Ecological site F154XA003FL
Dry Yellow Sands Pine Woodland

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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): 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: Sandhill (State 1) and Xeric Hammock (State 2)(FNAI, 2010)

Ecological site concept

Dry Yellow Sand Pine Woodlands occur in deep infertile excessively drained sands. These Entisols are yellowish in color and are generally acidic. The site occurs on ridges and shallow slopes (< 8% but can range up to 40%). Distinguishing features of these yellow sands include very deep-water tables, lack of soil profile development, and coarse soil texture. Map unit components are numerous, and predominantly restricted to the Central Florida Ridges and Uplands physiographic provinces, including the Brooksville Ridge, Cotton Plant Ridge, Mount Dora Ridge, Lake Wales Ridge, Ocala Hills, Marion Uplands, and Sumter Uplands units.

This site concept is distinct because of its native condition (i.e., reference site vegetation), component soils, successional patterns, and wildlife habitat. Natural woodland vegetation is adapted to edaphic conditions of deep, droughty, yellow sands with a deep seasonal high water table. Pine woodlands and “sandhills” are dominated by widely spaced longleaf pine (Pinus palustris) and continuous swaths of herbaceous ground cover vegetation consisting of dominant bunch grasses and numerous herbaceous and low woody species.

Associated sites

R154XX001FL	**Yellow Sands Xeric Uplands** These sites are excessively drained communities that occur in similar to slightly higher, drier, more xeric landscape positions
F154XX002FL	**Xeric Bicolor Sandy Uplands** These sites are excessively drained communities that occur in similar to slightly higher, drier, more xeric landscape positions
F154XA004FL	**Moist Sandy Pine-Hardwood Woodlands** These sites are somewhat poorly to well drained communities that occur in lower, wetter landscape positions
F154XA006FL	**Dry White Sand Scrubs** These sites are excessively drained communities that occur in similar to slightly higher, drier, more xeric landscape positions
F154XA008FL	**Moist Sandy Scrubby Flatwoods** These sites are moderately well to well drained communities that occur in slightly lower, slightly wetter, more mesic landscape positions
F154XA009FL	**Moist Basic Pine Uplands** These sites are moderately well to well drained communities that occur in slightly lower, slightly wetter, more mesic landscape positions
F154XA010FL	**Moist Lithic Flatwoods And Hammocks** These sites are somewhat poorly to well drained communities that occur in lower, wetter landscape positions

Similar sites

R154XX001FL	**Yellow Sands Xeric Uplands** These sites will have a deeper depth to a seasonal high-water table (>80 inches) and greater than 80 inches of yellow sand. These will often have more xeric reference plant communities and different management strategies.
F154XX002FL	**Xeric Bicolor Sandy Uplands** These sites will have a deeper depth to a seasonal high-water table (>80 inches) and greater than 80 inches of sand with two contrasting colors. These will often have more xeric reference plant communities and different management strategies.
F154XA006FL	**Dry White Sand Scrubs** These sites will have a similar depth to a seasonal high-water table (80 inches) and greater than 80 inches of white, bleached sand rather than yellow sand. These infertile soils will often have more xeric reference plant communities and different management strategies.

Table 1. Dominant plant species

Tree	(1) *Pinus palustris* (2) *Quercus laevis*
Shrub	(1) *Quercus laevis* (2) *Quercus geminata*
Herbaceous	(1) *Aristida stricta* (2) *Pityopsis graminifolia*

Physiographic features

The Central Florida Peninsula features rolling topography of ridges, hills, and dunes interspersed with low-lying valleys, depressions, and drainage ways. The entire area is located in within the Floridian Section of the Coastal Plain Province of the Atlantic Plain. Elevation ranges from sea level to 260 feet (0 to79 m).

This site occurs on sandy, excessively drained uplands in central and west-central Florida. Slopes are nearly level to strongly sloping (0 to 40%). The site occurs on elevated hills of eolian or marine deposition. The soils are sandy to more than 80 inches.

Table 2. Representative physiographic features

Hillslope profile	(1) Backslope (2) Summit (3) Shoulder
Landforms	(1) Marine terrace > Hill
Runoff class	Very low to high
Flooding frequency	None
Ponding frequency	None
Elevation	6–35 m
Slope	0–12%
Water table depth	152–203 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	0–79 m
Slope	0–40%
Water table depth	107–203 cm

Climatic features

The climate is characterized as humid subtropical with long hot summers and mild winters. In the winter months, Canadian air masses move across Peninsular Florida and produce cool, cloudy, and 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 two to four 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)	227-365 days
Freeze-free period (characteristic range)	365 days
Precipitation total (characteristic range)	1,295-1,346 mm
Frost-free period (actual range)	212-365 days
Freeze-free period (actual range)	308-365 days
Precipitation total (actual range)	1,270-1,372 mm
Frost-free period (average)	303 days
Freeze-free period (average)	355 days

Precipitation total (average)	1,321 mm

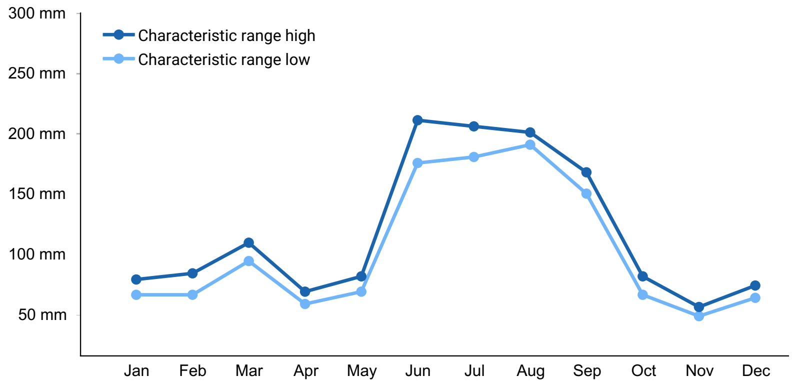

Figure 1. Monthly precipitation range

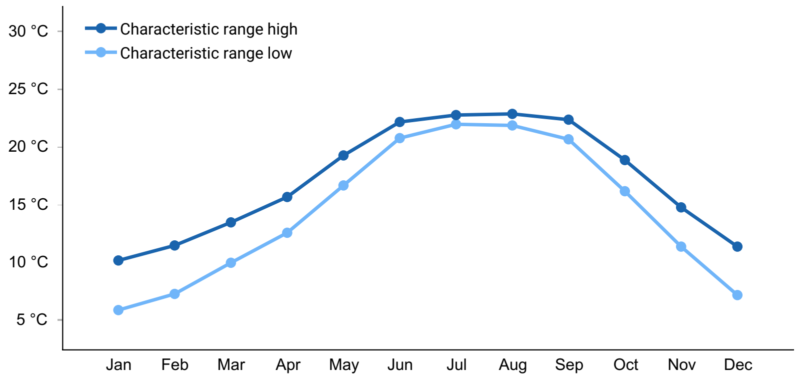

Figure 2. Monthly minimum temperature range

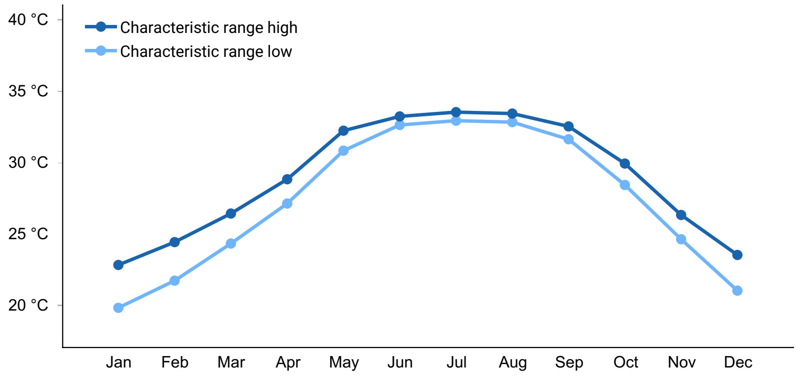

Figure 3. Monthly maximum temperature range

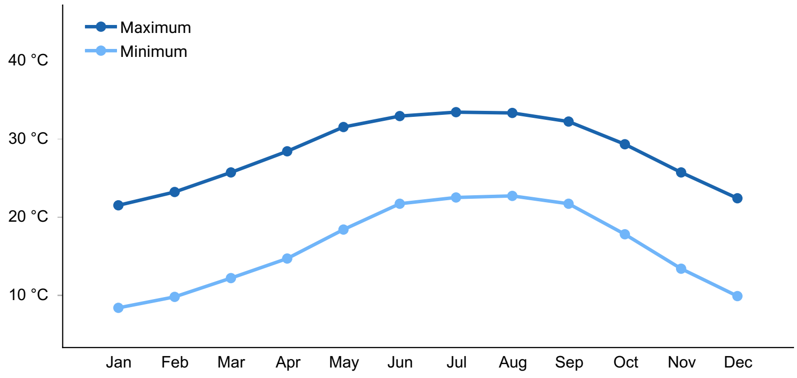

Figure 4. Monthly average minimum and maximum temperature

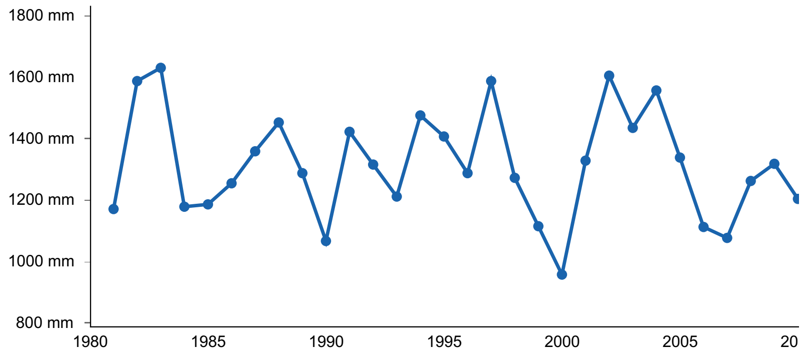

Figure 5. Annual precipitation pattern

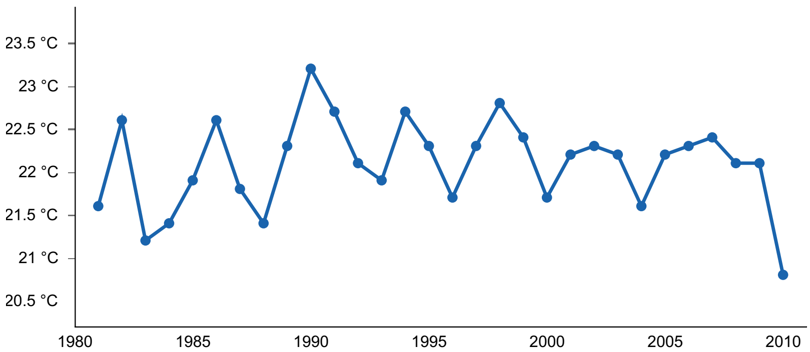

Figure 6. Annual average temperature pattern

Climate stations used

- (1) CLERMONT 9 S [USC00081641], Clermont, FL
- (2) INVERNESS 3 SE [USC00084289], Inverness, FL
- (3) LISBON [USC00085076], Leesburg, FL
- (4) MTN LAKE [USC00085973], Lake Wales, FL
- (5) LAKELAND [USW00012883], Lakeland, FL
- (6) BARTOW [USC00080478], Bartow, FL
- (7) GAINESVILLE 11 WNW [USC00083322], Gainesville, FL
- (8) BROOKSVILLE CHIN HILL [USC00081046], Brooksville, FL
- (9) ORANGE SPRINGS 2SSW [USC00086618], Fort Mc Coy, FL
- (10) SAINT LEO [USC00087851], San Antonio, FL
- (11) TARPON SPGS SEWAGE PL [USC00088824], Tarpon Springs, FL

Influencing water features

This site occurs in extensive areas of hills surrounded by wetter environments. The site is situated on soils that have very deep seasonal high water tables (predominantly > 80 inches). Subsurface water flow is dependent on the presence or absence of an aquitard (loamy or clayey layer). The presence, depth, and orientation of this restrictive layer may affect subsurface water movement.

Given significant hydrologic differences of surrounding communities, this site can have a very abrupt ecotones with dramatic shifts in species composition. Some deep-rooted species are able to tap into the deep or very deep seasonal high water table.

Hydrogeomorphically, these uplands receive water from local precipitation. Slope gradient, rapid infiltration, and saturated hydraulic conductivity results in negligible to low surface runoff. The combination of infertile sand, low available water, and rapid or very rapid saturated hydraulic conductivity influences natural plant vegetation.

Soil features

Soils are excessively drained, uncoated or coated, Typic Quartzipsamments (Gainesville, Kershaw, Lake, Ortega), and Lamellic Quartzipsamments (Alpin, Candler, Penney). Soils of minor extent classify as Humic Psammentic Dystrudepts (Orlando) or Entic Grossarenic Alorthods (Centenary). These soils formed mainly from eolian or sandy marine sediments. Slopes generally range from 0 to 8% but can be as steep as 40%. The small amounts of silt and clay (generally < 10%) and infertile sands are largely responsible for low pH and low base saturation.

These very deep, porous sands will not restrict rooting depth, and some deep-rooted species may be able to access the water table. Without sufficient, periodic precipitation, shallower rooted species can develop moisture stress during the hot summers.

Figure 7. Representative Soil Series

Table 5. Representative soil features

Parent material	(1) Marine deposits (2) Eolian deposits
Surface texture	(1) Fine sand (2) Sand (3) Loamy sand (4) Loamy fine sand (5) Clay
Drainage class	Well drained to excessively drained
Permeability class	Rapid to very rapid
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	4.32–9.91 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	1
Soil reaction (1:1 water) (0-101.6cm)	4.7–5.1
Subsurface fragment volume <=3" (0-101.6cm)	0–3%
Subsurface fragment volume >3" (0-101.6cm)	0%

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Slow to very rapid
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	3.3–15.24 cm
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)	3.5–7.3
Subsurface fragment volume <=3" (0-101.6cm)	Not specified
Subsurface fragment volume >3" (0-101.6cm)	Not specified

Ecological dynamics

The natural community associated with the Dry Yellow Sands Pine Woodlands is “Longleaf Pine Sandhill” (hereafter “Sandhills”; FNAI, 2010). Fire regimes are the primary driver of community distribution and ecological dynamics in sandhills. The fine fuels of herbaceous ground cover vegetation enable frequent fire ignition and spread. Ground fires affect sandhill ecological dynamics in many ways: preparation of seedbed for germination of longleaf pine and other native sandhill species; stimulation of seed production in many species of grasses and forbs; maintenance of open stand conditions needed for sun-loving plant species; and reduced growth of hardwoods and non-native species (Abrahamson, 1984; Walker and Peet, 1983; Wade and Lundsford, 1990; Waldrop et al., 1992; Outcalt et al., 2002; Glitzenstein et al., 2003; Rienhard and Menges, 2004). Once established in sandhill communities, mature pines and oaks are resistant to injury from frequent ground fires (Glitzenstein et al., 1995).

Sandhills burned frequently and with some regularity on the order of once per 1 to 5 years (Robbins and Myers, 1992; Gilliam and Platt, 1999; Rodgers and Provencher, 1999; Provencher et al., 2001; Glitzenstein et al., 2003).

Changes in fire regimes trigger radical shifts in species composition and abundance in Central Florida sandhills. Where fire is infrequent (fire return intervals > 10 years), woody abundance increases, and fire intolerant sand pines and hardwoods increase in abundance. This in turn changes the physiognomy and ecological dynamics of the community (Glitzenstein et al., 1995; Platt, 1999; Provencher et al., 2000; VanLear et al., 2005).

The diversity and abundance of sandhill groundcover herbaceous species decreases with infrequent or absent fire, as thick growths of woody plants compete with herbaceous vegetation for light and other resources. Typical ground cover of burned yellow sands sandhills contains 20 to 30 species /m², many of these interspersed among a matrix of bunchgrass (*Aristida beyrichiana*, *Schizachyrium scoparium*, *Sorghastrum secundum*, Andropogon spp.) (Rodgers and Provencher, 1999; Carr et al., 2010; Peet, 2006). Following period of fire suppression of > 10 years, ground cover richness drops to < 5 species /m² (Provencher et al., 2001; Varner et al., 2005), and herbaceous species cover is similarly diminished. Concurrently, fire intolerant hardwood species gradually replace longleaf pine and fire tolerant oaks of the over- and mid-stories (i.e., turkey and bluejack oaks).

Following long term fire suppression (> 80 years), Central Florida sandhills will eventually be replaced by oak dominated closed canopy forests (Givens et al., 1984; Myers, 1985; Peroni and Abrahamson, 1986; Myers and White, 1987; Abrahamson and Abrahamson, 1996). In most cases, this is a xeric hammock with sand live oak (*Q.*

geminata) canopy and understory of low growing clonal oaks and other hardwood seedlings (FNAI 2010).

When fire suppressed sandhills do burn, excess woody fuel loads and ground litter encourage hotter and more intense fires which may cause excessive pine mortality (Varner et al., 2005). Smoldering fires in litter accumulations can kill underground plant part and hinder post-fire recovery. For the purposes of ecological restoration of fire suppressed sandhills, the manner and timing of fire reintroduction is very much dependent on the amount of fuel buildup (Varner et al., 2005).

Wind damage associated with hurricanes and strong storms infrequently affect ecological dynamics of Central Florida sandhills. Strong winds can cause local or widespread pine mortality. Although hurricanes usually dissipate before reaching the interior of the peninsula, large storms do affect the region on the order of 2 to 3 per century.

Other natural disturbances that affect Central Florida sandhills include pine and hardwood mortality caused by insects and pathogen. Southern pine beetle (Dendroctonus frontalis; SPB) is a species of bark beetle native to the Southeastern Coastal Plain. Periodically SPB populations increase to epidemic levels and healthy pines are killed as infestations expand. Most susceptible to SPB mortality are densely planted even-aged loblolly and longleaf pine stands, which is common in community timber plantations (Schowalter et al., 1981). Widely space longleaf pines in natural stands are less susceptible to SPB related mortality.

State and transition model

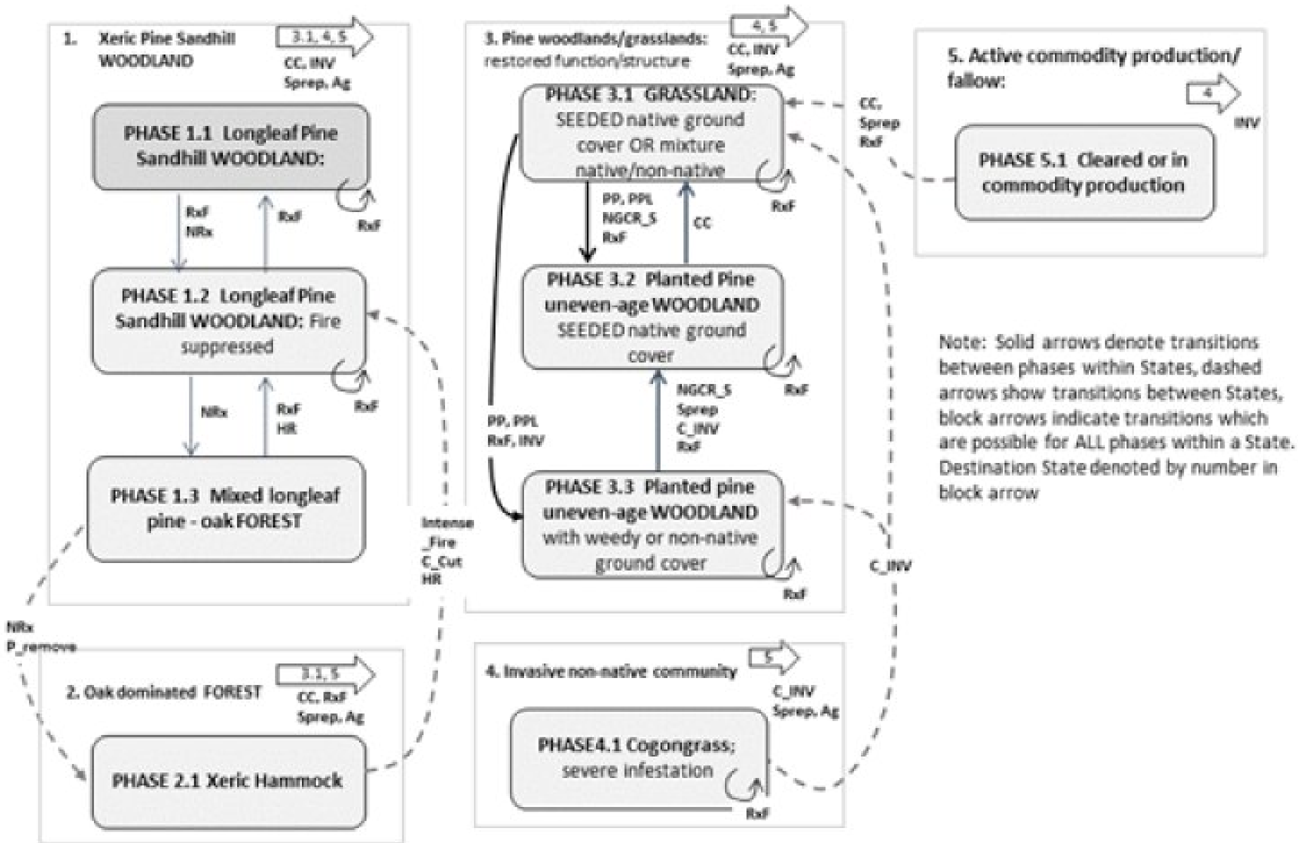

Figure 8. Dry sandy pine woodlands

RxF	Frequent interval prescribed fire
Intense_Fire	Infrequent (intense) fire, often stand replacing catastrophic fire
NRx	Fire suppression, or very infrequent non-catastrophic fire
HR	Hardwood reduction (mechanical and chemical, no ground disturbance)
PP	Planted Pine (not Longleaf)
PPL	Planted Pine (Longleaf)
P_remove	Selective logging of pines
CC	Clearcut
Sprep	Site prep (mechanical and chemical)
INV	Invasion of noxious non-native plant species
C_INV	Mechanical/chemical control of invasive plant species
NGCR_S	Native ground cover restoration: active seeding
Ag	Various agricultural practices for crop cultivation

Figure 9. Dry Yellow Sands Pine Woodland

State 1
Longleaf Pine Sandhill Woodland

The canopy of Phase 1.1 contains widely spaced mature longleaf pines (P. palustris) intermixed with patches of regenerating longleaf pine seedlings and saplings. Typical Phase 1.1 stands are mosaics of even-aged longleaf pine “cohorts”, with dense patches of pine seedlings distributed in canopy gaps. Midstory vegetation of Phase 1.1 is generally sparse, consisting of patches of oaks, notably turkey oak (*Quercus laevis*), bluejack oak (*Q. incana*) and sand live oak (*Q. geminata*). Other small statured oaks are often present, although usually in low abundance under conditions of frequent fire. Groundcover vegetation of Phase 1.1 Sandhills is dominated by perennial bunch grasses which form a matrix of mostly continuous cover. Numerous plant species are common in the interstitial spaces between grass tussocks. Wiregrass (*Aristida stricta* var. beyrichiana) is a ubiquitous dominant bunchgrass in Phase 1.1 groundcover. Other common bunchgrasses include lopsided indiangrass (*Sorghastrum secundum*), little bluestem (*Schizachyrium scoparium* var. stoloniferum), pineywoods dropseed (*Sporobolus junceus*) and other bluestem species (*Andropogon ternarius* var. ternarius, *A. gyrans* var. gyrans).

State 2
Oak dominated Forest (Xeric Hammock)

State 2 describes late successional vegetation of the site, resulting from long term fire suppression of longleaf pine sandhill communities (FNAI 2010). Unlike sandhills, State 2 Xeric Hammocks are closed canopy forests of sand live oak (*Q. geminata*), which overtop mid- and under-story vegetation comprised of other oaks and hardwood seedlings. These lower strata are overwhelmingly dominated by scrub oaks and palmetto (*Serenoa repens*). Other shrub species are variously present, including rusty staggerbush (*Lyonia ferruginea*), sparkleberry (*Vaccinium arboreum*), deerberry (*V. stamineum*), black cherry (*Prunus serotina*), American beautyberry (*Callicarpa americana*), common persimmon (*Diospyros virginiana*). Depending on length of fire suppression and geography, Xeric Hammock will often contain remnant species of former longleaf pine sandhills, including turkey oak, bluejack oak, sparkleberry, and remnant wiregrass. Herbaceous ground cover in State 2 is very sparse or absent. The forest floor is covered with oak leaf litter which holds considerable moisture, creating mesic conditions at ground level and further depressing native herbaceous growth as well as pine germination (FNAI 2010). The State 2 Xeric Hammock community is fire resistant. Fine fuels are absent, and hardwood litter retains ample moisture which deters fire spread. When fires do occur, they are severe and generally occur in extreme drought conditions. Unlike surface fires, these intense fires consume most standing biomass.

State 3
Restored Pine Woodlands/Grasslands

State 3 variously describes a grasslands and pine woodlands consisting of seeded and planted native species, OR a mixture of native and non-native herbaceous species. Notably, this state describes conditions where native propagules have been extirpated following long term fire suppression and/or extensive soil disturbance associated with commodity land uses. Native plant populations are purposefully re-established in this state, for the purpose of ecological restoration. The phases of State 3 include grasslands and, if native pines are planted, woodlands with herbaceous ground cover. These plant communities have restored ecological function and provide habitat for native wildlife species. Restoration of native bunchgrasses provides fine fuels for frequent ground fires and is necessary for restoration of ecological site dynamics. Once established, the bunch grass matrix provides habitat suitable for establishment of other native plant populations, either from artificial seeding or natural recruitment. State 3 grasslands and woodlands may provide suitable habitat for ground nesting birds and small mammals. Furthermore, the availability of native forage provides habitat for the gopher tortoise (Gopherus polyphemus), a terrestrial turtle listed as a threatened species in Florida.

State 4
Invasive non-native plant community

State 4 describes a condition where a single noxious non-native species has invaded and dominated the site. By far, the most common noxious invasive plant species of this site 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 and thrives on acidic, nutrient-poor soils and droughty conditions (MacDonald 2004). Furthermore, cogongrass is a prolific seed producer, and readily invades following soil disturbances. (Yager, Miller, and Jones 2010). Once clones are established, rapid cogongrass growth will extirpate native ground cover plant populations. In addition to its competitive advantage over native vegetation for space and resources, cogongrass may be allelopathic in some situations (Brook 1989, Bryson and Carter 1993). Cogongrass is a fire adapted species which burns readily and intensely. Furthermore, it thrives in post-fire conditions where it colonizes rapidly clonally and from seed. Cogongrass fueled fires are up to 20% hotter than natural ground fires of native pinelands (MacDonald 2004). These hot fires may deter any pine or hardwood regeneration. In the Southeastern U.S., cogongrass does not have any natural herbivore enemies, nor any known pathogens.

State 5
Active commodity production/Fallow fields

This state describes commodity land uses of the Dry Yellow Sands Pine Woodland concept. Commodity crops common to Central Florida xeric sands include a variety of annual and perennial crops, the most notable of which is citrus. Other crops include horticultural ornamentals, vineyards, and some row crops. Pine plantations which are managed for community production of pulpwood or saw timber are included in this state. Also included are improved pastures of bahiagrass (or other sod forming grass species). All phases of State 5 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.

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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	05/13/2025
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:

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

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

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

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

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17. **Perennial plant reproductive capability:**
