

Ecological site F113XY907IL

Fragic Till Plain Woodland

Last updated: 5/17/2024
Accessed: 11/23/2024

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): 113X–Central Claypan Areas

The eastern Illinois portion of the Central Claypan Areas MLRA is in the Till Plains Section of the Central Lowland Province of the Interior Plains (USDA-NRCS, 2006) and includes the Southern Till Plain Natural Division of the natural divisions of Illinois (Schwegman, 1973; 1997; IDNR, 2018) in south-central Illinois. South-central Illinois is a dissected Illinoian till plain south of the terminal Wisconsin moraine. This region consists of nearly level to gently sloping, old till plains. Stream valleys are shallow and generally are narrow. Elevation is about 660 feet (200 meters), increasing gradually from south to north. Local relief is generally low on the broad, flat till plains and flood plains and high on the dissected hills bordering rivers or drainage systems. The Kaskaskia, Little Muddy, Little Wabash, Embarras, and Skillet Fork rivers are part of this area. This region is covered with loess, which overlies old glacial drift (Illinoian till) that has a high content of clay. Fragipans are also present. Pennsylvanian limestone and shale bedrock underlay the glacial till. The dominant soil orders in this region are Alfisol and Mollisol. The soils in the area predominantly have a mesic soil temperature regime, an aquic or udic soil moisture regime, and mixed or smectitic mineralogy. They generally are very deep, well drained to poorly drained, and loamy or clayey. (USDA-NRCS, 2006).

Classification relationships

Major Land Resource Area (MLRA) (USDA-NRCS, 2006):

113 – Central Claypan Areas, Eastern Part

U.S. Forest Service Ecoregions (Cleland et al. 2007):

Domain: Humid Temperate Domain

Division: Hot Continental Division

Province: Eastern Broadleaf Forest (Continental)

Province Code: 222

Section: Central Till Plains, Oak-Hickory Section

Section Code: 222G

Ecological site concept

This woodland community type is found throughout the Central Claypan Areas MLRA in south-central Illinois. Fragic Till Plain Woodland ecological sites are found on convex ridges, knolls and gentle side slopes of drainageways on till plains. They formed in loess and the underlying silty or loamy deposits that overlie a strongly developed paleosol with a shallow to moderately deep fragipan.

The historic reference plant community was a woodland dominated by drought and fire-tolerant post oak (*Quercus stellata* Wangenh.*) and hickory species (*Carya* spp.), including shagbark hickory (*Carya ovata* (Mill.) K. Koch), mockernut hickory (*Carya tomentosa* (Lam.) Nutt.) along with a dense ground flora. Post oak and associated trees may be stunted due to the unfavorable soil conditions. Soils contain a subsurface hardpan (fragipan) that is impermeable or nearly impermeable, causing a shallowly perched water table. The soil moisture fluctuates widely

throughout the growing season. A fragipan layer leads to 'xerohydric' conditions. The canopy is typically strongly dominated by post oak, but may include white oak (*Quercus alba* L.), swamp white oak (*Quercus bicolor* Willd.), southern red oak (*Quercus falcata* Michx.), and/or blackjack oak (*Quercus marilandica* Münchh.). The shrub and woody vine strata may contain Virginia creeper (*Parthenocissus quinquefolia* (L.) Planch.), Carolina rose (*Rosa carolina* L.), blackberry (*Rubus* spp.), and poison ivy (*Toxicodendron radicans* (L.) Kuntze.). The herbaceous layer can be fairly dissimilar from one stand to the next. Some stands can be dominated by sweet woodreed (*Cinna arundinacea* L.), Indian woodoats (*Chasmanthium latifolium* (Michx.) Yates.) and slender spikerush (*Eleocharis tenuis* var. *verrucosa* (Svens.) Svens.). Plants more typical of dry and dry-mesic soil grow on slight rises, including fescue sedge (*Carex festucacea* Schkuhr ex Willd.), Pennsylvania sedge (*Carex pensylvanica* Lam.), poverty oatgrass (*Danthonia spicata* (L.) P. Beauv. ex Roem. & Schult.), woodland sunflower (*Helianthus divaricatus* L.), and others (Taft et al. 1994, 1995; NatureServe 2017).

Woodlands were distinguished from forest, by their relatively open understory, and the presence of sun-loving ground flora species (White, 1994). Fire was the primary disturbance factor that maintained this ecological site, while drought, windthrow, and grazing were secondary factors (LANDFIRE 2009).

* All plant common and scientific names in this document were obtained from the U.S. Department of Agriculture – Natural Resources Conservation Service National PLANTS Database (USDA NRCS, 2018).

Associated sites

F113XY905IL	Wet Upland Woodland The Fragic Till Plain Woodland ecological sites are in a drainage sequence with Wet Upland Woodlands that are on nearly level summits and broad till plains.
F113XY911IL	Loamy Till Backslope Forest A backslope forest ecological site, that is often downslope, on loamy till soils. Fragipans are absent.
F113XY910IL	Fragic Backslope Woodland Fragic Backslope ecological sites are on steeper downslopes that also support oak-hickory woodlands with fragic horizons.

Similar sites

F113XY910IL	Fragic Backslope Woodland Fragic Backslope Woodland ecological sites are on steeper downslopes that also support oak-hickory woodlands with fragic horizons.
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Table 1. Dominant plant species

Tree	(1) <i>Quercus stellata</i>
Shrub	(1) <i>Rosa carolina</i>
Herbaceous	(1) <i>Schizachyrium scoparium</i> (2) <i>Carex</i>

Physiographic features

This site is on convex ridges, knolls and gentle side slopes of drainageways in uplands with slopes of 2 to 7 percent. The site generates runoff to adjacent, downslope ecological sites. This site does not flood.

Table 2. Representative physiographic features

Hillslope profile	(1) Shoulder
Slope shape up-down	(1) Convex
Landforms	(1) Upland > Ground moraine (2) Loess hill (3) Structural bench (4) Till plain

Runoff class	Medium to high
Elevation	107–411 m
Slope	2–7%
Water table depth	38–76 cm
Aspect	Aspect is not a significant factor

Climatic features

The soil temperature regime of MLRA 113 is classified as mesic, where the mean annual soil temperature is between 47 and 59°F. Temperature and precipitation occur along a north-south gradient, where temperature and precipitation increase the further south you travel (USDA-NRCS 2006). The average freeze-free period of this ecological site is about 192 days, while the frost-free period is about 169 days (Table 2). The majority of the precipitation occurs as rainfall in the form of convective thunderstorms during the growing season. Average annual precipitation is 45.6 inches, which includes rainfall plus the water equivalent from snowfall. The average annual low and high temperatures are 43.9°F and 64.5°F, respectively (Table 3). Climate data and analyses are derived from 30-year average gathered from four National Oceanic and Atmospheric Administration (NOAA, 1980-2010) weather stations contained within the range of this ecological site.

Table 3. Representative climatic features

Frost-free period (characteristic range)	160-162 days
Freeze-free period (characteristic range)	184-187 days
Precipitation total (characteristic range)	1,092-1,219 mm
Frost-free period (actual range)	158-163 days
Freeze-free period (actual range)	182-192 days
Precipitation total (actual range)	1,067-1,219 mm
Frost-free period (average)	161 days
Freeze-free period (average)	186 days
Precipitation total (average)	1,168 mm

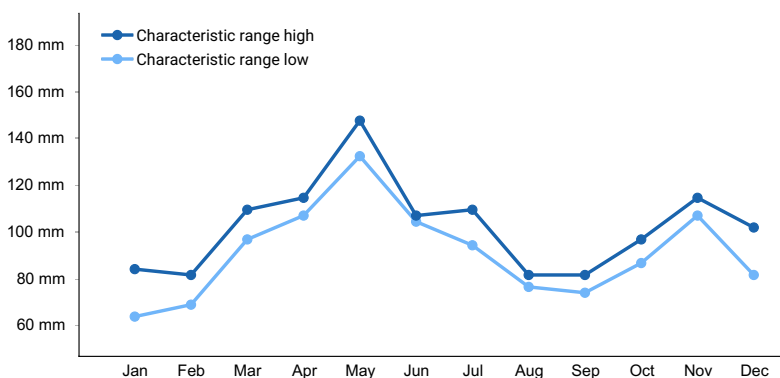


Figure 1. Monthly precipitation range

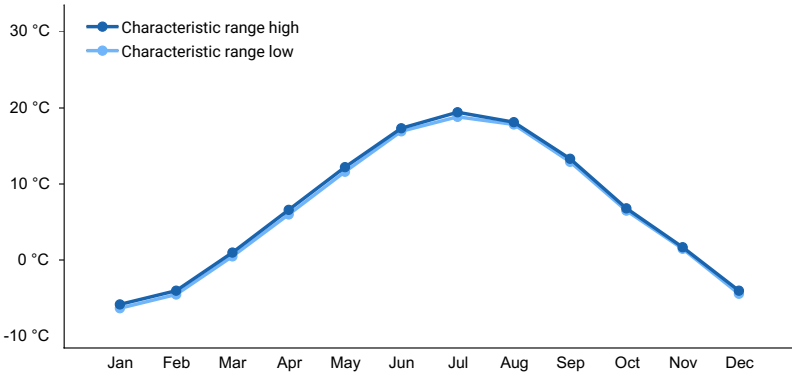


Figure 2. Monthly minimum temperature range

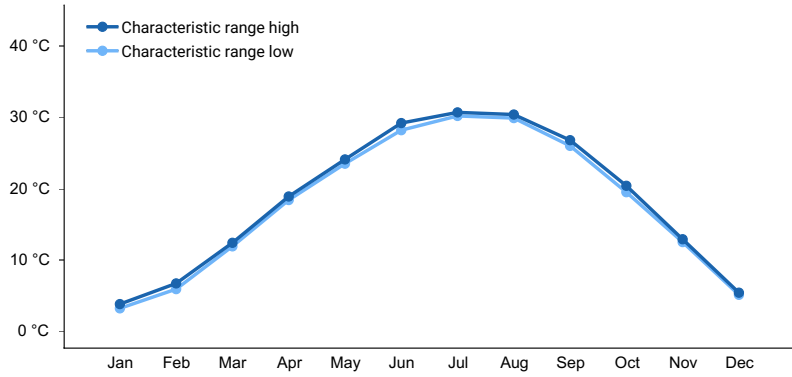


Figure 3. Monthly maximum temperature range

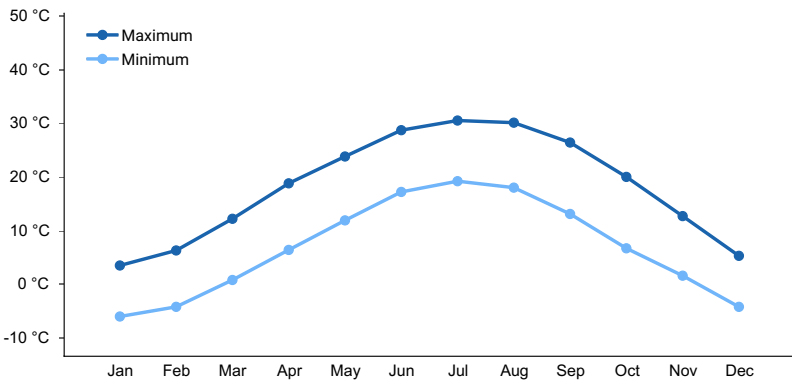


Figure 4. Monthly average minimum and maximum temperature

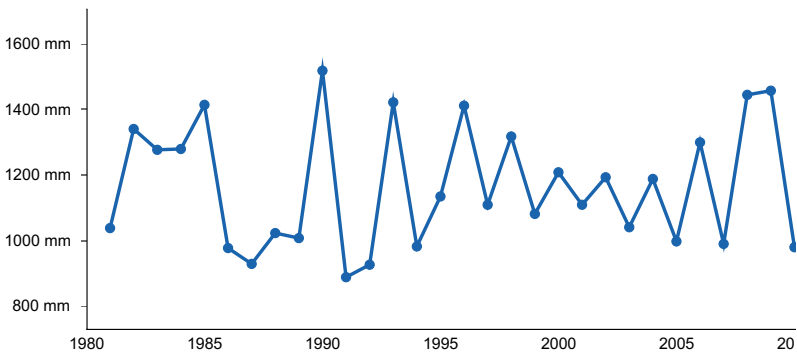


Figure 5. Annual precipitation pattern

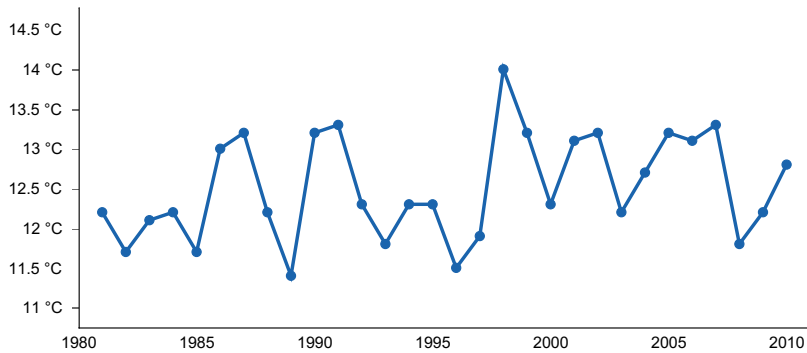


Figure 6. Annual average temperature pattern

Climate stations used

- (1) MT VERNON 3 NE [USC00115943], Mount Vernon, IL
- (2) VANDALIA [USC00118781], Vandalia, IL
- (3) MARION 4 NNE [USC00115342], Marion, IL
- (4) OLNEY 2S [USC00116446], Olney, IL
- (5) CARMi 3 [USC00111302], Carmi, IL

Influencing water features

Fragic Till Plain Woodlands are not influenced by wetland or riparian water features. However, a seasonal zone of saturation occurs, perched on the fragipan in the subsoil. Precipitation is the main source of water for this ecological site. Infiltration is slow, and surface runoff is high. Surface runoff contributes water to downslope ecological sites. These areas have a fragipan with a very slow rate of water transmission through the pan. There is a perched, seasonal water table is at a depth of about 30 inches from December through April in most years. (SSS NRCS OSD, 2018).

Soil features

These soils have a root-restricting fragipan at 15 to 30 inches. They formed in loess and the underlying silty or loamy deposits that overlie a strongly developed paleosol or underlying weathered materials of interbedded sandstone, shale, and siltstone. They have thin, light-colored, silt loam surface horizons, and silt loam, silty clay loam or sandy clay loam subsoils. They are very strongly acid to neutral. A seasonal high water table is perched above the fragipan during the spring months in most years. Soils of this ecological site are in the Alfisol order, further classified as fine-silty, mixed, active, mesic Oxyaquic Fragiudalfs or fine, smectitic, mesic Aeric Fragic Epiaqualfs. Soil series associated with this site include Ava, Bluford, and Grantsburg.

Table 4. Representative soil features

Parent material	(1) Till (2) Loess
Surface texture	(1) Silt loam
Family particle size	(1) Fine (2) Fine-silty
Drainage class	Somewhat poorly drained to moderately well drained
Permeability class	Very slow to slow
Depth to restrictive layer	38–76 cm
Soil depth	152–203 cm
Available water capacity (Depth not specified)	5.08–17.78 cm
Electrical conductivity (Depth not specified)	0–2 mmhos/cm

Sodium adsorption ratio (Depth not specified)	0–13
Soil reaction (1:1 water) (Depth not specified)	4.5–7.3
Subsurface fragment volume ≤3" (Depth not specified)	0–2%
Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

The MLRA lies within the transition zone between the eastern deciduous forests and the tallgrass prairies. Most upland woodlands on lands with gently rolling topography were relatively open (Anderson and Anderson 1975), and could be characterized as open woodlands or savannas depending upon tree densities (White, 1994). These open canopy woodlands represented a transition between the extensive prairies on much of the uplands of the prairie peninsula and the closed forests of the dissected terrain of the river valleys. At the time of European settlement these open canopy woodlands were strongly influenced by periodic fires (McClain and Elzinga 1994).

The landscape position and juxtaposition to prairies lead to a probable fire frequency of every 3 to 5 years (Anderson, 1982; McClain et al., 1999). Fire constitutes the main natural process for this type and likely maintained an open canopy structure. These ecological sites ranged from savannas near the prairie edge to open, park-like woodlands farther away. (Anderson, 1975; Coates, 1992; Edgin and others, 1996, 1997, 2002, 2003; Taft et al., 1994; White, 1994). Dense thickets of oak sprouts occurred during periods of less-frequent fire, but periodic fire would eventually clear them out.

Drought, grazing, and windthrow have also played a role in shaping this ecological site. Grazing by native large herbivores, such as bison (*Bos bison*), prairie elk (*Cervus elaphus*), and white-tailed deer (*Odocoileus virginianus*), would have effectively kept understory conditions more open, creating conditions more favorable to oak reproduction and woodland ground flora species (Anderson, 1982; Irland 2000; Peterson 2000; NatureServe 2018). Wind and ice would have periodically opened the canopy up by knocking over trees or breaking substantial branches off canopy trees. When coupled with fire, periods of drought, herbivory, and high wind events can greatly delay the establishment and maturation of woody vegetation (Pyne et al. 1996).

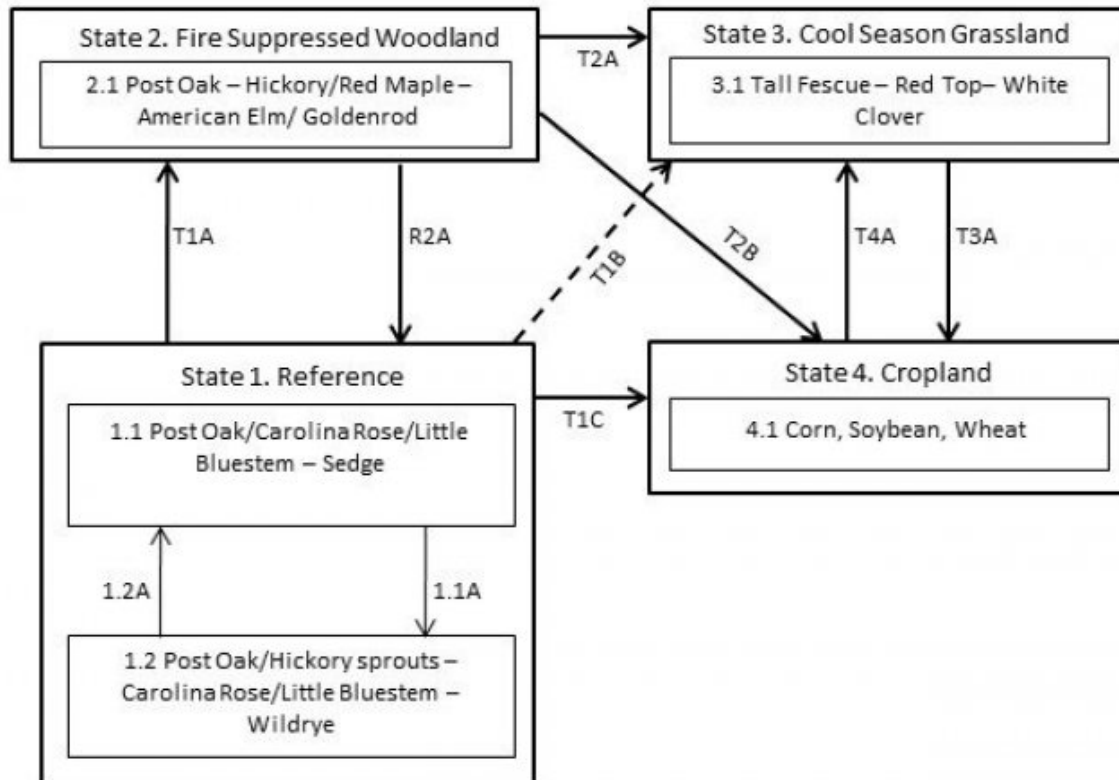
Extensive conversion for agriculture has fragmented this system. These ecological sites are moderately productive. Today, many of these ecological sites have been cleared and converted to pasture or has been maintained in woody cover with increased stand density. Uncontrolled domestic grazing has also impacted these remaining woodland communities, further diminishing the diversity of native plants and introducing species that are tolerant of grazing, such as coralberry (*Symphoricarpos orbiculatus* Moench), gooseberry (*Ribes* spp.), and Virginia creeper (*Parthenocissus quinquefolia* (L.) Planch.).

Grazed sites also have a more open understory. In addition, soil compaction and soil erosion can be a problem and lower productivity. In the long term absence of fire, woody species, especially hickory (*Carya* spp.) and hophornbeam (*Ostrya virginiana* (Mill.) encroach into these woodlands (IDNR, 2018). Once established, these woody plants can quickly fill the existing understory increasing shade levels with a greatly diminished ground flora (Dey and Kabrick, 2015). Remaining woodland ecological sites have a younger (50 to 80 years) canopy layer whose species composition and quality has been altered by timber harvesting practices.

A provisional state and transition diagram is depicted in Figure 2. Detailed descriptions of each state, transition, plant community, and pathway follow the model. This model is based on available experimental research, field observations, professional consensus, and interpretations. It may change as knowledge increases.

State and transition model

Fragic Till Plain, F113XY907IL (Provisional)



Code	Event/Activity/Process
T1A	Fire suppression > 20 years; woody invasion; repeated timber harvests; domestic grazing
T1B	Tillage; vegetative seeding; grassland management
T1C, T3A	Tillage; conservation cropping system; water management
T2A	Woody removal; tillage; vegetative seeding; grassland management
T2B	Woody removal; tillage; conservation cropping system
T4A	Vegetative seeding; grassland management
1.1A	Fire-free interval 10+ years
1.2A	Fire interval 3-5 years
R2A	Forest stand improvement; livestock access control; prescribed fire, 3-5 years; long term stand rotation

**State 1
Reference State**

These open woodland reference communities were strongly influenced by fire. Herbivory by native (now expatriated) ungulates also played a role. Consequently, drought and fire-tolerant post oak and hickories over a ground flora of tallgrass prairie grasses, sedges and wildflowers made up this woodland. There are two phases associated with this reference state.

Dominant plant species

- post oak (*Quercus stellata*), tree
- Carolina rose (*Rosa carolina*), shrub
- little bluestem (*Schizachyrium scoparium*), grass
- sedge (*Carex*), grass

Community 1.1

Post oak /Carolina Rose/ Little bluestem-sedge

The overstory in this phase is dominated by post oak with scattered blackjack oak (*Quercus marilandica* Münchh.) and hickories. This open woodland community typically has a two-tiered structure. The abundant herbaceous layer was dominated by little bluestem. Fire frequency was likely every 3 to 5 years. This continued fire and natural native grazing would have maintained the more open canopy and profusion of ground flora species.

Dominant plant species

- post oak (*Quercus stellata*), tree
- little bluestem (*Schizachyrium scoparium*), grass
- sweet woodreed (*Cinna arundinacea*), other herbaceous

Community 1.2

Post oak / hickory sprouts - Carolina rose / little bluestem-wildrye

The overstory in this phase is dominated by post oak with scattered blackjack oak and hickories. This brushy woodland community typically has a three-tiered structure. It is characterized by a thick understory of oak and hickory saplings, and shrubs. The herbaceous layer is reduced but still dominated by little bluestem. Fire-free intervals likely ranged from 5 to 20 years.

Dominant plant species

- post oak (*Quercus stellata*), tree
- hybrid hickory (*Carya*), shrub
- Carolina rose (*Rosa carolina*), shrub
- little bluestem (*Schizachyrium scoparium*), grass
- wildrye (*Elymus*), grass

Pathway 1.1A

Community 1.1 to 1.2

Fire interval greater than 10 years

Pathway 1.2A

Community 1.2 to 1.1

Fire interval 3-5 years

State 2

Fire Suppressed Woodland

Most current areas of Fragile Till Plain Woodlands have experienced fire exclusion for decades. In the absence of fire, ongoing recruitment of trees into the canopy develops a closed canopy, shading out the rich herbaceous ground flora. This results in the formation of Post Oak – Hickory / Oak & Hickory Saplings / Goldenrod forests. Black oak and midstory species may increase. Herbaceous cover and diversity greatly diminishes, leaf litter builds

up, and more shade-tolerant woodland species persist, such as goldenrods (*Solidago* spp.), panic grasses (*Dichanthelium* spp.) and asters (*Symphyotrichum* spp.). The understory also develops with oak and hickory saplings along with sassafras and black cherry. Many of the closed Fragic Till Plain Woodlands have been heavily grazed by domestic livestock at some point in their history. Grazing decreases the cover and abundance of saplings, shrubs and herbaceous ground flora, opening up the understory. Weedy native shrubs and vines, such as coralberry (*Symphoricarpos orbiculatus* Moench), gooseberry (*Ribes* spp.), poison ivy (*Toxicodendron radicans* (L.) Kuntze) and Virginia creeper (*Parthenocissus quinquefolia* (L.) Planch.), often flourish after grazing, and exotic species like tall fescue (*Schedonorus arundinaceus* (Schreb.) Dumort., nom. Cons.) and sericea lespedeza (*Lespedeza cuneata* (Dum. Cours.) G. Don) increase in abundance. Poorly managed grazing can cause compaction and denudation of the soil surface. Soil compaction may also further limit height growth of trees. With poorly managed grazing, this can result in an increase in weedy natives such as sedges (*Carex* spp.), and exotics such as sericea lespedeza (*Lespedeza cuneata* (Dum. Cours.) G. Don) if they are present. Single-tree timber harvesting also occurred, resulting in a high grading of the canopy structure, creating many stands with poor quality trees.

Dominant plant species

- post oak (*Quercus stellata*), tree
- hybrid hickory (*Carya*), tree
- red maple (*Acer rubrum*), tree
- American elm (*Ulmus americana*), tree
- goldenrod (*Solidago*), other herbaceous

State 3

Cool Season Grassland

Conversion of other states to non-native cool season species such as tall fescue (*Schedonorus arundinaceus* (Schreb.) Dumort., nom. cons.), red top (*Agrostis stolonifera* L.) and white clover (*Trifolium repens* L.) has been common in the Illinois Central Claypan area.

Dominant plant species

- tall fescue (*Schedonorus arundinaceus*), grass
- creeping bentgrass (*Agrostis stolonifera*), grass
- white clover (*Trifolium repens*), other herbaceous

State 4

Cropland

This is an occasional state that exists with intensive cropping of corn (*Zea mays* L.), soybeans (*Glycine max* (L.) Merr.), and winter wheat (*Triticum aestivum* L.) occurring. Water management activities are needed to maximize yields. Some conversion to cool season grassland occurs for a limited period of time before transitioning back to cropland.

Dominant plant species

- corn (*Zea mays*), grass
- common wheat (*Triticum aestivum*), grass
- soybean (*Glycine max*), other herbaceous

Transition T1A

State 1 to 2

Fire suppression greater than 20 years allows woody plants to increase. Repeated timber harvests and domestic grazing may also occur.

Transition T1B

State 1 to 3

Tillage; vegetative seeding; grassland management

Transition T1C

State 1 to 4

Tillage; conservation cropping system; water management

Restoration pathway R2A

State 2 to 1

Forest stand improvement; livestock access control; prescribed fire, 3-5 years; long term stand rotation

Transition T2A

State 2 to 3

Woody removal; tillage; vegetative seeding; grassland management

Transition T2B

State 2 to 4

Woody removal; tillage; conservation cropping system

Transition T3A

State 3 to 4

Tillage; conservation cropping system; water management

Transition T4A

State 4 to 3

Vegetative seeding; grassland management

Additional community tables

Inventory data references

No field plots were available for this site. A review of the scientific literature and professional experience were used to approximate the plant communities and ecological dynamics for this provisional ecological site. Information for the state-and-transition model was obtained from the same sources. All community phases are considered provisional based on the sources identified in ecological site description.

Other references

Relationship to other established ecological classifications:

Biophysical Setting (LANDFIRE, 2009); the reference community of this ecological site is also similar to: South-Central Interior/Upper Coastal Plain Flatwoods: CES203.479

National Vegetation Classification System (NatureServe, 2018): the reference community of this ecological site is most similar to: Post Oak / Sweet Woodreed Flatwoods Forest (*Quercus stellata* / *Cinna arundinacea* Flatwoods Forest); CEG002405, *Quercus stellata* Interior Flatwoods Forest Alliance, A3431.

Illinois Natural Areas Survey (INAS) (White, 1978); the reference community of this ecological site is most similar to: INAS Community Class – Forest; Natural community – Southern Flatwoods

Contributors

Douglas Wallace

Ralph Tucker
Zach Weber

Approval

Suzanne Mayne-Kinney, 5/17/2024

Acknowledgments

Contact information for primary authors: Ralph Tucker (ralph.tucker@mo.usda.gov), Soil Scientist, United States Department of Agriculture - Natural Resources Conservation Service (USDA-NRCS), Union, MO; Zach Weber (zach.weber@il.usda.gov), Soil Scientist, USDA-NRCS, Olney, IL; Douglas Wallace (doug.wallace@mo.usda.gov), Ecologist, USDA-NRCS, Columbia, MO.

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	11/23/2024
Approved by	Suzanne Mayne-Kinney
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:**
