Ecological site PX133A00X007
Wet Longleaf Pine Woodland

Accessed: 04/17/2024

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): 133A–Southern Coastal Plain

This MLRA (shown in orange in the figure above) is in Alabama (26 percent), Mississippi (24 percent), Georgia (21 percent), Florida (8 percent), North Carolina (7 percent), Virginia (5 percent), South Carolina (4 percent), Tennessee (4 percent), and Louisiana (1 percent). It makes up about 106,485 square miles (275,930 square kilometers). It is the largest MLRA in the U.S. The city of Alexandria, Virginia, is at the northernmost tip of the area. The MLRA also includes Fredericksburg, Richmond, and Petersburg, Virginia; Rocky Mount, Goldsboro, Fayetteville, and Lumberton, North Carolina; Florence, Sumter, and Orangeburg, South Carolina; Albany and Tifton, Georgia; Tallahassee, Florida; Tuskegee, Eufaula, Selma, and Tuscaloosa, Alabama; Savannah, Tennessee; Corinth, Starkville, Grenada, Meridian, Hattiesburg, and McComb, Mississippi; and Bogalusa, Louisiana. Interstates 95, 64, 85, 40, 20, 20/59, 26, 16, 75, 10, 65, 59, and 55 cross this area from north to south. This area extends from Virginia to Louisiana and Mississippi, but it is almost entirely within three sections of the Coastal Plain Province of the Atlantic Plain. The northern part is in the Embayed Section, the middle part is in the Sea Island Section, and the southern part is in the East Gulf Coastal Plain Section. This MLRA is strongly dissected into nearly level and gently undulating valleys and gently sloping to steep uplands. Stream valleys generally are narrow in their upper reaches but become broad and have widely meandering stream channels as they approach the coast. Elevation ranges from 80 to 655 feet (25 to 200 meters), increasing gradually from the lower Coastal Plain northward. Local relief is mainly 10 to 20 feet (3 to 6 meters), but it is 80 to 165 feet (25 to 50 meters) in some of the more deeply dissected areas.

Classification relationships

ATTENTION: This ecological site meets the requirements for PROVISIONAL. A provisional ecological site is established after ecological site concepts are developed and an initial state-and-transition model is drafted. A provisional ecological site typically will include literature reviews, land use history information, legacy data, and must include some soils data, ocular estimates for canopy and/or species composition by weight, and some line-point intercept information. A provisional ecological site provides the conceptual framework of soil-site correlation for the development of the ESD. For more information about this ecological site, please contact your local NRCS office.

Ecological site concept

This system occurs on wet mineral soil sites, primarily in the Middle and Outer Coastal Plain but occasionally in the Fall-line Sandhills. Landforms include low areas in relict beach ridge systems and eolian sand deposits, and poorly drained clayey,
loamy, or sandy flats. They occasionally occur on river terraces above current flood levels. Soils range from clayey to sandy, with no
accumulated organic surface layer. Soils are seasonally saturated, due to high water table or poor soil drainage. The unifying feature of
this system is wet mineral soils associated with a high frequency of fire. Variation in soil texture appears to be a primary driver of
differences between associations within the system, with biogeography also important. The vegetation is naturally dominated by *Pinus palustris* or, less frequently, other wetland pines. There is a dense ground cover of herbs and

low shrubs; grasses dominate but there is often a large diversity of other herbs. Frequent, low-intensity fire is the dominant natural ecological force. Descriptions of Ecological Systems for
Modeling of LANDFIRE Biophysical Settings
Ecological Systems
06 October 2007
Descriptions provided to TNC and LANDFIRE by NatureServe

Table 1. Dominant plant species

Tree	(1) *Pinus palustris* (2) *Pinus serotina*
Shrub	Not specified
Herbaceous	(1) *Aristida stricta* (2) *Ctenium aromaticum*

Legacy ID

F133AY007NC

Physiographic features

This area extends from Virginia to Louisiana and Mississippi, but it is almost entirely within three sections of the Coastal Plain Province of the Atlantic Plain. The northern part is in the Embayed Section, the middle part is in the Sea Island Section, and the southern part is in the East Gulf Coastal Plain Section. This MLRA is strongly dissected into nearly level and gently undulating valleys and gently sloping to steep uplands. Stream valleys generally are narrow in their upper reaches but become broad and have widely meandering stream channels as they approach the coast. Elevation ranges from 80 to 655 feet (25 to 200 meters), increasing gradually from the lower Coastal Plain northward. Local relief is mainly 10 to 20 feet (3 to 6 meters), but it is 80 to 165 feet (25 to 50 meters) in some of the more deeply dissected areas.

Table 2. Representative physiographic features

Landforms	(1) Marine terrace (2) Hill (3) Interfluve
Flooding frequency	None
Ponding frequency	None
Elevation	120–660 ft
Slope	0–6%
Water table depth	6–30 in
Aspect	SE

Climatic features

The average annual precipitation in this area ranges from 41 to 53 inches (1,041 to 1,346 millimeters). Maxiumum precipitation occurs in midsummer, and the minimum occurs in autumn. High-intensity, convective thunderstorms account for summer rainfall. If snow occurs at all, it is in small amounts.

The average annual temperature ranges from 59 to 65 degrees F (15 to 18 degrees C).

Climate data is based on Normal PRISM data for the period 1981-2010.

Table 3. Representative climatic features

Frost-free period (average)	204 days

Freeze-free period (average)	232 days
Precipitation total (average)	50 in

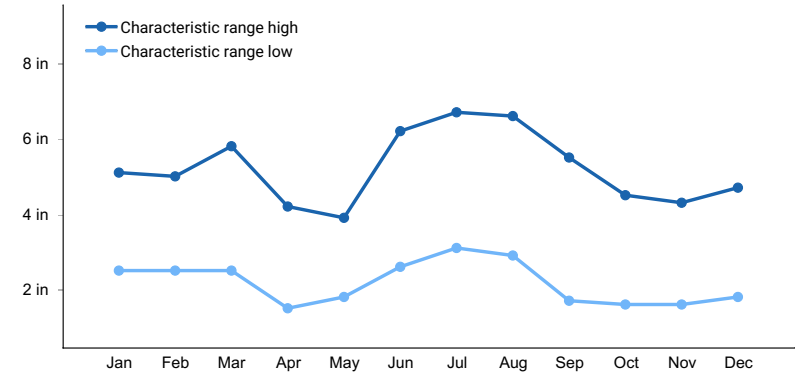

Figure 1. Monthly precipitation range

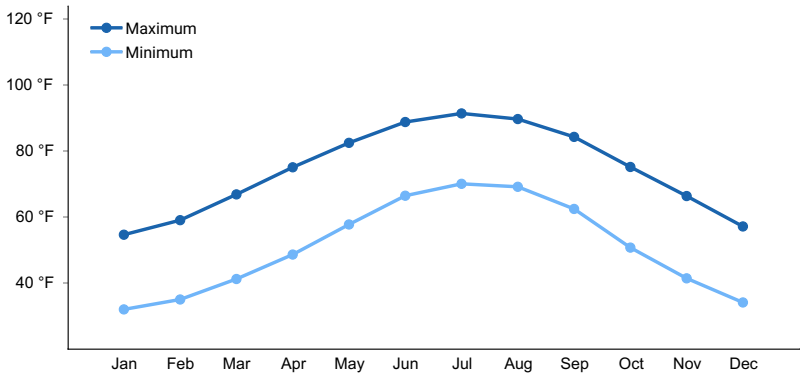

Figure 2. Monthly average minimum and maximum temperature

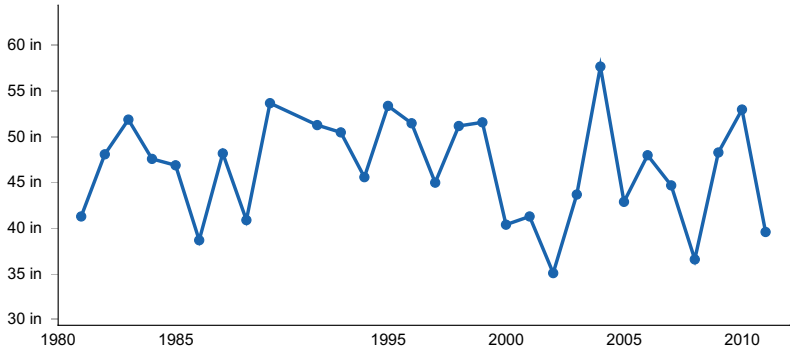

Figure 3. Annual precipitation pattern

Climate stations used

- (1) BYRON EXP STN [USC00091448], Byron, GA
- (2) AIKEN 5SE [USC00380074], Aiken, SC
- (3) CAMDEN 3 W [USC00381310], Camden, SC
- (4) SANDHILL RSCH ELGIN [USC00387666], Elgin, SC
- (5) CHERAW [USC00381588], Cheraw, SC
- (6) AUGUSTA BUSH FLD AP [USW00003820], Augusta, GA
- (7) COLUMBIA [USW00013883], West Columbia, SC
- (8) JACKSON SPRINGS 5 WNW [USC00314464], Jackson Springs, NC
- (9) JOHNSTON 4 SW [USC00384607], Johnston, SC
- (10) PELION 4 NW [USC00386775], Pelion, SC
- (11) HAMLET [USC00313784], Hamlet, NC
- (12) MACON MIDDLE GA RGNL AP [USW00003813], Macon, GA

- (13) POPE AFB [USW00013714], Fort Bragg, NC

Influencing water features

No water features significantly influence this site.

Soil features

Landscape: Lower, middle, upper coastal plain
Landform: Flats, depressions, Carolina bays
Geomorphic Component: Talfs, dips
Parent Material: Marine deposits, fluviomarine deposits
Elevation: 40 to 450 feet
Mean Annual Air Temperature: 57 to 70 degrees F.
Mean Annual Precipitation: 35 to 55 inches
Frost Free Period: 190 to 245 days

GEOGRAPHICALLY ASSOCIATED SOILS:
Chipley soils--do not have an argillic horizon
Coxville soils---have more than 35 percent clay in the top 20 inches of the Bt horizon
Dunbar soils--have more than 35 percent clay in the top 20 inches of the Bt horizon
Goldsboro soils--have dominant chroma of 3 or more between the base of the A or Ap horizons and depths of 30 inches
Lynchburg soils--have higher chroma between the base of the A or Ap
horizon and a depth of 30 inches
Noboco soils--are better drained and have a seasonal high water table at 30 to 40 inches below the soil surface
Norfolk soils--are better drained and have a seasonal high water table at more than 40 inches below the soil surface
Ocilla soils--have sandy A and E horizons more than 20 inches thick
Pantego soils--have an umbric epipedon
Paxville soils--have an umbric epipedon
Pelham soils--have sandy A and E horizons more than 20 inches thick
Scranton soils--do not have an argillic horizon
Stallings soils--have less than 18 percent clay in the top 20 inches of the Bt horizon
Woodington soils--have less than 18 percent clay in the top 20 inches of the Bt horizon

DRAINAGE AND PERMEABILITY:
Depth Class: Very deep
Drainage Class (Agricultural): Poorly drained
Internal Free Water Occurrence: Very shallow, persistent
Flooding Frequency and Duration: None, very rare, rare, occasional, frequent for brief to
Ponding Frequency and Duration: None
Index Surface Runoff: Negligible
Permeability: Moderate (Saturated Hydraulic Conductivity: Moderately high
Shrink-Swell Potential: Low

USE AND VEGETATION:
Major Uses: Forest, cropland
Dominant Vegetation: Where cultivated--corn, soybeans, and small grains. Where wooded--pond pine, loblolly pine, and hardwoods.

DISTRIBUTION AND EXTENT:
Distribution: Alabama, Florida, Georgia, North Carolina, South Carolina, and Virginia
Extent: Large

Rains, Coxville, Albany, Goldsboro, Persanti, Clarendon, Dunbar, Duplin, Eunola, Izagora, Leefield, Lynchburg, Stilson

Table 4. Representative soil features

Surface texture	(1) Loamy sand (2) Sandy loam (3) Fine sandy loam
Drainage class	Moderately well drained to somewhat poorly drained
Permeability class	Moderate to moderately slow
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	7–11 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	3.5–6
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This system occurs on wet mineral soil sites, primarily in the Middle and Outer Coastal Plain but occasionally in the Fall-line Sandhills. Landforms include low areas in relict beach ridge systems and eolian sand deposits, and poorly drained clayey,
loamy, or sandy flats. They occasionally occur on river terraces above current flood levels. Soils range from clayey to sandy, with no
accumulated organic surface layer. Soils are seasonally saturated, due to high water table or poor soil drainage. The unifying feature of
this system is wet mineral soils associated with a high frequency of fire. Variation in soil texture appears to be a primary driver of
differences between associations within the system, with biogeography also important.
Vegetation: Vegetation is a set of associations that are naturally woodlands or savannas dominated by *Pinus palustris* or, less
frequently, by *Pinus serotina*, *Pinus elliottii*, or some combination. Hardwoods are present in any abundance only in examples altered
by fire suppression. The ground cover is a dense combination of herbs and low shrubs. A variety of ericaceous shrubs and hollies is
common, with density determined by fire history. Grasses naturally dominate the ground cover. *Aristida stricta* often dominates within
its range, but *Ctenium aromaticum*, *Sporobolus pinetorum*, *Sporobolus teretifolius*, or other grasses may dominate. A great diversity of
other herbs is often present, including composites, sedges, insectivorous plants, and variety of showy forbs. Communities in this
system are often very high in species richness, with some of the highest values measured anywhere at the 1/10-hectare, 1/100-hectare,
and 1-square-meter levels. However, some associations are naturally low to moderate in species richness.
Dynamics: Frequent fire is the predominant natural force in this system and is crucial in determining its structure and even its
identity. Communities naturally burned every few years, many averaging as often as every 3 years. Fires are naturally low to moderate

in intensity. They burn above-ground parts of herbs and shrubs but have little effect on the fire-tolerant trees. Vegetation recovers very
quickly from fire, with live herbaceous biomass often restored in just a few weeks. Many plants have their flowering triggered by
burning. In the absence of fire, the shrubs increase and hardwoods may invade the system. Herb layer density and diversity decline
after just a couple of years without fire. In time, unburned examples will become nearly indistinguishable from the drier associations
of Atlantic Coastal Plain Peatland Pocosin and Canebrake (CES203.267).
Canopies are believed to naturally be many-aged, consisting of a fine mosaic of small even-aged groves driven by gap-phase
regeneration. Longleaf pine is shade-intolerant and slow to reach reproductive age but is very long-lived. Most plants in this systemDescriptions of Ecological Systems for
Modeling of LANDFIRE Biophysical Settings
Ecological Systems of
location MRLC Map Zones 45, 46, 47, 48, 53, 54, 55, 56, 57, 58,
59, 60 OR 61; Including Aggregates
06 October 2007
Descriptions provided to TNC and LANDFIRE by NatureServe

State and transition model

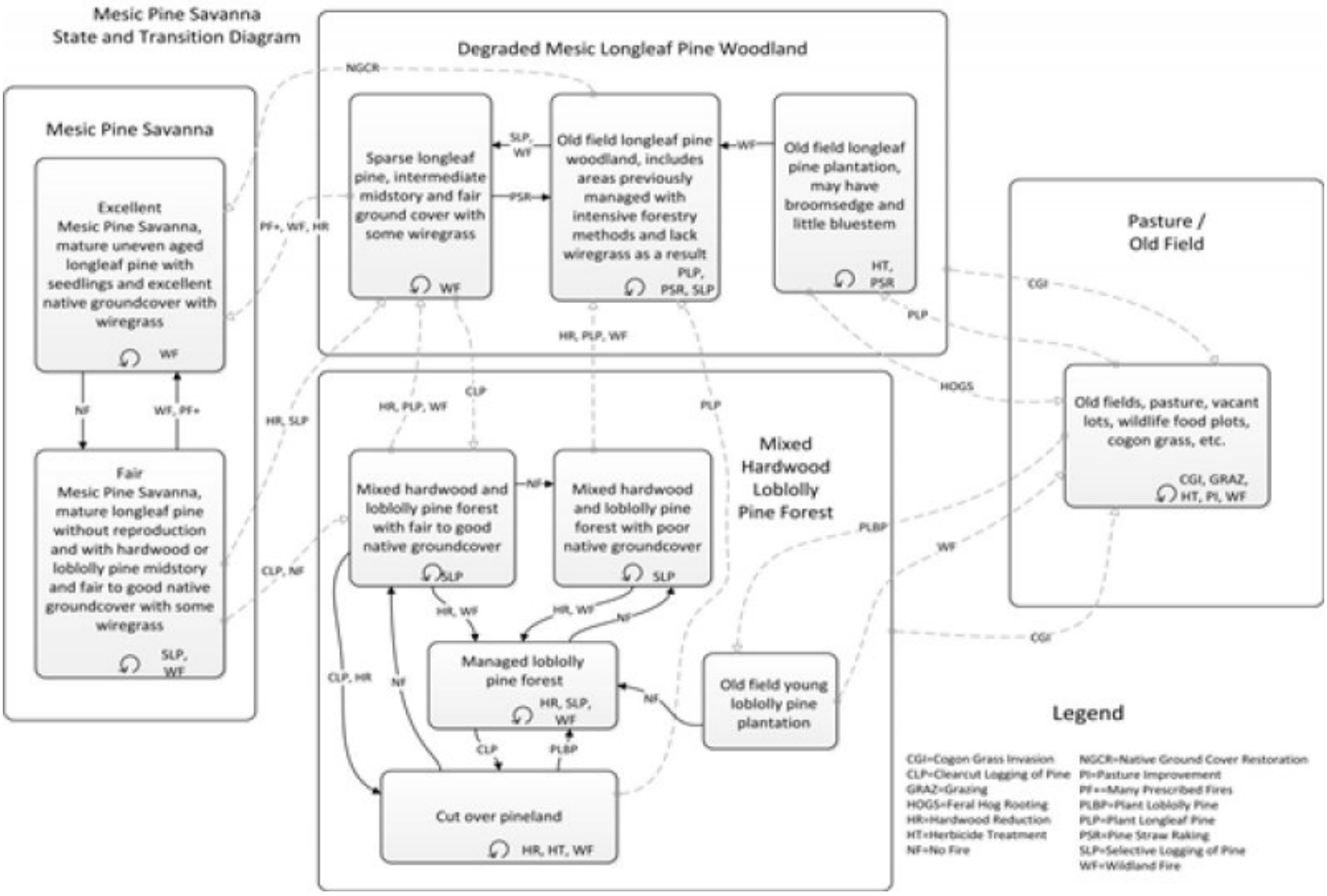

Figure 5. image

State 1
Reference State - Longleaf Pine/ Blackjack Oak - Southern wiregrass upland

This is the historic climax plant community for this ecological site. An open canopy of longleaf pine exists with a minimal oak understory, commonly *Quercus marilandica* (blackjack oak).Fire is the most important process in maintaining the natural vegetation of this ecological site. The amount of canopy closure in this community depends

on the fire regime. Lack of fire tends to lead to the degradation of the natural vegetation by causing canopy closure by hardwoods and loss of longleaf pine and native grasses.

Community 1.1
Mature longleaf pine overstory, mid- and understory oak encroachment, in need of fire

This community phase is generally the result of lower fire frequency. Either fire suppression or a change in fire regime (burning every 3 to 5 years, dormant season burns) allows woody vegetation growth in the mid- and understory. Species composition is similar to phase 1.1. The dominant overstory species is longleaf pine, which are widely spaced across the landscape. Because of the buildup of litter and resulting lack of bare mineral soil, longleaf pine regeneration is inhibited. If fire suppression continues, oaks and other hardwoods will thrive, eventually out-competing any young longleaf that have managed to become established. In addition, herbaceous groundcover is not as abundant as in phase 1.1, although species composition is similar. Changes in fire regime result in successful hardwood encroachment, litter accumulation, and a subsequent shift in herbaceous species abundances. Note: Data associated with this phase needs to be updated. 2.6.2014 DCP

Forest overstory. longleaf pine (Pinus palustris)
turkey oak (Quercus laevis)

State 2
Longleaf Pine - Oak Woodland

The longleaf pine-hardwood forest state is characterized by a more closed canopy relative to the reference state. BLackjack oak (*Quercus marilandica*) cover begins to rival longleaf pine. Less fire-tolerant pines such as loblolly pine (*Pinus taeda*) begin to establish. Hardwood trees such as bluejack oak (*Q. incana*) and persimmon (*Diospyros virginiana*) compete with the remaining longleaf for canopy space. Shrub density and mass is increased relative to the reference state. Herbaceous species richness and productivity will continue to decline with canopy closure and the resulting decrease in sunlight penetration. Species richness is the number of different species present.

Community 2.1
Degraded longleaf pine with sparse regeneration, intermediate mid-story, and fair ground cover

More than five years of fire suppression crosses a threshold from state 1 to state 2. This state is characterized by scattered longleaf pine. Continued fire suppression allows oak seedlings to reach basal diameters greater than four inches, which allows the hardwoods to resist surface fires that may occur. Thus, blackjack oak cover begins to rival that of longleaf pine, and, due to lack of longleaf pine regeneration will become dominant. Loblolly pine (*Pinus taeda*) may also begin to encroach. Herbaceous species richness suffers from continued fire suppression. Increased shade negatively impacts native groundcover as hardwood coverage continues to expand. The result is degraded stand structure and reduction in fine fuels needed to carry a prescribed burn. This cycle continues to support hardwood dominance. NOTE: DATA NEEDS TO BE UPDATED! 2.6.2014 DCP

Forest overstory. Pinus palustris (longleaf pine)
Quercus laevis (turkey oak)
Quercus margarettae (dwarf post oak)
Quercus incana (bluejack oak)
Diospyros virginiana (persimmon)

State 3
Hardwood-Mixed Pine Forest

Lack of a favorable environment for regeneration and competition from hardwoods and other pines have resulted in either longleaf being lost from the site, or remaining individual trees being widely dispersed. Pines such as loblolly pine may have become established due to lack of fire. Canopy closure approaches 100 percent, dominated by oaks with some hickory, sweetgum, and persimmon. Because of lack of sunlight penetration to the understory, shrub size and numbers are reduced relative to state 2, and herbaceous species characteristic of the reference state are very sparse or no longer present.

Community 3.1
Mixed hardwood- Pine forest

The canopy of this community phase is usually dominated by blackjack oak (*Quercus marilandica*) and can have scattered loblolly pine (*Pinus taeda*). Longleaf can still be present, but regeneration is not occurring. Other oaks (*Q. incana*, Q. margarettae), persimmon (*Diospyros virginiana*), and sweetgum (*Liquidambar styraciflua*) are also present. The absence of fuels from pine needles and herbaceous plants will further decrease the ability of the site to carry surface fires and perpetuate the scrub oak-dominated forest. NOTE: DATA NEEDS TO BE UPDATED!! 2.6.2014 DCP

Forest overstory. Pinus palustris (longleaf pine)
Pinus taeda (loblolly pine)
Quercus marilandica (blackjack oak)

Forest understory. Gaylussacia dumosa (dwarf huckleberry)
Vaccinium stamineum (deerberry)
Tephrosia virginiana (Virginia tephrosia)

State 4
Mixed Oak - Hardwood Forest

The Mixed Oak - Hardwood state is the product of long-term lack of fire management (century scale?). This community phase is naturally present in patches within the larger ecological site, most often on microsites that are protected from fire (Frost and Langley, 2008; Edwards et al., 2013). However, large-scale fire suppression allows continued encroachment of fire-tolerant oaks, and longleaf pine reproduction eventually ceases. This leaves the site open for continued oak domination. Fine fuels typical for low intensity ground fires are absent, but coarser fuels such as branches and leaves are present. Brockway and Outcalt (2000) suggest that presecribed fire alone is not effective at enhancing natural longleaf establishment after a major disturbance event such as wildfire. Hardwood removal (chemical or mechanical) in combination with prescribed fire is much more effective. NOTE: DATA NEEDS TO BE UPDATED!! 2.6.2014 DCP

Community 4.1
Mixed oak - Hardwood Forest

This could probably use some fleshing out... This community phase is naturally present in patches within the larger ecological site, most often on microsites that are protected from fire (Frost and Langley, 2008; Edwards et al., 2013). However, long-term fire suppression or lack of forest management can lead to larger spatial coverage of this state (Sorrie, 2011). After continued encroachment of fire-tolerant oaks, longleaf pine reproduction eventually ceases. This leaves the site open for continued oak domination. Fine fuels needed to carry low intensity ground fires are absent, but coarser fuels such as branches and leaves are present.

Forest overstory. Quercus laevis (turkey oak)
Quercus incana (bluejack oak)
Pinus palustris (longleaf pine)
Pinus taeda (loblolly pine)
Sassafras albidum (sassafras)
Diospyros virginiana (persimmon)

Forest understory. Tephrosia virginiana (Virginia tephrosia)
Vaccinium stamineum (deerberry)

State 5
Planted Longleaf Pine with Native ground cover

Longleaf pine are planted to grow trees to a marketable size or to attempt to restore a system that would be similar to the reference plant community and in the interim sell pine straw as an urban landscape mulch (Alig et al., 2002). However, the richness of herbaceous species and associated animals are unlikely to completely mimic the reference state. However, this state is a functioning ecosystem with strong similarities to the reference plant

community. Planted pines are generally even-aged and evenly spaced. If longleaf pine planting density is too high, the trees will shade out heliophytic native ground cover. In dense even-aged stands needle fall may be high, which can contribute to hotter fires. Consultation with a professional forester is recommended before establishing a longleaf pine plantation. Grasses commonly planted in this state are wiregrass, little bluestem, Indiangrass and switchgrass.

Community 5.1
Planted longleaf pine-native grasses

A shift to a planted longleaf pine - native grass state could be made from any other forested state in the ecological site by clear cutting, preparing the site and establishing pines and native ground cover (Fox et al., 2004). On former cropland, pasture or old field states, scalping and subsoiling will probably be necessary when preparing the site for tree planting. A planted longleaf pine - native grass state can be managed with fire and utilized as wildlife habitat or livestock grazing land. If shifted from a hardwood forest state, clear cut hardwood trees will sprout from the roots and will have to be controlled, usually with herbicides. If not controlled when the longleaf seedlings are young, hardwood trees and shrubs will likely overcome the site, overtopping and out- competing the longleaf seedlings for light. If shifted from a pine plantation state, a large variety of species could occur in the understory including trees, shrubs, vines, grasses, and grass-like species, forbs, and ferns. Supplemental planting of native understory species may or may not be needed depending on condition of the seed bank and the goals and objectives of the land manager. If pine species other than longleaf were originally established, the plantation can be shifted to longleaf either gradually with selective cutting, prescribed burning and longleaf seedling planting, or all at once with a clearcut, site prep and longleaf plantation establishment. If shifted from a pasture, cropland, or abandoned field state, the understory vegetation will likely be determined by the existing vegetation prior to tree planting and the field preparation that took place. If no permanent vegetation was present (i.e. crop field) then annual species will likely dominate the understory. If perennial grasses were present (i.e. pasture or abandoned field) then these grasses may return along with other annual species occasionally accompanied by greenbriar and blackberry. All understory species will start to diminish as the tree canopy closes unless thinning is utilized to manage for understory vegetation. More desirable native grasses and forbs will not be likely to appear from the seedbank if there is any history of cultivation. Supplemental planting will be necessary if native understory species restoration is a goal for the property. Planted longleaf pine - native grass states will need to be seeded or plugged to native warm season grasses such as wiregrass, little bluestem, and other native species that are commonly utilized as wildlife habitat. In these cases, tree canopy closure must be managed to allow for adequate light for understory vegetation to thrive. NOTE: DATA NEEDS TO BE UPDATED! 2.6.2014 DCP

State 6
Pine Plantation - Non-native ground cover

Loblolly and slash are the pine species most often planted in the region to produce a marketable wood product. Establishment of these pines has resulted in longleaf stands lacking native ground cover. Subsequent management will be in keeping with long-term and interim objectives and may include vegetation management with prescribed burning, and periodic stand thinning.

Community 6.1
Longleaf pine plantation with non-native groundcover

In recent years, longleaf pine planting has increased. However, not all tree planting is accompanied by native ground cover restoration. In the case of having non-native ground cover, the ecological functionality of the ecosystem does not mirror that of a complete longleaf pine-wiregrass ecosystem. Subsequent management should be planned with long term and interim objectives and may include vegetation management with prescribed burning and periodic stand thinning.

Forest overstory. Pinus palustris (longleaf pine)

Community 6.2
Loblolly or slash pine plantation

Southern pines can be managed in a variety of different ways and for a variety of different purposes including timber

production, wildlife habitat, recreation, carbon sequestration, biomass production, pine straw production, silvopasture, or a combination of purposes. Pine plantations in this area are primarily managed for pulpwood or higher value products such as saw and veneer logs or utility poles. These products require using even-aged management that ultimately calls for clear-cutting and re-planting at the end of a specified rotation age. Precommercial thinning may occur as early as 5-10 years after stand establishment, and commercial thinning may occur at approximately 10 year intervals, usually producing pulpwood. Pine plantations usually undergo a final harvest between 25 and 45 years of age, but shorter rotation crops of 15 to 18 years are also considered. Silviculture practices include but are not limited to: site preparation, prescribed burning, tree planting, weed control, fertilization, and thinning (Alig et al., 2002). Alternative management prescriptions have been developed to allow for increased plant diversity, especially in the understory; improved wildlife habitat; and uneven-aged and mixed species overstories. Essentially these management prescriptions call for heavier thinning, more frequent prescribed burning and either planting or allowing natural regeneration of native grasses, forbs, shrubs and pine and/or hardwood trees. A proportion of the mature trees are allowed to reach much greater age than typical rotation ages for timber management purposes, creating greater variety of tree sizes and canopy structure. This state can be managed in a way to restore either the planted longleaf pine-native grass state (state 5) or the degraded longleaf pine woodland state (state 2). The pine plantation state can be maintained indefinitely unless a major disturbance such as a crown fire, inclement weather condition, pest, or disease contributes to eliminating the stand. Hardwood tree species will encroach after any thinning operation and must be controlled with prescribed fire, herbicides or a combination of both if a pure pine stand is desired.

Forest overstory. Pinus taeda
Pinus elliottii

State 7
Crop or Pasture land

If a pine plantation is not established, the most common agricultural use of the site is pasture or hay production. Fruit and vegetable production, and row crops can be regionally important. Agricultural yield information is available through Web Soil Survey (WSS) and can accessed here: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

State 8
Abandoned/Old Field

When management or regular disturbances cease on cut-over forest, row crop or forage land, weedy and woody species become established. The abandoned field state is recognized by secondary plant community succession. Invasive species such as Chinese privet (*Ligustrum sinense*), silktree (Albiziz julibrissin), and cogon grass (*Imperata cylindrica*l) can invade and dominate southern pine sites and prevent many uses. Cogon grass is particularly difficult and costly to control.

Transition T1A
State 1 to 2

Continued infrequent or lack of fire will lead to a transition from state 1 to state 2. Increased hardwood and shrub development will occur, and these species will become more fire-tolerant as basal diameters increase. Lack of fire allows the accumulation of a thick litter layer, which inhibits longleaf pine seed germination. Lack of longleaf regeneration further enhances the success of hardwood species. The threshold from state 1 to state 2 is crossed when the natural fire frequency is removed for more than 5 years. Without persistent and costly management, reversal (restoring state 1) is extremely difficult (Walker and Silletti, 2006).

Transition T1B
State 1 to 5

Transition from state 1 to state 5: Clear cut, plant longleaf, re-establish native groundcover if necessary Although not recommended, it is possible to convert from state 1 to state 5. Site preparation should occur after an area is clear cut. Coarse woody debris can impede tree planters. Concentrating debris in windrows and piles and burning it is recommended. Unwanted vegetation should be controlled prior to planting to reduce competition for the new stand. This can be accomplished by mechanical and/or chemical methods. Herbicide prescriptions can be

developed to target specific species or groups of unwanted vegetation. For example, some herbicides target woody plants; others kill grasses or legumes. Care should be taken when using herbicides to avoid unwanted disturbance and herbicide application to any remaining native ground cover. The site should be monitored for appearance of native groundcover. If herbaceous species do not naturally regenerate, the seed source may have been lost. Native groundcover should be established by planting. Selective cutting can perpetuate stand integrity while providing monetary gain to the landowner. Professional foresters should be consulted on this type of management goal.

Transition T1C
State 1 to 6

Transition from state 1 to state 6: Clear cut, plant pines (longleaf, loblolly, slash), maintain 2-3 year fire frequency Although not recommended, it is possible to convert from State 1 to State 6. Site preparation should occur after an area is clear cut. Coarse woody debris can impede tree planters. Concentrating debris in windrows and piles and burning it is recommended. Unwanted vegetation should be controlled prior to planting to reduce competition for the new stand. This can be accomplished by mechanical and/or chemical methods. Herbicide prescriptions can be developed to target specific species or groups of unwanted vegetation. For example, some herbicides target woody plants, while others kill grasses or legumes. Selective cutting can perpetuate stand integrity while providing monetary gain to the landowner. Professional foresters should be consulted on this type of management goal.

Transition T1D
State 1 to 7

Transition from State 1 to State 7: Clear-cut, stump and brush removal, establish crop or pasture

Transition T1E
State 1 to 8

Transition from State 1 to State 8: Although not recommended, it is possible to transition from the reference state to the Abandoned/Old Field State. This would occur upon clear-cutting and abandonment.

Restoration pathway R2A
State 2 to 1

Restoration from state 2 to state 1: Reintroduction of 2-3 year fire frequency, hardwood removal and/or herbicide if necessary A return to the 2-3 year fire frequency can restore state 2 to state 1. Longleaf forests accumulate high levels of litter due to the large size and decay resistance of the needles. Care should be exercised when re-introducing fire to this community. Fuel treatments such as raking and/or wetting the area around existing trees and mowing to remove standing fuels might be necessary to prevent mortality of the overstory. In some areas, removal of hardwoods by mechanical or chemical means can hasten restoration (Provencher et al., 2001; Brockway and Outcalt, 2000).

Conservation practices

Brush Management
Prescribed Burning
Restoration and Management of Rare and Declining Habitats
Forest Stand Improvement

Transition T2A
State 2 to 3

Transition from state 2 to state 3: Continued lack of fire or infrequent burning Continued fire suppression (> 5 year fire return interval) can affect significant changes in vegetation structure and composition in this ecological site. Hardwood encroachment and establishment is outcompeting the remaining longleaf pine. Furthermore, natural regeneration of longleaf pine and the native herbaceous groundcover species is retarded.

Transition T2B
State 2 to 5

Transition from state 2 to state 5: Remove existing hardwoods (and pines if desired), plant longleaf, re-establish native groundcover if necessary, reintroduction of 2-3 year fire frequency After timber removal, site preparation should occur. Coarse woody debris can impede tree planters. Concentrating debris in windrows and piles and burning it is recommended. Unwanted vegetation should be controlled prior to planting to reduce competition for the new stand. This can be accomplished by mechanical and/or chemical methods. Herbicide prescriptions can be developed to target specific species or groups of unwanted vegetation. For example, some herbicides target woody plants, while others kill grasses or legumes. Care should be taken when using herbicides, as further disturbance and herbicide application can be detrimental to any remaining native ground cover. The site should be monitored for the appearance of native groundcover. If herbaceous species do not naturally regenerate, the seed source may have been lost. Native groundcover should be established by planting.

Transition T2C
State 2 to 6

Transition from state 2 to state 6: Clear cut (or hardwood removal), plant pines (longleaf, loblolly, slash), reintroduction of 2-3 year fire frequency After timber removal, site preparation should occur. Coarse woody debris can impede tree planters. Concentrating debris in windrows and piles and burning it is recommended. Unwanted vegetation should be controlled prior to planting to reduce competition for the new stand. This can be accomplished by mechanical and/or chemical methods. Herbicide prescriptions can be developed to target specific species or groups of unwanted vegetation. For example, some herbicides target woody plants, while others kill grasses or legumes. If transitioning to community phase 6.1, longleaf pine should be planted if necessary. If transitioning to community phase 6.2, other pine species should be planted.

Transition T2D
State 2 to 7

Transition from state 2 to state 7: Clear-cut, stump and brush removal, establish crop or pasture

Transition T2E
State 2 to 8

Transition from state 2 to state 8: Although not recommended, it is possible to transition from this state to the Abandoned/Old field state. This would occur upon clear-cutting and abandonment.

Restoration pathway R3A
State 3 to 2

Restoration from state 3 to state 2: Mechanical and chemical removal of hardwoods and unwanted pines (loblolly, slash), planting longleaf pine if necessary, reintroduction of 3-5 year fire return interval. Longleaf forests accumulate high levels of litter because needles are large and decay resistant. High residual fuel loads may be present where longleaf pine occur. If desired longleaf pine trees are still present on the site, care should be exercised when re-introducing fire to this community. Fuel treatments such as raking and/or wetting the area around existing trees and mowing to remove standing fuels might be necessary to prevent mortality of the overstory. Site preparation is important after timber removal. Coarse woody debris can impede tree planters. Concentrating debris in windrows and piles and burning it is recommended. Unwanted vegetation should be controlled prior to planting to reduce competition for the new stand. This can be accomplished by mechanical and/or chemical methods. Herbicide prescriptions can be developed to target specific species or groups of unwanted vegetation. For example, some herbicides target woody plants, while others kill grasses or legumes. Care should be taken when using herbicides to avoid unwanted disturbance and herbicide application to any remaining native ground cover. The site should be monitored for the appearance of native grasses. If herbaceous species do not naturally regenerate, the seed source may have been lost. If native grasses must be planted becuase no seed source is present, the system cannot be restored to state 2, but will resemble the functioning ecosystem of state 5.

Conservation practices

Brush Management
Prescribed Burning
Tree/Shrub Site Preparation
Tree/Shrub Establishment
Restoration and Management of Rare and Declining Habitats
Forest Stand Improvement

Transition T3A
State 3 to 4

Transition from state 3 to state 4: Continued lack of fire or infrequent burning Continued fire suppression results in further significant changes in vegetation structure and composition in this ecological site. Hardwood species, particularly scrub oaks, now dominate the forest mid-story, and herbaceous ground cover is largely absent. This community is unable to carry low intensity fires without drastic chemical or mechanical treatments, or catastrophic fires.

Transition T3B
State 3 to 5

Transition from state 3 to state 5: Remove oaks and other hardwoods, plant longleaf, re-establish native groundcover if necessary, reintroduction of 2-3 year fire frequency After timber removal, site preparation should occur. Coarse woody debris can impede tree planters. Concentrating debris in windrows and piles and burning it is recommended. Unwanted vegetation should be controlled prior to planting to reduce competition for the new stand. This can be accomplished by mechanical and/or chemical methods. Herbicide prescriptions can be developed to target specific species or groups of unwanted vegetation. For example, some herbicides target woody plants, while others kill grasses or legumes. Care should be taken when using herbicides to avoid unwanted disturbance and herbicide application to any remaining native ground cover. The site should be monitored for the appearance of native groundcover. If herbaceous species do not naturally regenerate, the seed source may have been lost. Native groundcover should be established by planting.

Transition T3C
State 3 to 6

Transition from state 3 to state 6: Clear cut (or hardwood removal), plant pines (longleaf, loblolly, slash), re-establish native groundcover if necessary, reintroduction of 2-3 year fire frequency After timber removal, site preparation should occur. Coarse woody debris can impede tree planters. Concentrating debris in windrows and piles and burning it is recommended. Unwanted vegetation should be controlled prior to planting to reduce competition for the new stand. This can be accomplished by mechanical and/or chemical methods. Herbicide prescriptions can be developed to target specific species or groups of unwanted vegetation. For example, some herbicides target woody plants, while others kill grasses or legumes.

Transition T3D
State 3 to 7

Transition from state 3 to state 7: Clear-cut, stump and brush removal, establish crop or pasture

Transition T3E
State 3 to 8

Transition from state 3 to state 8: Although not recommended, it is possible to transition from this state to the Abandoned/Old field State. This would occur upon clear-cutting and abandonment.

Restoration pathway R4A
State 4 to 3

Restoration from state 4 to state 3: Mechanical and chemical removal of hardwoods, establishment of pines if necessary, reintroduction of 3-5 year fire return interval. Site preparation is important after timber removal. Coarse woody debris can impede tree planters. Concentrating debris in windrows and piles and burning it is recommended. Unwanted vegetation should be controlled prior to planting to reduce competition for the new stand. This can be accomplished by mechanical and/or chemical methods. Herbicide prescriptions can be developed to target specific species or groups of unwanted vegetation. For example, some herbicides target woody plants, while others kill grasses or legumes. Care should be taken when using herbicides, as disturbance and herbicide application can be detrimental to any remaining native ground cover. The site should be monitored for the appearance of native groundcover. If herbaceous species do not naturally regenerate, the seed source may have been lost. Native groundcover should be established by planting.

Conservation practices

Brush Management
Prescribed Burning
Tree/Shrub Site Preparation
Tree/Shrub Establishment
Restoration and Management of Rare and Declining Habitats
Forest Stand Improvement

Transition T4A
State 4 to 5

Transition from state 4 to state 5: Hardwood removal (clear-cut, herbicide), longleaf establishment, native groundcover restoration if needed, reintroduction of 2-3 year fire frequency Site preparation is important after timber removal. Coarse woody debris can impede tree planters. Concentrating debris in windrows and piles and burning it is recommended. Unwanted vegetation should be controlled prior to planting to reduce competition for the new stand. This can be accomplished by mechanical and/or chemical methods. Herbicide prescriptions can be developed to target specific species or groups of unwanted vegetation. For example, some herbicides target woody plants, while others kill grasses or legumes. Care should be taken when using herbicides, as disturbance and herbicide application can be detrimental to any remaining native ground cover.

Transition T4B
State 4 to 6

Transition from state 4 to state 6: Hardwood removal (clear-cut, herbicide), plant pines (longleaf, loblolly, slash), reintroduction of 2-3 year fire frequency After timber removal, site preparation should occur. Coarse woody debris can impede tree planters. Concentrating debris in windrows and piles and burning it is recommended. Unwanted vegetation should be controlled prior to planting to reduce competition for the new stand. This can be accomplished by mechanical and/or chemical methods. Herbicide prescriptions can be developed to target specific species or groups of unwanted vegetation. For example, some herbicides target woody plants, while others kill grasses or legumes.

Transition T4C
State 4 to 7

Transition from state 4 to state 7: Clear-cut, stump and brush removal, establish crop or pasture

Transition T4D
State 4 to 8

Transition from state 4 to state 8: Clear cut and abandonment or lack of management

Restoration pathway R5A

State 5 to 1

Restoration from state 5 to state 1: This will require very long-term management (century-scale) in order to achieve an uneven-aged stand. This option is not viable for one generation of ownership to accomplish. In order to achieve the reference state, the stand must be managed to be uneven-aged.

Conservation practices

Prescribed Burning
Restoration and Management of Rare and Declining Habitats
Forest Stand Improvement

Transition T5A
State 5 to 2

Transition from state 5 to state 2: Lack of fire (fire return interval > 3 years) Fire suppression can significantly change the vegetation structure and composition of this ecological site. Hardwood encroachment results from fire suppression. Furthermore, natural regeneration of longleaf pine and the native herbaceous groundcover species is retarded as fuels build up. However, this transition would be different in that state 2 describes natural longleaf stands. The transition from a planted stand would have different age structure, but the trigger (lack of fire) would be the same. This would cause the result to be most like state 2 except the pines would be even-aged.

Transition T5B
State 5 to 6

Transition from state 5 to state 6: Although it is not recommended to transition from a system that contains native ground cover, it is possible if tree density is too high and shades out the native heliophytic vegetation. If transitioning to community phase 6.1, native ground cover is lost. If transitioning to community phase 6.2, longleaf pine is removed, and native groundcover is lost.

Transition T5C
State 5 to 7

Transition from state 5 to state 7: Clear-cut, stump and brush removal, crop/pasture establishment

Transition T5D
State 5 to 8

Transition from state 5 to state 8: Clear-cut, abandonment

Restoration pathway R6A
State 6 to 5

Restoration from state 6 to state 5: If transitioning from phase 6.1, native ground cover restoration should occur. If transitioning from phase 6.2, longleaf pine needs to be established in addition to native ground cover establishment. This requires removal of other pine species. Site preparation should occur after timber removal. Coarse woody debris can impede tree planters. Concentrating debris in windrows and piles and burning it is recommended. Unwanted vegetation should be controlled prior to planting to reduce competition for the new stand. This can be accomplished by mechanical and/or chemical methods. Herbicide prescriptions can be developed to target specific species or groups of unwanted vegetation. For example, some herbicides target woody plants, while others kill grasses or legumes. Care should be taken when using herbicides to avoid unwanted disturbance and herbicide application to any remaining native ground cover.

Conservation practices

Brush Management
Prescribed Burning

Tree/Shrub Site Preparation
Tree/Shrub Establishment
Restoration and Management of Rare and Declining Habitats
Forest Stand Improvement

Transition T6A
State 6 to 7

Transition from state 6 to state 7: Clear-cut, stump and brush removal, crop/pasture establishment

Transition T6B
State 6 to 8

Transition from State 6 to State 8: Clear-cut, abandonment

Restoration pathway R7B
State 7 to 5

Restoration from State 7 to State 5: Assess site suitability (pH requirements for longleaf pine), specific site preparation (scalping, subsoiling), plant longleaf pine, establish native groundcover This restoration pathway requires specific management. First, many agricultural fields and pastures have received lime applications, which, over time have increased the pH of the soil. It is difficult to successfully establish longleaf pine on sites with a pH higher than 7.0. If pH is not an issue, the pasture grasses and agricultural weed complex will be. Aggressive control of these herbaceous species can be achieved using appropriate herbicides. A technique called scalping has also proved to be beneficial on agricultural lands, particularly pastures. Scalping essentially forms a shallow (2-4”) but wide (30-36”) furrow by peeling the soil back. Scalping is not recommended for wet areas or soils with high clay content because the scalped rows may hold too much water and drown the seedlings. Highly compacted crop land may require sub-soiling prior to planting to break up any overly compacted soil that will inhibit seedling establishment.

Conservation practices

Prescribed Burning
Firebreak
Tree/Shrub Site Preparation
Tree/Shrub Establishment
Restoration and Management of Rare and Declining Habitats
Forest Stand Improvement

Restoration pathway R7A
State 7 to 6

Restoration from State 7 to State 6: Site preparation, longleaf or other pine planting, and reintroduction of 2-3 year fire frequency This restoration pathway requires specific management. First, many agricultural fields and pastures have received lime applications, which, over time have increased the pH of the soil. It is difficult to successfully establish longleaf pine on sites with a pH higher than 7.0. If pH is not an issue, the pasture grasses and agricultural weed complex will be. Aggressive control of these herbaceous species can be achieved using appropriate herbicides. A technique called scalping has also proved to be beneficial on agricultural lands, particularly pastures. Scalping essentially forms a shallow (2-4”) but wide (30-36”) furrow by peeling the soil back. Scalping is not recommended for wet areas or soils with high clay content because the scalped rows may hold too much water and drown the seedlings. Highly compacted crop land may require sub-soiling prior to planting to break up any overly compacted soil that will inhibit seedling establishment.

Conservation practices

Brush Management
Prescribed Burning
Firebreak
Tree/Shrub Site Preparation
Restoration and Management of Rare and Declining Habitats
Forest Stand Improvement
Transition from Irrigation to Dry-land Plan - Applied

Transition T7A
State 7 to 8

Transition from State 7 to State 8: Clear-cut, abandonment

Restoration pathway R8A
State 8 to 5

Restoration from State 8 to State 5: Longleaf pine establishment and native groundcover restoration should occur. This requires removal of other pine species. After timber removal, site preparation should occur. Coarse woody debris can impede tree planters. Concentrating debris in windrows and piles and burning it is recommended. Unwanted vegetation should be controlled prior to planting to reduce competition for the new stand. This can be accomplished by mechanical and/or chemical methods. Herbicide prescriptions can be developed to target specific species or groups of unwanted vegetation. For example, some herbicide target woody plants, while others kill grasses or legumes. Care should be taken when using herbicides, as further disturbance and herbicide application can be detrimental to any remaining native ground cover.

Conservation practices

Brush Management
Prescribed Burning
Firebreak
Tree/Shrub Site Preparation
Tree/Shrub Establishment
Restoration and Management of Rare and Declining Habitats
Forest Stand Improvement

Restoration pathway R8B
State 8 to 6

Restoration from State 8 to State 6: Land must be cleared, brush removed, and pines established This requires removal of hardwood and other undesirable species. After timber removal, site preparation should occur. Coarse woody debris can impede tree planters. Concentrating debris in windrows and piles and burning it is recommended. Unwanted vegetation should be controlled prior to planting to reduce competition for the new stand. This can be accomplished by mechanical and/or chemical methods. Herbicide prescriptions can be developed to target specific species or groups of unwanted vegetation. For example, some herbicide target woody plants, while others kill grasses or legumes. Care should be taken when using herbicides, as further disturbance and herbicide application can be detrimental to any remaining native ground cover.

Conservation practices

Brush Management

Prescribed Burning
Firebreak
Tree/Shrub Site Preparation
Tree/Shrub Establishment

Transition T8A
State 8 to 7

Transition from State 8 to State 7: Land should be cleared and stumped, and crop or pasture established

Additional community tables

Table 5. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
longleaf pine	PIPA2	*Pinus palustris*	Native	–	5–35	–	–
blackjack oak	QUMA3	*Quercus marilandica*	Native	–	10–30	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
pineland threeawn	ARST5	*Aristida stricta*	Native	–	5–20
Gray's beaksedge	RHGR2	*Rhynchospora grayi*	Native	–	0.1–0.5
dwarf huckleberry	GADU	*Gaylussacia dumosa*	Native	–	0.1–0.5
pineywoods dropseed	SPJU	*Sporobolus junceus*	Native	–	0.1–0.5
Addison's rosette grass	DIOVA	*Dichanthelium ovale var. addisonii*	Native	–	0.1–0.5
Forb/Herb					
grayhairy wild indigo	BACI	*Baptisia cinerea*	Native	–	0.1–0.5
dwarf huckleberry	GADU	*Gaylussacia dumosa*	Native	–	0.1–0.5
coastal plain dawnflower	STPAP8	*Stylisma patens ssp. patens*	Native	–	0.1–0.5
capillary hairsedge	BUCIC	*Bulbostylis ciliatifolia var. coarctata*	Native	–	0.1–0.5
pine barren stitchwort	MICA8	*Minuartia caroliniana*	Native	–	0.1–0.5
St. Andrew's cross	HYHY	*Hypericum hypericoides*	Native	–	0.1–0.5
narrowleaf silkgrass	PIGR4	*Pityopsis graminifolia*	Native	–	0.1–0.5
kidneyleaf rosinweed	SICO5	*Silphium compositum*	Native	–	0.1–0.5
anisescented goldenrod	SOODO	*Solidago odora var. odora*	Native	–	0.1–0.5
wavyleaf noseburn	TRUR	*Tragia urens*	Native	–	0.1–0.5
tall ironweed	VEAN	*Vernonia angustifolia*	Native	–	0.1–0.5
Shrub/Subshrub					
Atlantic poison oak	TOPU2	*Toxicodendron pubescens*	Native	–	0.1–0.5
Tree					
turkey oak	QULA2	*Quercus laevis*	Native	1–10	5–15
bluejack oak	QUIN	*Quercus incana*	Native	–	1–5
sassafras	SAAL5	*Sassafras albidum*	Native	–	0–5
common persimmon	DIVI5	*Diospyros virginiana*	Native	–	0.5–5
bluejack oak	QUIN	*Quercus incana*	Native	–	0.1–3.5

Table 7. Community 2.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
blackjack oak	QUMA3	*Quercus marilandica*	Native	–	10–30	–	–
longleaf pine	PIPA2	*Pinus palustris*	Native	–	5–20	–	–
bluejack oak	QUIN	*Quercus incana*	Native	–	0–5	–	–
common persimmon	DIVI5	*Diospyros virginiana*	Native	–	0–3	–	–

Table 8. Community 3.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
blackjack oak	QUMA3	*Quercus marilandica*	Native	–	20–40	–	–
longleaf pine	PIPA2	*Pinus palustris*	Native	–	1–20	–	–
loblolly pine	PITA	*Pinus taeda*	Native	–	5–20	–	–

Table 9. Community 3.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Forb/Herb					
Virginia tephrosia	TEVI	*Tephrosia virginiana*	Native	–	0–5
Shrub/Subshrub					
deerberry	VAST	*Vaccinium stamineum*	–	–	1–10
dwarf huckleberry	GADU	*Gaylussacia dumosa*	Native	–	0.5–10

Table 10. Community 4.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
blackjack oak	QUMA3	*Quercus marilandica*	Native	–	20–40	–	–
loblolly pine	PITA	*Pinus taeda*	Native	–	0–10	–	–
bluejack oak	QUIN	*Quercus incana*	Native	–	1–5	–	–
longleaf pine	PIPA2	*Pinus palustris*	Native	–	0–5	–	–
common persimmon	DIVI5	*Diospyros virginiana*	Native	–	0.5–3	–	–
sassafras	SAAL5	*Sassafras albidum*	Native	–	0.5–3	–	–

Table 11. Community 4.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Forb/Herb					
Virginia tephrosia	TEVI	*Tephrosia virginiana*	Native	–	1–3
Shrub/Subshrub					
deerberry	VAST	*Vaccinium stamineum*	Native	–	1–5

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	

Approved by	
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:

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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):**

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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:**

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17. **Perennial plant reproductive capability:**