate to such great depths, tree roots are able to reach mineral substrate, and tree stature increases. Drainage of these sites will lower the water table and increase drying of the surface. However, the exposure of organic soils to oxygen will increase organic material decomposition, will decrease organic material thickness, and will ultimately lower the soil surface elevation.

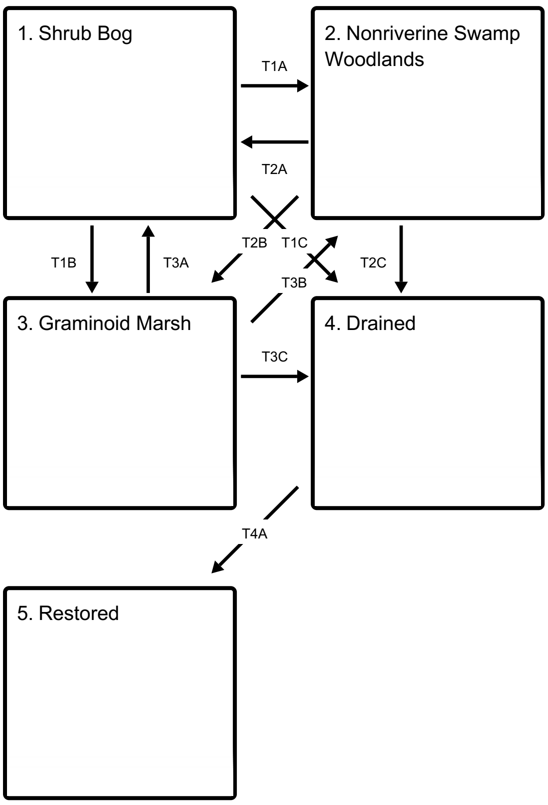
Locations with seasonally drier soils may be more prone to fire, which may also reduce the thickness of the organic soil by consuming it as fuel when dry. Intense fire during drought may consume enough organic soil material to create new open water or marsh areas when the water table returns. The variety of vegetation communities that historically occur on this site are representative of a variety of strategies to adapt to historical fire return intervals. For example, pond pine and Atlantic white cedar are well adapted to stand replacement fire, while bay woodlands are well suited to thrive on this site only in the prolonged absence of fire.

Hurricanes produce winds and rain that can have significant impact. Organic soils decrease the rooting strength of trees and make them more susceptible to windfall. Extreme precipitation can increase and prolong inundation and saturation.

In the State and Transition Model below for this site where soils meet hydric criteria, hydrologically driven transitions represent both changes in conditions across space as well as changes in conditions over time. Ideally, transitions would represent only changes over time. As updates to the soil survey allow, individual states within this site may be split into individual distinct sites.

State and transition model

Ecosystem states

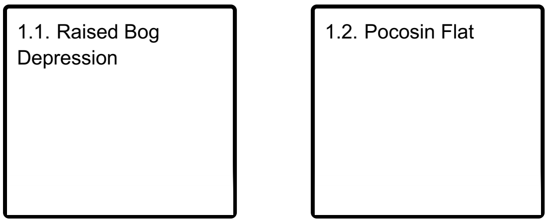


T1A - Decreased organic soil depth
T1B - Significantly increased inundation
T1C - Drainage
T2A - Increased organic soil depth
T2B - Significantly increased inundation
T2C - Drainage
T3A - Periodic fire and significantly decreased inundation
T3B - Decreased inundation

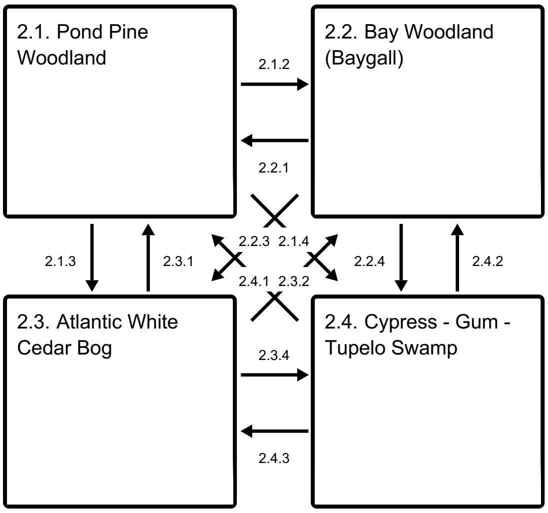
T3C - Drainage

T4A - Restoration of hydrology, vegetation, and fire

State 1 submodel, plant communities



State 2 submodel, plant communities



2.1.2 - Loss of periodic fire

2.1.3 - Stand replacement fire

2.1.4 - Loss of periodic fire and increased inundation

2.2.1 - Periodic fire

2.2.3 - Stand replacement fire

2.2.4 - Increased inundation

2.3.1 - Periodic fire

2.3.2 - Undisturbed succession

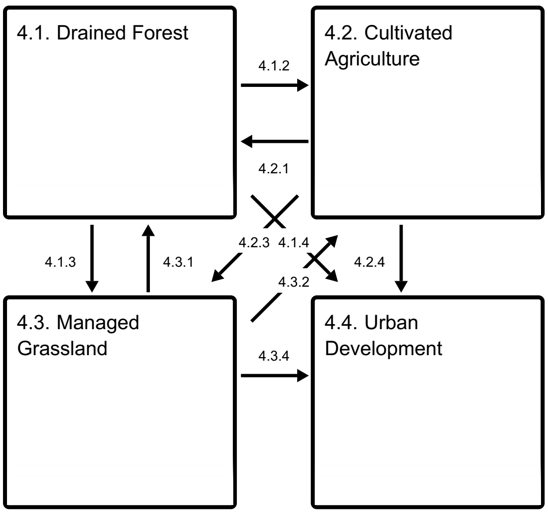
2.3.4 - Undisturbed succession and increased inundation

2.4.1 - Decreased inundation and periodic fire

2.4.2 - Decreased inundation and undisturbed succession

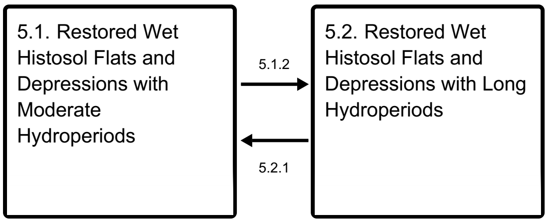
2.4.3 - Decreased inundation and stand replacement fire

State 4 submodel, plant communities



4.1.2 - Land clearing and cultivation
4.1.3 - Land clearing and establishment of grassland
4.1.4 - Land clearing and urban development
4.2.1 - Establishment of trees
4.2.3 - Establishment of grassland
4.2.4 - Urban development
4.3.1 - Establishment of trees
4.3.2 - Establishment of cultivation
4.3.4 - Urban development

State 5 submodel, plant communities



5.1.2 - Increased periods of saturation
5.2.1 - Decreased periods of saturation

State 1
Shrub Bog

Shrub bog is found on the edge of swamps, in stream head drainage seeps, and on flat, poorly drained divides between rivers. Shrub bogs occur in areas of poor internal drainage that typically have highly developed organic soils. Community dynamics are driven by hydrology, especially hydroperiod, accumulation of organic soils, and periodic fire. This site has a long hydroperiod with the water table at or near the soil surface 6 to 12 months of the year. Periodic low intensity surface fire impacts species composition and productivity, but intense fire during droughty conditions can consume significant volumes of organic soil. Periodic low intensity surface fires favor pond pine, but the absence of fire favors bay hardwoods and slash pine. Intense fire can significantly lower soil surface elevation and may cause a state transition with prolonged periods of inundation. (FNAI, 2010; Schafale et al., 1990; Sharitz et al., 1982)

Dominant plant species

- pond pine (*Pinus serotina*), tree
- loblolly bay (*Gordonia lasianthus*), tree
- sweetbay (*Magnolia virginiana*), tree
- fetterbush lyonia (*Lyonia lucida*), shrub
- swamp titi (*Cyrilla racemiflora*), shrub
- wax myrtle (*Morella cerifera*), shrub

Community 1.1
Raised Bog Depression

Shrub bog consists of dense stands of broadleaved evergreen shrubs and vines, with or without an overstory of scattered pine or bay trees, growing in raised mucky soil on a depression. The sponge-like characteristics of a broad expanse of a raised organic soil profile holds the water table at or very near the surface for extended periods of time without creating substantial ponding. These sites may be saturated nearly year around. Their hydrology is quite unique. Shrub bog is found on the edge of swamps, in stream head drainage seeps, and on flat, poorly drained divides between rivers. Raised bog conditions describe the end-point of ecological succession in these communities when the accumulation of woody organic materials develop deep peaty soils. Thick organic soils limit the access of tree roots to the more nutrient rich mineral soils buried beneath the organics. Tree stature and canopy cover become diminished. Raised bogs on depressions are handled separately from pocosins which are found specifically on flats. They are treated separately for proper understanding and management of hydrology. Raised bogs in depressions are hydrologically distinct from pocosin flats, because a depression holds more water on the bog for longer hydroperiods. With longer hydroperiods, organic soils more easily accumulate to deeper depths. Depressional hydrology facilitates the prolonged hydroperiod necessary to accumulate sufficient organic material to raise the soil surface above the surrounding mineral soil surface. The results are similar, but the hydrology of a depression is much more facilitative than a flat on an interstream divide. Depressional hydrology facilitates this process much more effectively than flat hydrology.

Dominant plant species

- pond pine (*Pinus serotina*), tree
- loblolly bay (*Gordonia lasianthus*), tree
- sweetbay (*Magnolia virginiana*), tree
- fetterbush lyonia (*Lyonia lucida*), shrub
- swamp titi (*Cyrilla racemiflora*), shrub
- wax myrtle (*Morella cerifera*), shrub
- inkberry (*Ilex glabra*), shrub
- coastal sweetpepperbush (*Clethra alnifolia*), shrub
- laurel greenbrier (*Smilax laurifolia*), shrub
- coral greenbrier (*Smilax walteri*), shrub
- giant cane (*Arundinaria gigantea*), grass
- Virginia chainfern (*Woodwardia virginica*), other herbaceous
- sphagnum (*Sphagnum*), other herbaceous
- pitcherplant (*Sarracenia*), other herbaceous
- Walter's sedge (*Carex striata*), other herbaceous

Community 1.2
Pocosin Flat

Pocosin consists of dense stands of broadleaved evergreen shrubs and vines, with or without an overstory of scattered pine or bay trees, growing in raised mucky soil on a flat or talf. The sponge-like characteristics of a broad expanse of a raised organic soil profile, characteristic of a pocosin, holds the water table at or very near the surface for extended periods of time without creating substantial ponding. These sites may be saturated nearly year around. Their hydrology is quite unique. By virtue of its position on interstream flats, supersaturated pocosin soils may be the source of surface water flows as water leaks out of the organic soil sponge in a slow sheet flow across the shallow organic and mineral soils at the margins of the raised organic soils. Some naturalists distinguish a “high pocosin” from a “low pocosin” by the stature of the woody cover. High pocosin being dominated by a forest overstory taller than 6 meters, while low pocosin refers to a more shrub-scrub woodland cover less than 6 meters tall. The distinction between the two is the thickness of the organic soil layers, with low pocosin occurring on the thickest. Thicker organic soils limit the access of tree roots to the more nutrient rich mineral soils buried beneath the organics. Tree stature and canopy cover become diminished. Low pocosin is probably the end-point of successional development on pocosin landforms. Raised bogs on depressions are handled separately from pocosins which are found specifically on flats. They are treated separately for proper understanding and management of hydrology. Raised bogs in depressions are hydrologically distinct from pocosin flats, because a depression holds more water on the bog for longer hydroperiods. With longer hydroperiods, organic soils more easily accumulate to deeper depths. Depressional hydrology facilitates the prolonged hydroperiod necessary to accumulate sufficient organic material to raise the soil surface above the surrounding mineral soil surface. The results are similar, but the hydrology of a depression is much more facilitative than a flat on an interstream divide. Depressional hydrology facilitates this process much more effectively than flat hydrology. (FNAI, 2010; Schafale et al., 1990; Sharitz et al., 1982)

Dominant plant species

- pond pine (*Pinus serotina*), tree
- loblolly bay (*Gordonia lasianthus*), tree
- sweetbay (*Magnolia virginiana*), tree
- fetterbush lyonia (*Lyonia lucida*), shrub
- swamp titi (*Cyrilla racemiflora*), shrub
- wax myrtle (*Morella cerifera*), shrub
- inkberry (*Ilex glabra*), shrub

- coastal sweetpepperbush (*Clethra alnifolia*), shrub
- laurel greenbrier (*Smilax laurifolia*), shrub
- coral greenbrier (*Smilax walteri*), shrub
- giant cane (*Arundinaria gigantea*), grass
- Virginia chainfern (*Woodwardia virginica*), other herbaceous
- sphagnum (*Sphagnum*), other herbaceous
- pitcherplant (*Sarracenia*), other herbaceous
- Walter's sedge (*Carex striata*), other herbaceous

State 2
Nonriverine Swamp Woodlands

Community 2.1
Pond Pine Woodland

Pond pine woodlands tend to occur on shallower organic soils and can occur on the outer perimeter of a raised bog or domed pocosin. Pond pine woodlands persist well and increasingly dominate this site type in the presence of periodic fire. Bay woodlands and pond pine woodlands are believed to be hydrologically very similar with fire dynamics driving the difference. Pond pine withstands low intensity fire well as it sprouts from epicormic buds. The serotinous cones of pond pine also enable it to reoccupy a site quickly after catastrophic fire. (FNAI, 2010; Nelson, 1986; Schafale et al., 1990; Sharitz et al., 1982)

Dominant plant species

- pond pine (*Pinus serotina*), tree
- loblolly bay (*Gordonia lasianthus*), tree
- sweetbay (*Magnolia virginiana*), tree
- red maple (*Acer rubrum*), tree
- swamp bay (*Persea palustris*), tree
- swamp titi (*Cyrilla racemiflora*), shrub
- fetterbush lyonia (*Lyonia lucida*), shrub
- maleberry (*Lyonia ligustrina*), shrub
- large gallberry (*Ilex coriacea*), shrub
- inkberry (*Ilex glabra*), shrub
- coastal sweetpepperbush (*Clethra alnifolia*), shrub
- laurel greenbrier (*Smilax laurifolia*), shrub
- wax myrtle (*Morella cerifera*), shrub
- giant cane (*Arundinaria gigantea*), grass
- Virginia chainfern (*Woodwardia virginica*), other herbaceous
- sphagnum (*Sphagnum*), other herbaceous

Community 2.2
Bay Woodland (Baygall)

Bay woodland communities tend to occur on shallower organic soils and can occur on the outer perimeter of a raised bog or domed pocosin. Bay woodlands persist well and increasingly dominate this site type in the long term absence of fire. Bay woodlands and pond pine woodlands are believed to be hydrologically very similar with fire dynamics driving the difference. Bay species sprout after low-intensity surface fire, but increasing bay abundance will increase fire intensity. Fires can be expected to be intense in the dense vegetation of a bay woodland, and bay trees do not typically survive high intensity fire. (FNAI, 2010; Nelson, 1986; Schafale et al., 1990; Sharitz et al., 1982)

Dominant plant species

- loblolly bay (*Gordonia lasianthus*), tree
- sweetbay (*Magnolia virginiana*), tree
- swamp bay (*Persea palustris*), tree
- red maple (*Acer rubrum*), tree

- fetterbush lyonia (*Lyonia lucida*), shrub
- large gallberry (*Ilex coriacea*), shrub
- swamp titi (*Cyrilla racemiflora*), shrub
- wax myrtle (*Morella cerifera*), shrub
- coastal doghobble (*Leucothoe axillaris*), shrub
- swamp doghobble (*Eubotrys racemosus*), shrub
- dahoon (*Ilex cassine*), shrub
- Virginia sweetspire (*Itea virginica*), shrub
- laurel greenbrier (*Smilax laurifolia*), shrub
- coral greenbrier (*Smilax walteri*), shrub
- sphagnum (*Sphagnum*), other herbaceous

State 2.3
Atlantic White Cedar Bog

Dense even aged stands of Atlantic white cedar can establish on deep organic soils following stand replacement fire. Often, they develop following a stand replacement fire that consumes soil and raises the water table. Atlantic white cedar bogs are found on peatlands and in other depressions, swales, or seepages with organic deposits. Cedar is not tolerant of fire, so it will not do well under conditions of periodic low intensity surface fire that is relatively common for many communities of this site. It is also shade intolerant so will only thrive in canopy openings. Loblolly pine is a common overstory associate in these communities. Atlantic white cedar bogs are relatively uncommon. (Nelson, 1986; Schafale et al., 1990; Sharitz et al., 1982)

Dominant plant species

- Atlantic white cedar (*Chamaecyparis thyoides*), tree
- red maple (*Acer rubrum*), tree
- fetterbush lyonia (*Lyonia lucida*), shrub
- loblolly bay (*Gordonia lasianthus*), shrub
- swamp titi (*Cyrilla racemiflora*), shrub
- wax myrtle (*Morella cerifera*), shrub
- sweetbay (*Magnolia virginiana*), shrub
- inkberry (*Ilex glabra*), shrub
- swamp bay (*Persea palustris*), shrub
- redbay (*Persea borbonia*), shrub

State 2.4
Cypress - Gum - Tupelo Swamp

A nonriverine Cypress - Gum - Tupelo swamp is typically a basin wetland vegetated with hydrophytic trees and shrubs that can withstand an extended hydroperiod. These swamps are highly variable in size, shape, and species composition. Historically, these sites were once more strongly dominated by large trees, particularly bald cypress. Small stands of large virgin cypress in nonriverine swamp environments still persist today, but logging has reduced most stands to relatively small sized gum and red maple trees, often with dense shrubs. Depending on the hydrology and fire history, shrubs may be found throughout a basin swamp or they may be concentrated around the perimeter. Historically, fires were probably rare, but might have occurred in drought periods. Stand killing fires under certain circumstances may have led to development of Atlantic white cedar bog communities. Areas susceptible to more frequent fire probably supported shrub bog communities rather than swamp. It seems likely that most Nonriverine Swamp Forests occur primarily in environments which have more nutrient influx than bogs or are more permanently wet and are protected from fire. (FNAI, 2010; Nelson, 1986; Schafale et al., 1990)

Dominant plant species

- bald cypress (*Taxodium distichum*), tree
- pond cypress (*Taxodium ascendens*), tree
- swamp tupelo (*Nyssa biflora*), tree
- water tupelo (*Nyssa aquatica*), tree
- red maple (*Acer rubrum*), tree
- laurel oak (*Quercus laurifolia*), tree

- water oak (*Quercus nigra*), tree
- sweetbay (*Magnolia virginiana*), shrub
- swamp bay (*Persea palustris*), shrub
- swamp titi (*Cyrilla racemiflora*), shrub
- fetterbush lyonia (*Lyonia lucida*), shrub
- coastal sweetpepperbush (*Clethra alnifolia*), shrub
- dahoon (*Ilex cassine*), shrub
- wax myrtle (*Morella cerifera*), shrub
- common buttonbush (*Cephalanthus occidentalis*), shrub
- laurel greenbrier (*Smilax laurifolia*), shrub
- coral greenbrier (*Smilax walteri*), shrub
- maidencane (*Panicum hemitomon*), grass
- chainfern (*Woodwardia*), other herbaceous
- sphagnum (*Sphagnum*), other herbaceous
- arrowhead (*Sagittaria*), other herbaceous
- lizard's tail (*Saururus cernuus*), other herbaceous
- smallspike false nettle (*Boehmeria cylindrica*), other herbaceous
- beaksedge (*Rhynchospora*), other herbaceous
- bladderwort (*Utricularia*), other herbaceous
- royal fern (*Osmunda regalis*), other herbaceous
- Walter's sedge (*Carex striata*), other herbaceous

Pathway 2.1.2
Community 2.1 to 2.2

Fire suppression

Pathway 2.1.3
Community 2.1 to 2.3

Stand replacement fire with nearby Atlantic white cedar seed source

Context dependence. This transition is probably uncommon, because stand replacement fire will also benefit pond pine.

Pathway 2.1.4
Community 2.1 to 2.4

Fire suppression and increased inundation

Pathway 2.2.1
Community 2.2 to 2.1

Periodic fire

Pathway 2.2.3
Community 2.2 to 2.3

Stand replacement fire with nearby Atlantic white cedar seed source

Pathway 2.2.4
Community 2.2 to 2.4

Increased inundation

Pathway 2.3.1

Community 2.3 to 2.1

Periodic fire

Pathway 2.3.2
Community 2.3 to 2.2

Undisturbed succession

Pathway 2.3.4
Community 2.3 to 2.4

Undisturbed succession and increased inundation.

Pathway 2.4.1
Community 2.4 to 2.1

Periodic fire and decreased inundation from some natural change to local hydrology.

Pathway 2.4.2
Community 2.4 to 2.2

Decreased inundation and undisturbed succession. Decreased inundation from some natural change to local hydrology.

Pathway 2.4.3
Community 2.4 to 2.3

Stand replacement fire with nearby Atlantic white cedar seed source and decreased inundation. Decreased inundation from some natural change to local hydrology.

State 3
Graminoid Marsh

Much of this community is commonly found occurring in shallow depressions containing standing water during most of the year. Some depressions are formed by fires that consume the organic soil material to depths that are sufficient to expose the water table. Most marsh is mucky and is dominated by dense stands of sedges, and they may succeed to shrub bog. (Florida SWCD, 1989; Sharitz et al., 1982)

Dominant plant species

- beaksedge (*Rhynchospora*), grass
- maidencane (*Amphicarpum*), grass
- threeawn (*Aristida*), grass
- bulrush (*Scirpus*), grass
- sedge (*Carex*), grass
- reed (*Phragmites*), grass
- flatsedge (*Cyperus*), grass
- rush (*Juncus*), grass
- spikerush (*Eleocharis*), grass
- umbrella-sedge (*Fuirena*), grass
- tenangle pipewort (*Eriocaulon decangulare*), other herbaceous
- clubmoss (*Lycopodium*), other herbaceous
- St. Peterswort (*Hypericum crux-andreae*), other herbaceous
- sandbog deathcamas (*Zigadenus glaberrimus*), other herbaceous
- cinnamon fern (*Osmunda cinnamomea*), other herbaceous
- arrowhead (*Sagittaria*), other herbaceous
- cattail (*Typha*), other herbaceous

- knotweed (*Polygonum*), other herbaceous

State 4
Drained

Historically, these sites have been drained frequently to support a variety of land uses including forestry, agriculture, and development. This drained state is included in this STM because this state exists widely today across the landscape. Drainage of wetlands today is significantly regulated. NRCS is required to consider impacts to wetlands according to Federal laws including, but not limited to, the Clean Water Act, the Wetland Conservation provisions of the Food Security Act of 1985, and State, Tribal, and local laws. It is the policy of NRCS to protect and promote wetland functions and values in all NRCS assistance (National Environmental Compliance Handbook (NECH) 610.36).

Community 4.1
Drained Forest

Forests are typically drained to facilitate timber production, especially artificial regeneration. The timber industry in the Southeast has artificially expanded the ecological footprint of slash pine and loblolly pine in particular.

Community 4.2
Cultivated Agriculture

Drainage is typically necessary on this site in order to establish cultivated agriculture.

Community 4.3
Managed Grassland

Lands drained in order to support pasture and/or hayland management.

Community 4.4
Urban Development

Lands developed to urban land use conditions.

Pathway 4.1.2
Community 4.1 to 4.2

Land clearing and cultivation

Pathway 4.1.3
Community 4.1 to 4.3

Land clearing and establishment of grassland

Pathway 4.1.4
Community 4.1 to 4.4

Land clearing and urban development

Pathway 4.2.1
Community 4.2 to 4.1

Establishment of trees. The timber industry in the Southeast has artificially expanded the ecological footprint of slash pine and loblolly pine in particular, mostly through significant site preparation during stand establishment.

Pathway 4.2.3

Community 4.2 to 4.3

Establishment of grassland

Pathway 4.2.4
Community 4.2 to 4.4

Urban development

Pathway 4.3.1
Community 4.3 to 4.1

Establishment of trees

Pathway 4.3.2
Community 4.3 to 4.2

Establishment of cultivation

Pathway 4.3.4
Community 4.3 to 4.4

Urban development

State 5
Restored

After land on this site has been drained, it is impossible to return fully to reference conditions that existed at that location prior to drainage, especially at locations that remained under active drainage management for long periods of time. Drained organic soils will have a lower soil surface elevation, and thinner organic horizons, than prior to drainage. Restoration efforts might include blocking and removing drainage structures, revegetation, and reintroduction of periodic fire, but redevelopment of organic soil surface elevations will take profoundly long periods of time to achieve, if ever.

Community 5.1
Restored Wet Histosol Flats and Depressions with Moderate Hydroperiods

This community represents restored wet histosol flats and depressions that experience moderate hydroperiods. The soils are saturated and inundated for much of the growing season. The longest saturation event within 30cm of the soil surface during the growing season ranges from 51 – 100 days. Prolonged periods of saturation and reduction reduces microbial decomposition rates, which allows for a significant amount of organic carbon to accumulate in the soils. Sites that have been restored for at least 20 years have facultative, facultative wet, and wetland obligate vegetation that dominate the community. The restored plant community composition is driven both by a species' ability to thrive in these conditions as well as whether or not it was planted at the restoration sites that were studied. (Moritz, 2021)

Dominant plant species

- bald cypress (*Taxodium distichum*), tree
- pond cypress (*Taxodium ascendens*), tree
- pond pine (*Pinus serotina*), tree
- red maple (*Acer rubrum*), tree

Community 5.2
Restored Wet Histosol Flats and Depressions with Long Hydroperiods

This community represents restored wet histosol flats and depressions that experience long hydroperiods. The soils are saturated and inundated for much of the year. The longest saturation event within 30cm of the soil surface during the growing season ranges from 101 days to the entire growing season. Prolonged periods of saturation and reduction reduces microbial decomposition rates, which allows for more organic carbon to accumulate in the soils when compared to restored wet histosol flats and depressions that experience moderate hydroperiods. Sites that have been restored for at least 20 years have facultative wet, and wetland obligate vegetation that dominate the community. The restored plant community composition is driven both by a species' ability to thrive in these conditions as well as whether or not it was planted at the restoration sites that were studied. (Moritz, 2021)

Dominant plant species

- bald cypress (*Taxodium distichum*), tree
- pond cypress (*Taxodium ascendens*), tree
- pond pine (*Pinus serotina*), tree

Pathway 5.1.2
Community 5.1 to 5.2

Increased periods of saturation. The longest saturation event within 30cm of the soil surface during the growing season ranges from 101 days to the entire growing season.

Pathway 5.2.1
Community 5.2 to 5.1

Decreased periods of saturation. The longest saturation event within 30cm of the soil surface during the growing season ranges from 51 days to 100 days.

Transition T1A
State 1 to 2

Decreased organic soil depth through either different fire dynamics or different hydrology.

Transition T1B
State 1 to 3

Significantly increased inundation

Transition T1C
State 1 to 4

The drained state is included in this STM because this state exists widely today across the landscape. This transition is included to show how we got to where we are today. Drainage of wetlands today is significantly regulated. NRCS is required to consider impacts to wetlands according to Federal laws including, but not limited to, the Clean Water Act, the Wetland Conservation provisions of the Food Security Act of 1985, and State, Tribal, and local laws. It is the policy of NRCS to protect and promote wetland functions and values in all NRCS assistance (National Environmental Compliance Handbook (NECH) 610.36).

Transition T2A
State 2 to 1

Increased organic soil depth through changes in fire or changes in hydrology.

Transition T2B
State 2 to 3

Significantly increased inundation

Transition T2C
State 2 to 4

The drained state is included in this STM because this state exists widely today across the landscape. This transition is included to show how we got to where we are today. Drainage of wetlands today is significantly regulated. NRCS is required to consider impacts to wetlands according to Federal laws including, but not limited to, the Clean Water Act, the Wetland Conservation provisions of the Food Security Act of 1985, and State, Tribal, and local laws. It is the policy of NRCS to protect and promote wetland functions and values in all NRCS assistance (National Environmental Compliance Handbook (NECH) 610.36).

Transition T3A
State 3 to 1

Periodic fire and significantly decreased inundation

Transition T3B
State 3 to 2

Decreased inundation

Transition T3C
State 3 to 4

The drained state is included in this STM because this state exists widely today across the landscape. This transition is included to show how we got to where we are today. Drainage of wetlands today is significantly regulated. NRCS is required to consider impacts to wetlands according to Federal laws including, but not limited to, the Clean Water Act, the Wetland Conservation provisions of the Food Security Act of 1985, and State, Tribal, and local laws. It is the policy of NRCS to protect and promote wetland functions and values in all NRCS assistance (National Environmental Compliance Handbook (NECH) 610.36).

Transition T4A
State 4 to 5

Remove, plug, or otherwise restore drainage, revegetate, and reintroduce periodic fire.

Additional community tables

Inventory data references

Data collection and analysis of field data will be performed during the Verification Stage of ESD development.

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Contributors

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Approval

Charles Stemmans, 2/12/2025

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	05/11/2025
Approved by	Charles Stemmans
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):**

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:

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

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

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

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:**

17. **Perennial plant reproductive capability:**