

Ecological site F154XA005FL

Poorly Drained Upland Pine-Hardwood Forests

Last updated: 2/21/2024
Accessed: 05/01/2024

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): 154X–South-Central Florida Ridge

MLRA 154 is entirely in Peninsular Florida, and contains 8,285 square miles. The landscape of MLRA 154 is characterized by a series of parallel, prominent sandy ridges of Pleistocene marine origin, including the Brooksville and Mount Dora Ridges. These North to South oriented parallel ridges are interspersed with more low lying physiographic provinces, including: upland hills, plains, valleys and gaps (Puri and Vernon, 1964). The extreme western portion of the MLRA consists of thin belt of coastal lowlands and marshlands.

Many of the soils of MLRA 154 are Pleistocene or Holocene sands that are underlain with older, loamy Pliocene marine sediments (Cypresshead formation) or the clayey Miocene marine sediments (Hawthorne formation). A combination of marine depositional events and the dissolution of underlying limestone (karst geology) is responsible for surficial topography throughout Peninsular Florida.

Classification relationships

All portions of the geographical range of this site falls under the following ecological / land classifications including:

-Environmental Protection Agency's Level 3 and 4 Ecoregions of Florida: 75 Southern Coastal Plain; 75c Central Florida Ridges and Uplands (Griffith, G. E., Omernik, J. M., & Pierson, S. M., 2013)

-Florida Natural Area Inventory, 2010 Edition: Upland Pine, Upland Mixed Woodland, and Upland Hardwood Forest (FNAI, 2010)

Ecological site concept

Map unit components associated with this concept occur on 2 to 12% slopes. Soils include very deep, poorly drained, loamy and clayey subsoils with low base saturation map units (Blichthon, Kanapaha, Wacahoota, Wacahoota Variant). Also included are very deep, poorly drained, loamy and clayey subsoils with high base saturation map units (Bivan, Boardman, Fellowship, Fellowship Variant, Flemington). This site is extensively mapped in the Northern Highlands, Fairfield Hills, Ocala Hills, Sumter Uplands, and Brooksville Ridge physiographic provinces of Central Florida.

Reference site vegetation include various upland hardwood plant communities. These are closed canopy forests of mainly hardwood species (pine may be present but not dominant). Included are some hardwood species typical of wet habitat. Understory vegetation is sparse.

Associated sites

F154XA004FL	Moist Sandy Pine-Hardwood Woodlands These sites are somewhat poorly drained communities that occur in higher, slightly drier landscape positions
F154XA007FL	Moist Sandy Wet-Mesic Flatwoods These are poorly drained communities that occur in slightly lower, wetter landscape positions
F154XA008FL	Moist Sandy Scrubby Flatwoods These sites are somewhat poorly drained communities that occur in higher, drier landscape positions
F154XA010FL	Moist Lithic Flatwoods And Hammocks These are poorly drained communities that occur in slightly lower, wetter landscape positions
F154XA011FL	Wet Lithic Flatwoods And Hammocks These are poorly drained communities that occur in slightly lower, wetter landscape positions
F154XA012FL	Wet Rich Forests And Woodlands These are poorly drained communities that occur in slightly lower, wetter landscape positions

Similar sites

F154XA007FL	Moist Sandy Wet-Mesic Flatwoods These sites occur on slightly lower landscapes (lowland flats) with similar soil drainage and sandy family particle size class. These sites will have slightly longer hydroperiods on more level landforms which will result in different plant community composition and structure.
F154XA011FL	Wet Lithic Flatwoods And Hammocks These sites occur on slightly lower landscapes (lowland flats) with similar soil drainage and loamy family particle size class. These sites will have slightly longer hydroperiods on more level landforms which will result in different plant community composition and structure.
F154XA012FL	Wet Rich Forests And Woodlands These sites occur on slightly lower landscapes (lowland flats) with similar soil drainage and clayey family particle size class. These sites will have slightly longer hydroperiods on more level landforms which will result in different plant community composition and structure.

Table 1. Dominant plant species

Tree	(1) <i>Quercus virginiana</i> (2) <i>Pinus taeda</i>
Shrub	(1) <i>Carya glabra</i> (2) <i>Ilex opaca</i>
Herbaceous	(1) <i>Chasmanthium laxum</i> var. <i>sessiliflorum</i> (2) <i>Oplismenus hirtellus</i>

Physiographic features

The physiography of the area is among the best defined in Peninsular Florida with rolling topography consisting of ridges, hills, and dunes interspersed with low-lying valleys, depressions, and drainageways. The entire area is located in within the Floridian Section of the Coastal Plain Province of the Atlantic Plain. Elevations of this concept ranges from 40 to 230 feet (12 to 70 meters). This site occurs on upland rises with loamy and clayey, poorly drained soils. Slopes are nearly level to strongly sloping and range from 0 to 12%.

The isolated distribution of this site is restricted to several distinct regions of the Northern Highlands, Fairfield Hills, Ocala Hills, Sumter Uplands, and Brooksville Ridge physiographic provinces. All of these disjunct highlands appear to be dis-severed remnants of a once continuous residual highland of older Miocene sediments (Hawthorne Group).

Table 2. Representative physiographic features

Hillslope profile	(1) Footslope
Landforms	(1) Marine terrace > Rise
Runoff class	Low to very low

Flooding frequency	None
Ponding frequency	None
Elevation	12–70 m
Slope	0–12%
Water table depth	8–30 cm
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	9–79 m
Slope	Not specified
Water table depth	0–46 cm

Climatic features

The climate is characterized by humid subtropical with long hot summers and mild winters. In the winter months, Canadian air masses move across Peninsular Florida and produce cool, cloudy, rainy weather. Freezing temperatures are occasional in the northern part of MLRA 154, with typically < 30 days of the year with temperatures dropping below freezing.

Precipitation is distributed fairly evenly throughout the year. Average annual precipitation ranges from 50 to 55 inches. Highest monthly precipitation falls from June through October, with June through August being the wettest period. Winter rainfall is associated with cold fronts.

Hurricanes and tropical storms affect much of the MLRA 154 region. Catastrophic hurricanes make landfall along the Atlantic coast of Peninsular Florida on the order of 2 to 4 times per century. Strong winds and heavy rainfall affect the interior peninsula; rainfall from hurricanes and tropical systems vary widely but can exceed 20 inches from one storm. Hurricanes are most likely to occur between June and November and are most common in August and September.

Table 4. Representative climatic features

Frost-free period (characteristic range)	255-365 days
Freeze-free period (characteristic range)	365 days
Precipitation total (characteristic range)	1,270-1,346 mm
Frost-free period (actual range)	215-365 days
Freeze-free period (actual range)	303-365 days
Precipitation total (actual range)	1,270-1,372 mm
Frost-free period (average)	312 days
Freeze-free period (average)	354 days
Precipitation total (average)	1,321 mm

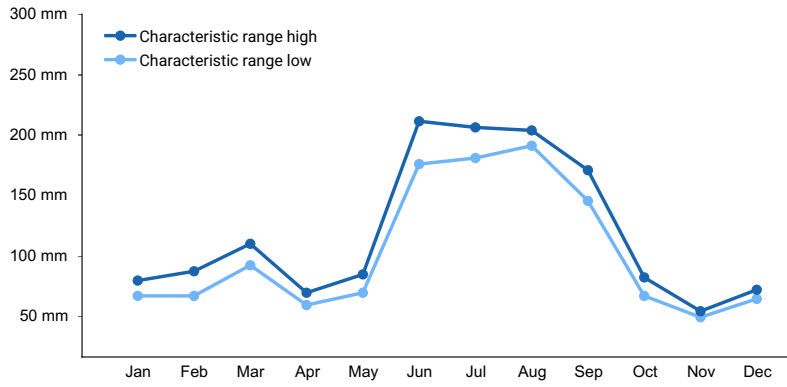


Figure 1. Monthly precipitation range

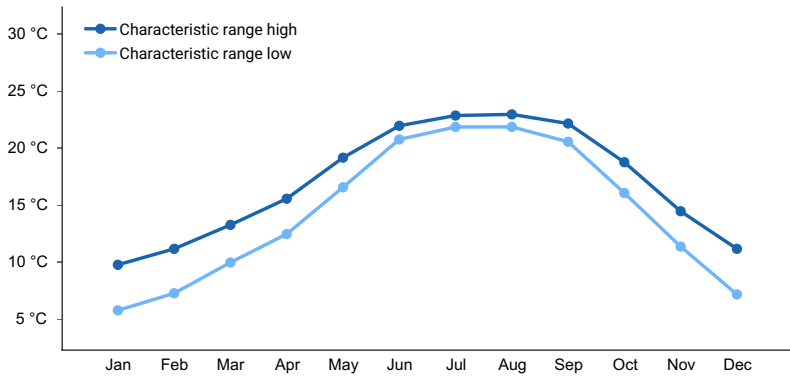


Figure 2. Monthly minimum temperature range

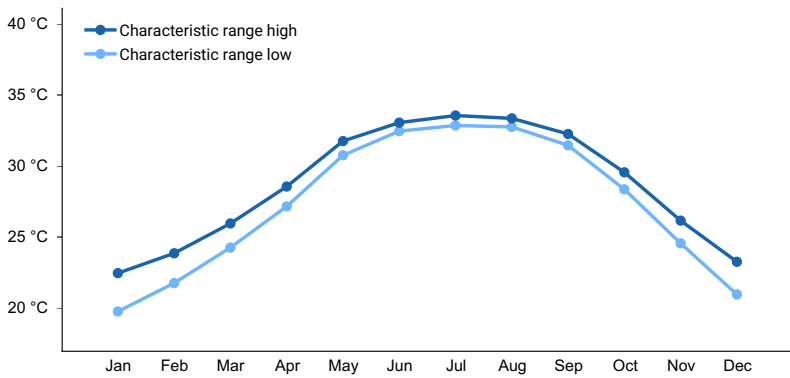


Figure 3. Monthly maximum temperature range

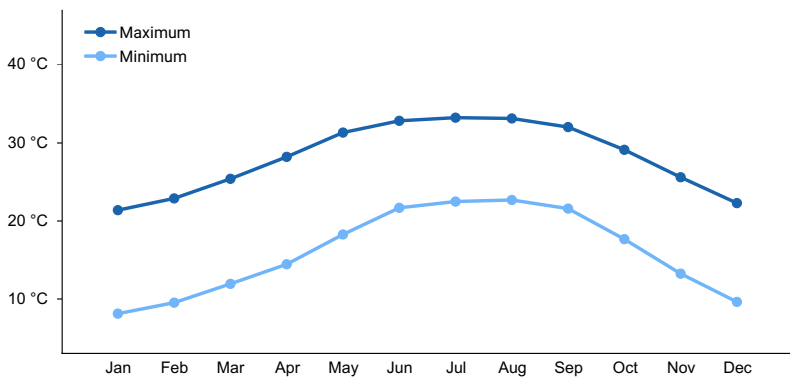


Figure 4. Monthly average minimum and maximum temperature

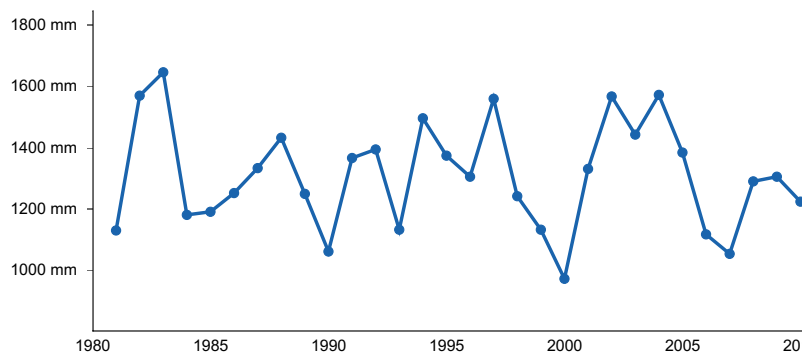


Figure 5. Annual precipitation pattern

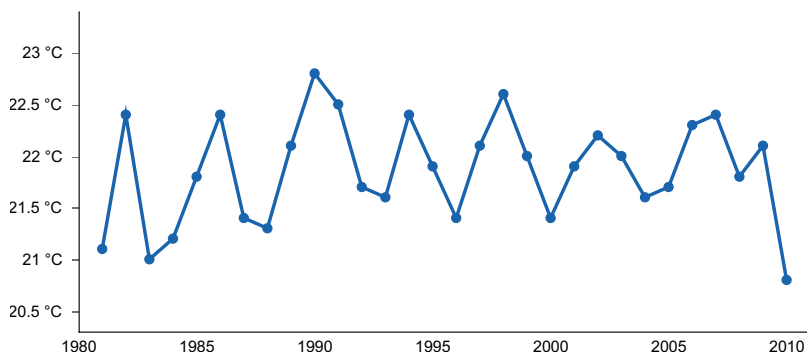


Figure 6. Annual average temperature pattern

Climate stations used

- (1) BROOKSVILLE CHIN HILL [USC00081046], Brooksville, FL
- (2) CLERMONT 9 S [USC00081641], Clermont, FL
- (3) INVERNESS 3 SE [USC00084289], Inverness, FL
- (4) PLANT CITY [USC00087205], Plant City, FL
- (5) TARPON SPGS SEWAGE PL [USC00088824], Tarpon Springs, FL
- (6) GAINESVILLE 11 WNW [USC00083322], Gainesville, FL
- (7) MTN LAKE [USC00085973], Lake Wales, FL
- (8) BARTOW [USC00080478], Bartow, FL
- (9) LISBON [USC00085076], Leesburg, FL
- (10) ORANGE SPRINGS 2SSW [USC00086618], Fort Mc Coy, FL

Influencing water features

Hydrology of this site is largely determined by landform position and surface morphometry. The modal concept for this site is areas of ridges, knolls, and side slopes on elevated landforms that are typically surrounded by drier ecological sites (Moist Rich Uplands, Moist Yellow Woodlands). The site is situated on poorly drained soils that dominantly have a perched water table at less than 12 inches (30.5 cm) during wet periods. A few soils have an apparent seasonal high water table.

Hydrogeomorphically, this concept includes uplands which receive water from local precipitation only, and discharge water through the soil to the Florida Aquifer or through surface runoff to adjacent sites. Seepage zones are common on hillslope positions. The slope gradient, moderate to slow infiltration, and moderately slow to very slow saturated hydraulic conductivity results in medium to very rapid surface runoff. The combination of high fertility, moderate to high available water, and moderately slow to very slow saturated hydraulic conductivity are the keys to this site's plant community.

Soil features

Soils are generally poorly drained, loamy Arenic Plinthic Paleaquults (Blichton), Arenic Paleaquults (Wacahoota, Wacahoota Variant), Grossarenic Paleaquults (Kanapaha), Typic Endoaquults (Boardman) or as poorly drained,

clayey Umbric Endoaqualfs (Fellowship) and Typic Albaqualfs (Bivans). These soils formed in sandy over loamy, loamy, or clayey marine sediments. The dominant representative slope for the correlated soil components is 2 to 12%. However, a few map units range from 0 to 2%. Clay content of the argillic horizon is dominantly 25 to 65%.

The extreme wetting and drying cycle of these soils along with parent materials high in iron and phosphates result in the development of plinthite, ironstone, or phosphatic nodules. Bivans, Blichton, Flemington and Kanapaha soils have a nodule content of 0 to 5%. Nodule content of Boardman, Fellowship, Wacahoota and Wacahoota Variant soils is 5 to 25%, and Fellowship Variant ranges from 35 to 60%.

Mineralogy is either siliceous or mixed on the loamy soils (Blichton, Boardman, Kanapaha, Wacahoota, and Wacahoota Variant) and the clayey soils (Bivans, Fellowship) are smectitic. These very deep soils will not restrict plant roots, although root distribution may be limited to cleavage planes in the clayey soils.

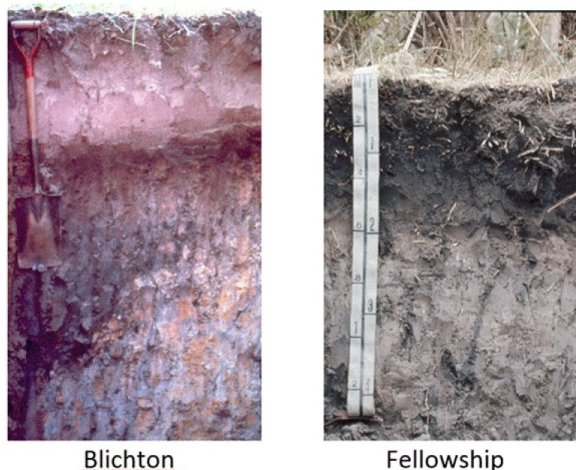


Figure 7. Poorly drained upland hardwood forest soils

Table 5. Representative soil features

Parent material	(1) Marine deposits
Surface texture	(1) Fine sand (2) Sand (3) Loamy fine sand (4) Loamy sand (5) Gravelly
Family particle size	(1) Loamy
Drainage class	Poorly drained
Permeability class	Very slow to moderately slow
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	7.11–14.73 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–1
Soil reaction (1:1 water) (0-101.6cm)	4.5–5.3

Subsurface fragment volume <=3" (0-101.6cm)	0-20%
Subsurface fragment volume >3" (0-101.6cm)	0-2%

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Very slow to rapid
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	Not specified
Calcium carbonate equivalent (0-101.6cm)	Not specified
Electrical conductivity (0-101.6cm)	0-2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0-4
Soil reaction (1:1 water) (0-101.6cm)	Not specified
Subsurface fragment volume <=3" (0-101.6cm)	Not specified
Subsurface fragment volume >3" (0-101.6cm)	Not specified

Ecological dynamics

The Poorly Drained Upland Pine-Hardwood Forests includes a range of mixed pine-hardwood and hardwood forest types. Forest composition and structure of this site is dependent on regional geography. This site is limited to the physiographic Uplands and Ridges of North and Central Florida (within MLRA 154). Many upland hardwood species reach their southern range limits in this region.

In general, the soils and forest vegetation of this site affect mesic conditions, compared to the sandy soil uplands prevalent in most of Central Florida. The higher concentrations of fine textured soils, coupled with loamy and clayey subsoils, affect relatively high nutrient and moisture availability in Poorly Drained Upland Pine-Hardwood Forests. Hardwood forest vegetation also contributes to mesic conditions of this site; dense and layered vegetation inhibits air movement and retains humidity, and leaf litter accumulation retains moisture in the topsoil.

Gap dynamics is the predominant driver of natural succession in Poorly Drained Upland Pine-Hardwood Forests. Mortality of one or more canopy trees creates forest gaps, which allow increased sunlight for seedling establishment. Wind damage creates localized canopy gaps. Similarly, winds from large hurricanes can kill large swaths of canopy hardwoods in these inland forests. Insects and other pathogens may kill single trees or groups of trees. Loblolly pines are particularly susceptible to insect mortality (i.e., Southern Pine Beetle).

Fires are infrequent in the forests of this site. Insufficient fine fuel availability, coupled with moisture laden leaf litter, inhibit fire ignition, and spread. Fire may creep into these hardwood forests from surrounding xeric uplands, but they rarely completely burn through the understory or consume much vegetation (Batista and Platt 1997). Fires may infrequently burn in upland mixed pine-hardwood forests typical of drier conditions of this Site, or in droughty weather conditions.

State and transition model

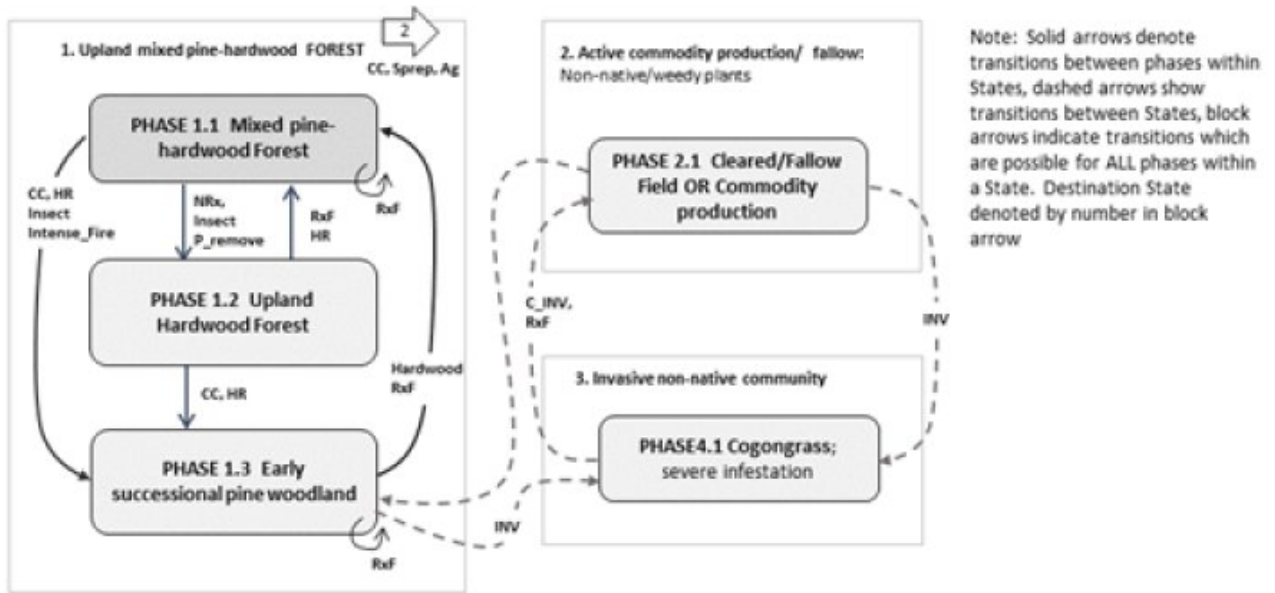


Figure 8. Poorly Drained Upland Hardwood Forests

RxF	Regular fire regime
Intense_Fire	Infrequent (intense) fire, often stand replacing catastrophic fire
NRx	Fire suppression, or very infrequent non-catastrophic fire
HR	Hardwood reduction
PP	Planted Pine
P_remove	Selective logging of pines
CC	Clearcut
Sprep	Site prep (mechanical and chemical)
Hardwood	Natural recruitment of hardwoods
INV	Invasion of noxious non-native plant species
C_INV	Mechanical/chemical control of invasive plant species
Ag	Various agricultural practices for crop cultivation
Insect	Pine (hardwood) mortality due to insect infestation

Figure 9. Poorly Drained Upland Hardwood Forests Legend

State 1

Upland mixed pine-hardwood or hardwood forest

Closed canopy forests characterize the State 1 (pre-settlement) vegetation of this site. These forests are comprised of mixed pine and hardwood species, or hardwoods only, depending on local moisture conditions and disturbance regimes. Characteristic canopy species include: live oak (*Quercus virginiana*), southern magnolia (*Magnolia grandiflora*), pignut hickory (*Carya glabra*), sweetgum (*Liquidambar styraciflua*), laurel oak (*Q. hemisphaerica*), swamp chestnut oak (*Q. michauxii*), southern hackberry (*Celtis occidentalis*), white ash (*Fraxinus americana*). Loblolly pine (*Pinus taeda*) may be present, particularly following canopy openings from wind or fire. Sub-canopy strata contain many seedlings and saplings of canopy hardwoods, in addition to shrubs and small tree species: (*Ilex opaca*), red bay (*Persea borbonia*), American hornbeam (*Carpinus caroliniana*), devil's walkingstick (*Aralia spinosa*), eastern hophornbeam (*Ostrya virginiana*), flowering dogwood (*Cornus florida*), eastern redbud (*Cercis canadensis*), winged elm (*Ulmus alata*), black cherry (*Prunus serotina*). Herbaceous species of the understory are shade-tolerant, and include partridgeberry (*Mitchella repens*), Virginia creeper (*Parthenocissus quinquefolia*), violets (*Viola* spp.), sedges (*Carex* spp.), sarsaparilla vine (*Smilax pumila*), ebony spleenwort (*Asplenium platyneuron*), woodsgrass (*Oplismenus hirtellus*), and longleaf woodoats (*Chasmanthium laxum* var. *sessiliflorum*).

State 2

Active commodity production

This state describes commodity land uses of the Poorly Drained Upland Pine-Hardwood Forests. The mesic soils of this site are desirable for agriculture and timber production, including annual row crops, orchards, and pine plantations. Also included in State 2 are improved pastures of bahiagrass (or other sod forming grass species). All phases of State 2 describe conditions following ground penetrating soil disturbance, to the degree that native ground cover is mostly absent. Generally these phases are characterized by the complete extirpation of native ground cover populations, including seed banks and dormant propagules, although native weedy species may

persist (mostly annual species). Depending on the severity and frequency of ground disturbance, soil profile characteristics in the upper part of the soil may be altered.

State 3

Invasive non-native plant community

State 3 describes a condition where one or several noxious non-native species has invaded and dominated the site. The most common noxious invasive plant species of cleared areas on these soils is cogongrass (*Imperata cylindrica*; (MacDonald 2004)). This highly clonal grass spreads rapidly by underground rhizomes and windblown seeds, forming dense circular patches which can become very large (on the order of 100's of acres). Cogongrass grows vigorously in full sunlight (MacDonald 2004). Furthermore, cogongrass is a prolific seed producer, and readily invades following soil disturbances. (Yager, Miller, and Jones 2010). Several other noxious plant species may invade forested phases of this Site.

References

. Fire Effects Information System. <http://www.fs.fed.us/database/feis/>.

. 2021 (Date accessed). USDA PLANTS Database. <http://plants.usda.gov>.

Other references

Abrahamson, W. G. (1984). Post-fire recovery of Florida Lake Wales ridge vegetation. *American journal of botany*, 71(1), 9-21.

Batista, W. B., & Platt, W. J. (1997). An old-growth definition for southern mixed hardwood forests (p. 11). US Department of Agriculture, Forest Service, Southern Research Station.

Brook, R. M. (1989). Review of literature on *Imperata cylindrica* (L.) Raeuschel with particular reference to South East Asia. *International Journal of Pest Management*, 35(1), 12-25.

Bryson, C. T., & Carter, R. (1993). Cogongrass, *Imperata cylindrica*, in the United States. *Weed Technology*, 7(4), 1005-1009.

Carr, S. C., Robertson, K. M., & Peet, R. K. (2010). A vegetation classification of fire-dependent pinelands of Florida. *Castanea*, 75(2), 153-189.

FNAI (2010). Guide to the natural communities of Florida: 2010 edition. Florida Natural Areas Inventory, Tallahassee, FL.

Gilliam, F. S., & Platt, W. J. (1999). Effects of long-term fire exclusion on tree species composition and stand structure in an old-growth *Pinus palustris* (longleaf pine) forest. *Plant Ecology*, 140, 15-26.

Glitzenstein, J. S. (2003). Long-Term Seasonal Burning at the St. Marks National Wildlife Refuge, North Florida: Changes in the Sandhill Plots After 23 Years. In 2nd International Wildland Fire Ecology and Fire Management Congress.

Glitzenstein, J. S., Streng, D. R., & Wade, D. D. (2003). Fire Frequency Effects on Longleaf Pine (*Pinus palustris* P. Miller) Vegetation in South Carolina and Northeast Florida, USA. *Natural Areas Journal*, 23(1), 22-37.

Glitzenstein, J. S., Platt, W. J., & Streng, D. R. (1995). Effects of fire regime and habitat on tree dynamics in north Florida longleaf pine savannas. *Ecological Monographs*, 65(4), 441-476.

MacDonald, G. E. (2004). Cogongrass (*Imperata cylindrica*)—biology, ecology, and management. *Critical Reviews in Plant Sciences*, 23(5), 367-380.

- Myers, R. L. (1985). Fire and the dynamic relationship between Florida sandhill and sand pine scrub vegetation. *Bulletin of the Torrey Botanical Club*, 241-252.
- Myers, R. L., & White, D. L. (1987). Landscape history and changes in sandhill vegetation in north-central and south-central Florida. *Bulletin of the Torrey Botanical Club*, 21-32.
- Peet, R. K. (2006). Ecological classification of longleaf pine woodlands. *The longleaf pine ecosystem*, 51-93.
- Provencher, L., Galley, K. E., Litt, A. R., Gordon, D. R., Brennan, L. A., Tanner, G. W., & Hardesty, J. L. (2000). Fire, herbicide, and chainsaw felling effects on arthropods in fire-suppressed longleaf pine sandhills at Eglin Air Force Base, Florida. In *The Role of Fire in Nongame Wildlife Management and Community Restoration: Traditional Uses and New Directions Proceedings of a Special Workshop (Vol. 2001, p. 24)*.
- Puri, H. S., & Vernon, R. O. (1964). Summary of the geology of Florida and a guidebook to the classic exposures.
- Provencher, L., Herring, B. J., Gordon, D. R., Rodgers, H. L., Galley, K. E., Tanner, G. W., ... & Brennan, L. A. (2001). Effects of hardwood reduction techniques on longleaf pine sandhill vegetation in northwest Florida. *Restoration Ecology*, 9(1), 13-27.
- Reinhart, K.O. and E.S. Menges. (2004). Effects of re-introducing fire to a central Florida sandhill community. *Applied Vegetation Science*, 7: 141-150.
- Robbins, L. E., & Myers, R. L. (1992). Seasonal effects of prescribed burning in Florida: a review. Miscellaneous publication/Tall Timbers Research, Inc.(USA).
- Rodgers, H. L., & Provencher, L. (1999). Analysis of longleaf pine sandhill vegetation in northwest Florida. *Castanea*, 138-162.
- Schowalter, T. D., Coulson, R. N., & Crossley Jr, D. A. (1981). Role of southern pine beetle and fire in maintenance of structure and function of the southeastern coniferous forest. *Environmental Entomology*, 10(6), 821-825.
- Van Lear, D. H., Carroll, W. D., Kapeluck, P. R., & Johnson, R. (2005). History and restoration of the longleaf pine-grassland ecosystem: implications for species at risk. *Forest ecology and Management*, 211(1-2), 150-165.
- Varner III, J. M., Gordon, D. R., Putz, F. E., & Hiers, J. K. (2005). Restoring fire to long-unburned *Pinus palustris* ecosystems: novel fire effects and consequences for long-unburned ecosystems. *Restoration Ecology*, 13(3), 536-544.
- Wade, D. D., & Lundsford, J. (1990). Fire as a forest management tool: prescribed burning in the southern United States. *Unasylva*, 41(3), 28-38.
- Waldrop, T. A., White, D. L., & Jones, S. M. (1992). Fire regimes for pine-grassland communities in the southeastern United States. *Forest Ecology and Management*, 47(1-4), 195-210.
- Walker, J., & Peet, R. K. (1984). Composition and species diversity of pine-wiregrass savannas of the Green Swamp, North Carolina. *Vegetatio*, 55, 163-179.
- Yager, L. Y., Miller, D. L., & Jones, J. (2010). Susceptibility of longleaf pine forest associations in south Mississippi to invasion by cogongrass [*Imperata cylindrica* (L.) Beauv.]. *Natural areas journal*, 30(2), 226-232.

Contributors

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Approval

Charles Stemmans, 2/21/2024

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	05/01/2024
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:**
