USDA Natural Resources Conservation Service

Ecological site F113XY916IL
Sandy Outwash Woodland

Last updated: 5/17/2024
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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): 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 Illinoisan 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 (Illinoisan 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). Northern crayfish frog (Lithobates areolatus), ornate box turtle (Terrapene ornata ornate) and remnant populations of greater prairie-chickens (Tympanuchus cupido) are characteristic animals of this region (IDNR, 2018).

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

The historic pre-European settlement vegetation on this site was dominated by broadleaf deciduous trees. Sandy Outwash Woodland occur on outwash terraces and upland ridges adjacent to stream valleys. Soils are well drained and very deep. (Nelson 2010; SSS NRCS OSD 2018; NatureServe 2018).

This black oak woodland community is moderately closed with typically 70 to 80 percent canopy cover. The more open stands tend to have well-developed shrub layers while more closed-canopy stands have fewer shrubs. Black oak, (Quercus velutina L. *) is the dominant tree species and makes up the great majority of the canopy (up to 70 percent) in most stands. Other common tree species include white oak (Quercus alba L.), pignut hickory (Carya

glabra (Mill.) Sweet), shagbark hickory (Carya ovata (Mill.) K. Koch), red maple (Acer rubrum L.) and black cherry (*Prunus serotina* Ehrh.). Shrubs such as gray dogwood (Cornus racemosa Lam.), American hazelnut (Corylus americana Walter), and blueberry (Vaccinium spp.) are typical. The ground layer contains species such as American hogpeanut (Amphicarpaea bracteata (L.) Fernald), aster (Asteraceae spp.), Pennsylvania sedge (Carex pensylvanica Lam.), spotted geranium (Geranium maculatum L.), feathery false lily of the valley (Maianthemum racemosum (L.) Link), and western brackenfern (Pteridium aquilinum (L.) Kuhn). Where Pennsylvania sedge forms dense sods, it may exclude shrub or sapling cover. The herbaceous layer can also include tall hairy agrimony (Agrimonia gryposepala Wallr.), beaked agrimony (Agrimonia rostellata Wallr.), American hogpeanut (Amphicarpaea bracteata (L.) Fernald), rattlesnake fern (Botrychium virginianum (L.) Sw.), eastern woodland sedge (Carex blanda Dewey), pointedleaf ticktrefoil (Desmodium glutinosum (Muhl. ex Willd.) Alph. Wood), nakedflower ticktrefoil (Desmodium nudiflorum (L.) DC.), fourleaf yam (Dioscorea quaternata J.F. Gmel.), licorice bedstraw (Galium circaezans Michx.), Christmas fern (Polystichum acrostichoides (Michx.) Schott), and poverty oatgrass (Danthonia spicata (L.) P. Beauv. ex Roem. & Schult.), among others. Fire is the primary disturbance factor that maintains this ecological site, while drought, windthrow, and grazing are secondary factors (LANDFIRE 2009; Nelson 2010; NatureServe 2018; Voigt and Mohlenbrock 1964; White 1978).

*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

F113XY920IL	**Silty Floodplain Forest** This ecological site is located in the floodplains below Sandy Outwash Woodlands.
F113XY919IL	**Wet Silty Floodplain Forest** This ecological site is located in the floodplains below Sandy Outwash Woodlands.
F113XY905IL	**Wet Upland Woodland** This ecological site is typically located adjacent to Sandy Outwash Woodlands.

Similar sites

F113XY915IL	**Lacustrine Terrace Forest** This ecological site is in similar landscape positions but on finer textured soils.

Table 1. Dominant plant species

Tree	(1) *Quercus velutina* (2) *Quercus alba*
Shrub	(1) *Corylus americana*
Herbaceous	(1) *Carex pensylvanica*

Physiographic features

This site is on very deep, well drained soils on outwash terraces and upland ridges adjacent to stream valleys. These soils formed in loess over sandy outwash and loess over eolian sands. Slopes range from 2 to 10 percent. (Table 1). The site generates runoff to adjacent lower floodplain sites.

Table 2. Representative physiographic features

Slope shape up-down	(1) Convex
Hillslope profile	(1) Shoulder
Landforms	(1) Outwash plain > Stream terrace
Runoff class	Low to medium
Elevation	361–836 ft
Slope	2–10%

Water table depth	72 in
Aspect	W, NW, N, NE, E, SE, S, SW

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 189 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 47.2 inches, which includes rainfall plus the water equivalent from snowfall. The average annual low and high temperatures are 43.7°F and 64.8°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)	159-167 days
Freeze-free period (characteristic range)	184-192 days
Precipitation total (characteristic range)	45-47 in
Frost-free period (actual range)	158-168 days
Freeze-free period (actual range)	183-193 days
Precipitation total (actual range)	44-47 in
Frost-free period (average)	163 days
Freeze-free period (average)	188 days
Precipitation total (average)	46 in

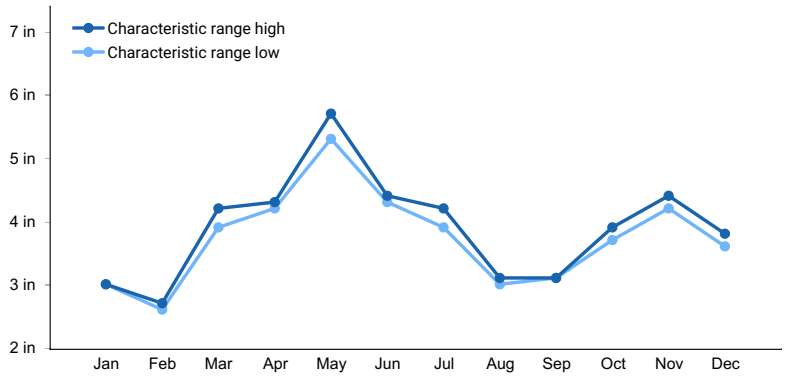


Figure 1. Monthly precipitation range

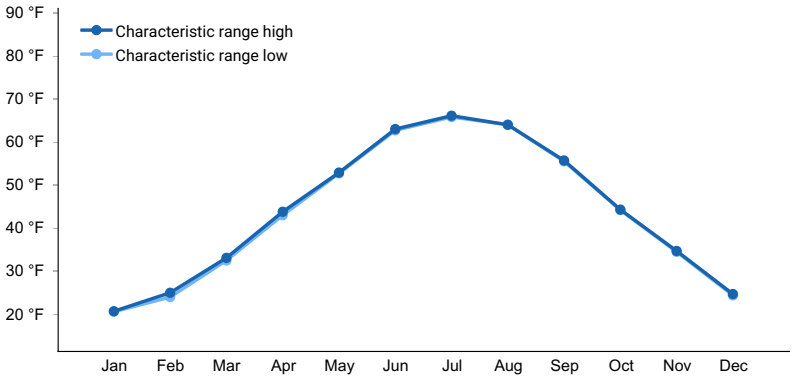


Figure 2. Monthly minimum temperature range

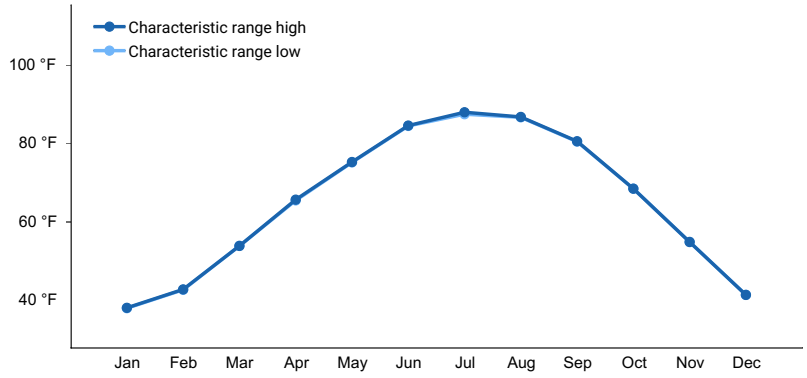


Figure 3. Monthly maximum temperature range

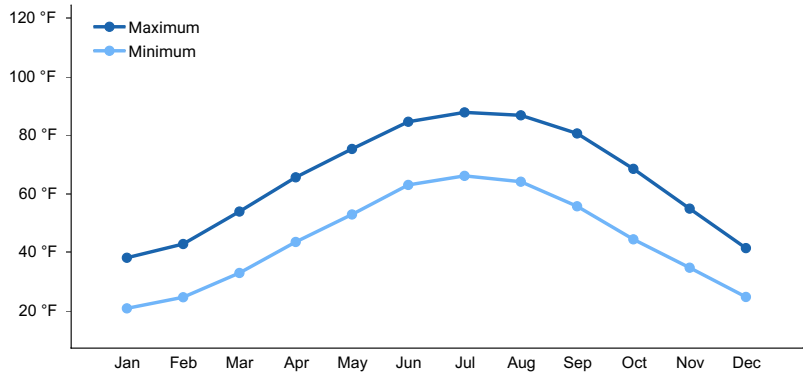


Figure 4. Monthly average minimum and maximum temperature

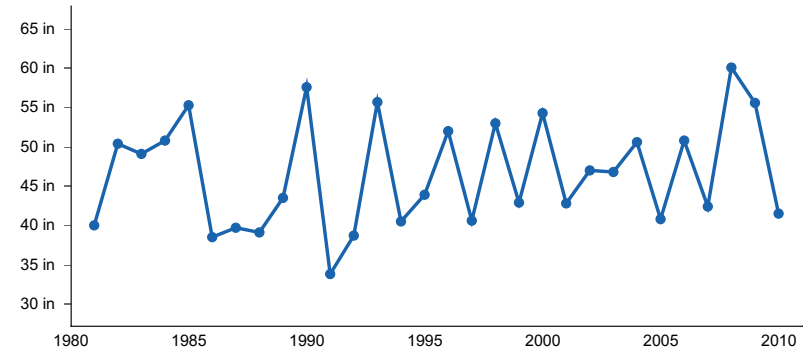


Figure 5. Annual precipitation pattern

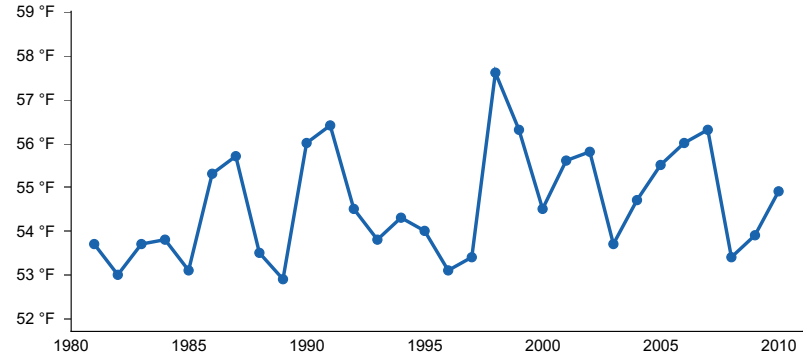


Figure 6. Annual average temperature pattern

Climate stations used

- (1) OLNEY 2S [USC00116446], Olney, IL
- (2) NEWTON [USC00116157], Newton, IL

Influencing water features

Sandy Dune Prairies are not influenced by wetland or riparian water features. Precipitation is the main source of water for this ecological site. Infiltration is high and surface runoff is low to moderate. Precipitation infiltrates the soil surface and percolates downward through the horizons unimpeded by any restrictive layer. Surface runoff contributes some water to downslope ecological sites. The depth of endosaturation is greater than 6 feet.

Soil features

These soils are very deep. The soils were formed under woodland vegetation, and have thin, light-colored surface horizons. Parent material is loess or other silty material and the underlying eolian loamy sand or sand. Permeability is moderate in the loess and rapid in the underlying material. These soils are not affected by seasonal wetness. Soils of this ecological site are in the Alfisol order. Soil series associated with this site include Thebes.

Table 4. Representative soil features

Parent material	(1) Loess (2) Outwash
Surface texture	(1) Silt loam (2) Loam
Family particle size	(1) Fine-silty
Drainage class	Well drained
Permeability class	Moderately slow
Soil depth	72 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-72in)	6–8 in
Soil reaction (1:1 water) (Depth not specified)	4.5–7.3
Subsurface fragment volume <=3" (Depth not specified)	0–3%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The MLRA lies within the transition zone between the eastern deciduous forests and the central tallgrass prairies. The heterogeneous topography of the area results in variable microclimates and fuel matrices that in turn are able to support prairies, savannas, woodlands, and forests. Sandy Outwash Woodlands form an aspect of this vegetative continuum. This ecological site occurs on outwash terraces and upland ridges adjacent to stream valleys. Species characteristic of this ecological site consist of oaks and a variety of understory species. (Anderson 1975; White 1978).

Fire is the most important ecosystem driver for maintaining this ecological site (Dey and Kabrick 2015). Fire intensity typically consisted of periodic, low-to-moderate severity surface fires (LANDFIRE 2009). Ignition sources included summertime lightning strikes from convective storms and bimodal, human ignitions during the spring and fall seasons. Native Americans regularly set fires to improve sight lines for hunting, driving large game, improving grazing and browsing habitat, agricultural and village clearing, and enhancing vital ethnobotanical plants (Barrett 1980; White 1994).

Drought has also played a role in shaping the woodland ecosystems in the region. The periodic episodes of reduced soil moisture in conjunction with the well-drained soils have favored the proliferation of plant species tolerant of such conditions. In addition, drought can also slow the growth of plants and result in dieback of certain

species. When coupled with fire, periods of drought can also greatly delay the recovery of woody vegetation, substantially altering the extent of shrubs and trees (Pyne et al. 1996).

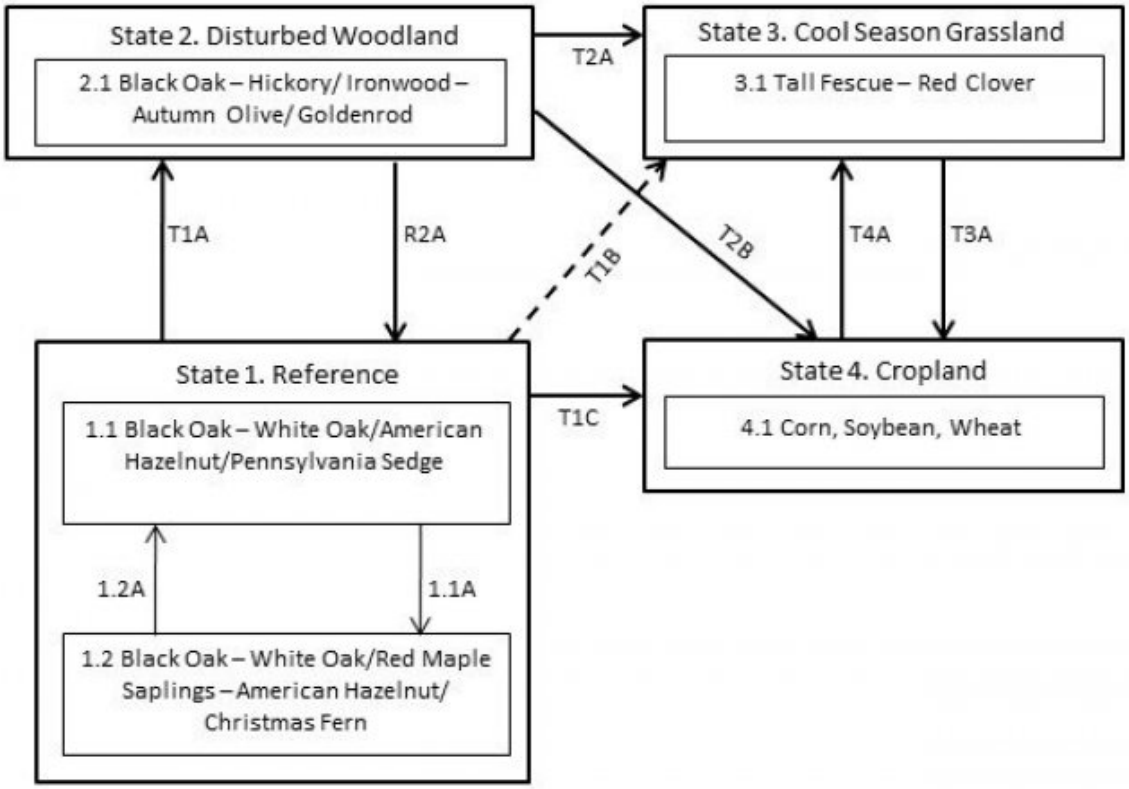
Grazing by native ungulates, ice storms, and periodic insect pest damage serve as an important secondary disturbance factors in wooded ecosystems, helping to shape stand composition, structure, condition, and functional complexity (Irland 2000; Briggs et al. 2002; LANDFIRE 2009). Grazing from native ungulates, such as bison (Bison bison), encourages the growth of woody plants by reducing understory species as well as reducing fine fuels that help carry fire into the woodlands (Briggs et al. 2002). Damage to stands from storms and pests can vary from minor, patchy effects of individual trees to major stand effects that could shift overstory composition (Irland 2000).

Today, many Sandy Outwash Woodland sites have been converted to row-crop agriculture or pasture and are likely to remain as such for the foreseeable future. In addition, grazing and fire suppression have reduced the integrity of remaining woodlands. Sites where remnant woodlands occur have experienced a shift in species composition and cover, and the current woodlands exhibit a more- closed canopy plant community. In addition, invasion by non-native species is rapidly threatening the remaining native communities. (NatureServe 2018)

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

Sandy Outwash Woodland, F113XY916IL
(Provisional)



Code	Event/Activity/Process
T1A	Fire suppression >30 years; woody invasion; repeated timber harvests; domestic uncontrolled 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 5-10 years
R2A	Forest stand improvement; access control; prescribed fire; long term stand rotation

State 1
Reference State

This woodland community was influenced by fire, drought, and wind. Herbivory by native (now expatriated) ungulates also played a role. There are two phases associated with this reference state. The overstory in one phase is dominated by black oak and white oak, with scattered other oaks. Fire, drought and natural native grazing would have maintained a more open canopy and abundant ground flora species. This other woodland community phase is characterized by an increase in the understory of maple saplings and shrubs. The herbaceous layer is diminished due to fire-free intervals.

Dominant plant species

- black oak (*Quercus velutina*), tree
- white oak (*Quercus alba*), tree
- American hazelnut (*Corylus americana*), shrub
- Pennsylvania sedge (*Carex pensylvanica*), grass

Community 1.1
Black Oak - White Oak/ American Hazelnut/ Pennsylvania Sedge

Fire interval of 5-10 years.

Dominant plant species

- black oak (*Quercus velutina*), tree
- white oak (*Quercus alba*), tree
- American hazelnut (*Corylus americana*), shrub
- Pennsylvania sedge (*Carex pensylvanica*), grass

Community 1.2
Black Oak - White Oak/ Red Maple saplings -American Hazelnut/ Christmas Fern

Fire interval in excess of 10 years.

Dominant plant species

- black oak (*Quercus velutina*), tree
- white oak (*Quercus alba*), tree
- red maple (*Acer rubrum*), shrub
- American hazelnut (*Corylus americana*), shrub
- Christmas fern (*Polystichum acrostichoides*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

Fire free interval greater than 10 years.

Pathway 1.2A
Community 1.2 to 1.1

Fire interval of >10 years.

State 2
Disturbed Woodland

Most current areas of Sandy Outwash Woodlands have experienced fire exclusion for decades along with periodic domestic livestock grazing. In the absence of fire, ongoing recruitment of trees into the canopy develops a closed canopy, shading out the herbaceous ground flora. Black oak, hickory and midstory species increase. Herbaceous cover and diversity greatly diminishes, leaf litter builds up, and more shade-tolerant species persist, such as elmleaf goldenrod (*Solidago ulmifolia* Muhl. ex Willd.) panic grass (*Dichanthelium dichotomum* (L.) Gould) and late purple aster (*Symphyotrichum patens* (Aiton) G.L. Nesom). The understory also changes with sassafras (*Sassafras albidum* (Nutt.) Nees) and black cherry (*Prunus serotina* Ehrh.) saplings. Transition to cool season grasslands

(State 3) or intensive cropland (State 4) is common.

Dominant plant species

- black oak (*Quercus velutina*), tree
- hybrid hickory (*Carya*), tree
- hophornbeam (*Ostrya virginiana*), shrub
- autumn olive (*Elaeagnus umbellata*), shrub
- goldenrod (*Solidago*), other herbaceous

Community 2.1
Black Oak - Hickory/ Ironwood - Autumn Olive/ Goldenrod

Species composition is altered from the reference state due to disturbances.

Dominant plant species

- pin oak (*Quercus palustris*), tree
- elm (*Ulmus*), tree
- autumn olive (*Elaeagnus umbellata*), shrub
- sedge (*Carex*), grass

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.) and red clover (*Trifolium pratense* L.) has been common in the Illinois Central Claypan area. Occasionally, these pastures may have scattered oaks. Long term uncontrolled grazing can cause significant soil erosion and compaction. A return to the reference state may be difficult, requiring a very long term series of management options.

Dominant plant species

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

Community 3.1
Tall Fescue - Red Clover

A community dominated by seeded cool season grasses and legumes.

Dominant plant species

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

State 4
Cropland

This is a state that exists currently on slopes less than 10 percent with intensive cropping of corn (*Zea mays* L.), soybeans (*Glycine max* (L.) Merr.), and winter wheat (*Triticum aestivum* L.) occurring. 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
- wheat (*Triticum*), grass
- soybean (*Glycine max*), other herbaceous

Community 4.1
Corn, Soybean, Wheat

Agricultural state with crops such as corn, beans, and winter wheat.

Dominant plant species

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

Transition T1A
State 1 to 2

Fire suppression >30 years; woody invasion; repeated timber harvests; uncontrolled livestock grazing

Transition T1B
State 1 to 3

Clearing; 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; access control; prescribed fire; 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 states and community phases are

considered provisional based on the sources identified in ecological site description.

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Other references

Relationship to other established ecological classifications
Biophysical Setting (LANDFIRE, 2009); the reference community of this ecological site is most similar to: North-Central Interior Dry Oak Forest and Woodland (CES202.047)

National Vegetation Classification System (NatureServe, 2018): the reference community of this ecological site is most similar to: Quercus velutina / Carex pensylvanica Forest (CEGL002078)

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

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Approval

Suzanne Mayne-Kinney, 5/17/2024

Acknowledgments

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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	05/19/2024
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:

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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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:**
