USDA Natural Resources Conservation Service

Ecological site F110XY011IL
Dry Glacial Drift Upland Forest

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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): 110X–Northern Illinois and Indiana Heavy Till Plain

The Northern Illinois and Indiana Heavy Till Plain (MLRA 110) encompasses the Northeastern Morainal, Grand Prairie, and Southern Lake Michigan Coastal landscapes (Schwegman et al. 1973, WDNR 2015). It spans three states – Illinois (79 percent), Indiana (10 percent), and Wisconsin (11 percent) – comprising about 7,535 square miles (Figure 1). The elevation is about 650 feet above sea level (ASL) and increases gradually from Lake Michigan south. Local relief varies from 10 to 25 feet. Silurian age fractured dolomite and limestone bedrock underlie the region. Glacial drift covers the surface area of the MLRA, and till, outwash, lacustrine deposits, loess or other silty material, and organic deposits are common (USDA-NRCS 2006).

The vegetation in the MLRA has undergone drastic changes over time. At the end of the last glacial episode – the Wisconsinan glaciation – the evolution of vegetation began with the development of tundra habitats, followed by a phase of spruce and fir forests, and eventually spruce-pine forests. Not until approximately 9,000 years ago did the climate undergo a warming trend which prompted the development of deciduous forests dominated by oak and hickory. As the climate continued to warm and dry, prairies began to develop approximately 8,300 years ago. Another shift in climate that resulted in an increase in moisture prompted the emergence of savanna-like habitats from 8,000 to 5,000 years before present (Taft et al. 2009). Forests maintained footholds on steep valley sides, morainal ridges, and wet floodplains. Fire, droughts, and grazing by native mammals helped to maintain the prairies and savannas until the arrival of European settlers, and the forests were maintained by droughts, wind, lightning, and occasional fire (Taft et al. 2009; NatureServe 2018).

Classification relationships

USFS Subregions: Southwestern Great Lakes Morainal (222K) and Central Till Plains and Grand Prairies (251D) Sections; Kenosha-Lake Michigan Plain and Moraines (222Kg), Valparaiso Moraine (Kj), and Eastern Grand Prairie (251Dd) Subsections (Cleland et al. 2007)

U.S. EPA Level IV Ecoregion: Kettle Moraines (53b), Illinois/Indiana Prairies (54a), and Valparaiso-Wheaton Morainal Complex (54f) (USEPA 2013)

National Vegetation Classification – Ecological Systems: North-Central Interior Dry-Mesic Oak Forest and Woodland (CES202.046) (NatureServe 2018)

National Vegetation Classification – Plant Associations: Quercus alba – Quercus rubra – Carya ovata Glaciated Forest (CEGL002068) (Nature Serve 2018)

Biophysical Settings: North-Central Interior Dry-Mesic Oak Forest and Woodland (BpS 4213100) (LANDFIRE 2009)

Illinois Natural Areas Inventory: Dry-mesic forest (White and Madany 1978)

Wisconsin Natural Communities: Southern dry-mesic forest (WDNR 2015)

Ecological site concept

Dry Glacial Drift Upland Forests are located within the green areas on the map (Figure 1). They occur on uplands. The soils are Alfisols that are moderately well to well drained and very deep, formed in loess or other silty or loamy material, loamy outwash, glacial till, or lacustrine deposits.

The historic pre-European settlement vegetation on this ecological site was dominated by a closed canopy of oaks. White oak (Quercus alba L.) and northern red oak (Quercus rubra L.) are the dominant species in the tree canopy, but black oak (Quercus velutina Lam.), and shagbark hickory (Carya ovata (Mill.) K. Koch) can also be present (White and Madany 1978; LANDFIRE 2009; NatureServe 2018). Hophornbeam (Ostrya virginiana (Mill.) K. Koch) and blackhaw (Viburnum prunifolium L.) are the dominant subcanopy and shrub species, respectively. Spotted geranium (Geranium maculatum L.) and wood anemone (Anemone quinquefolia L.) are characteristic herbaceous species of this closed canopy forest (White and Madany 1978; WDNR 2015). Herbaceous species characteristic of an undisturbed plant community associated with this ecological site include forked aster (Eurybia furcata (Burgess) G.L. Nesom), heartleaf skullcap (Scutellaria ovata Hill), and threebirds (Triphora trianthophora (Sw.) Rydb.) (Taft et al. 1997; Bernthal 2003; WDNR 2015). Fire is the primary disturbance factor that maintains this ecological site, while storm damage and drought are secondary factors (LANDFIRE 2009).

Associated sites

F110XY012IL	**Moist Glacial Drift Upland Forest** Loess or other silty or loamy material, loamy outwash, glacial till, or lacustrine deposits with a water table within 18-72 inches including Aptakisic, Blount, Del Rey, Nappanee, Ozaukee, Sabina, Starks, St. Clair, Tuscola, and Whitaker soils

Similar sites

F110XY012IL	**Moist Glacial Drift Upland Forest** Moist Glacial Drift Upland Forests are on adjacent, down-gradient landscapes and have a water table within 18-72 inches

Table 1. Dominant plant species

Tree	(1) *Quercus alba* (2) *Quercus rubra*
Shrub	(1) *Ostrya virginiana* (2) *Viburnum prunifolium*
Herbaceous	(1) *Geranium maculatum* (2) *Anemone quinquefolia*

Physiographic features

Dry Glacial Drift Upland Forests occur on uplands. They are situated on elevations ranging from approximately 400 to 1312 feet ASL. The site does not experience flooding but rather generates runoff to adjacent, downslope ecological sites.

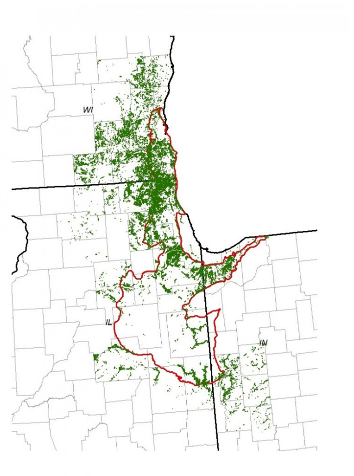


Figure 1.

Table 2. Representative physiographic features

Slope shape across	(1) Convex
Slope shape up-down	(1) Convex
Landforms	(1) Upland
Runoff class	Low to very high
Elevation	122–400 m
Slope	0–20%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

The Northern Illinois and Indiana Heavy Till Plain falls into the hot-summer humid continental climate (Dfa) and warm-summer humid continental climate (Dfb) Köppen-Geiger climate classifications (Peel et al. 2007). The two main factors that drive the climate of the MLRA are latitude and weather systems. Latitude, and the subsequent reflection of solar input, determines air temperatures and seasonal variations. Solar energy varies across the seasons, with summer receiving three to four times as much energy as opposed to winter. Weather systems (air masses and cyclonic storms) are responsible for daily fluctuations of weather conditions. High-pressure systems are responsible for settled weather patterns where sun and clear skies dominate. In fall, winter, and spring, the polar jet stream is responsible for the creation and movement of low-pressure systems. The clouds, winds, and precipitation associated with a low-pressure system regularly follow high-pressure systems every few days (Angel n.d.).

The soil temperature regime of MLRA 110 is classified as mesic, where the mean annual soil temperature is between 46 and 59°F (USDA-NRCS 2006). Temperature and precipitation occur along a north-south gradient, where temperature and precipitation increase the further south one travels. The average freeze-free period of this ecological site is about 165 days, while the frost-free period is about 136 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 36 inches, which includes rainfall plus the water equivalent from snowfall (Table 3). The average annual low and high temperatures are 38.6 and 58.4°F, respectively.

Table 3. Representative climatic features

Frost-free period (characteristic range)	129-146 days
Freeze-free period (characteristic range)	156-177 days
Precipitation total (characteristic range)	889-940 mm
Frost-free period (actual range)	116-152 days

Freeze-free period (actual range)	133-191 days
Precipitation total (actual range)	889-965 mm
Frost-free period (average)	136 days
Freeze-free period (average)	165 days
Precipitation total (average)	914 mm

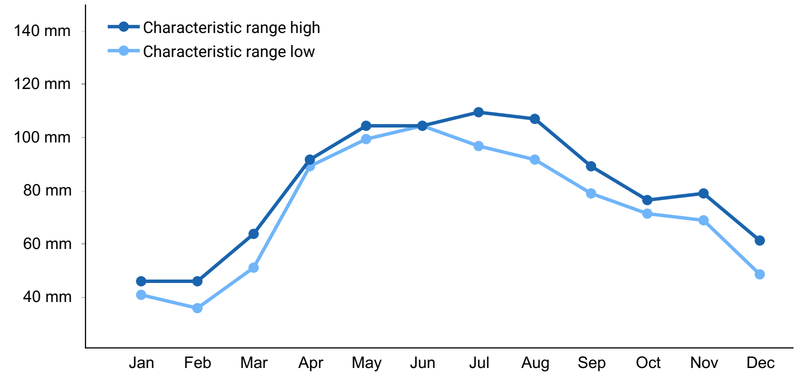


Figure 2. Monthly precipitation range

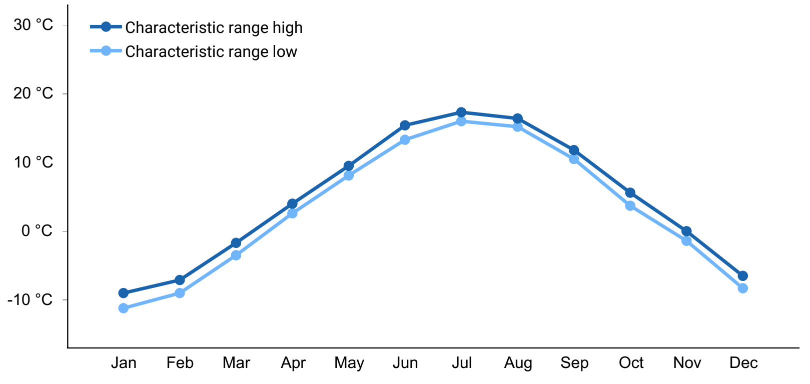


Figure 3. Monthly minimum temperature range

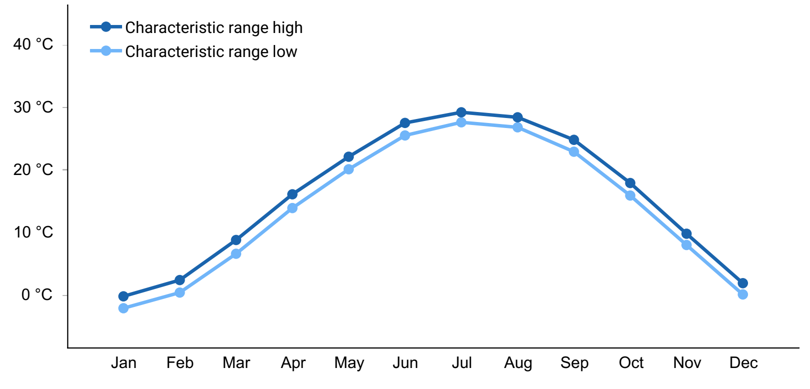


Figure 4. Monthly maximum temperature range

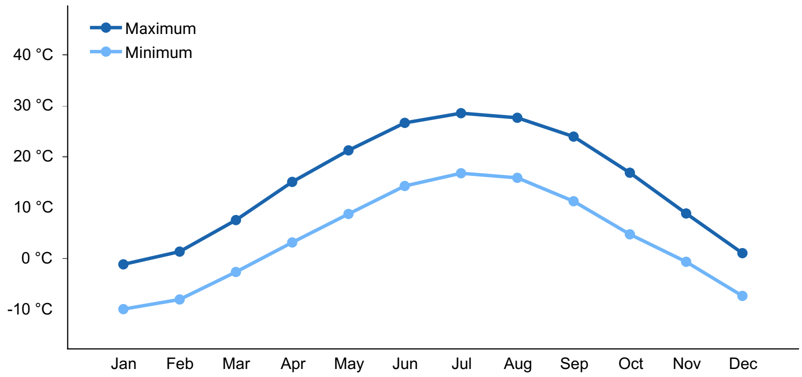


Figure 5. Monthly average minimum and maximum temperature

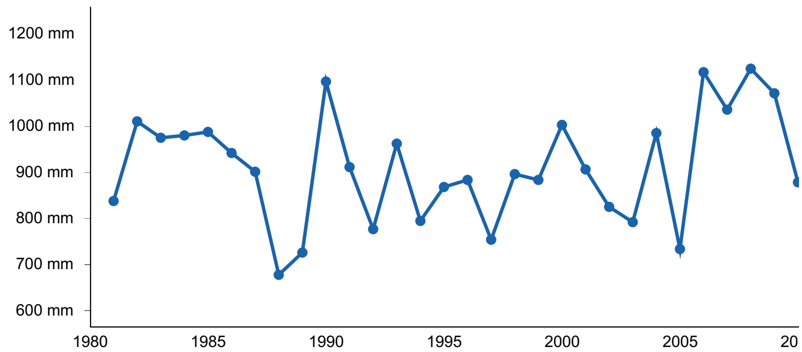


Figure 6. Annual precipitation pattern

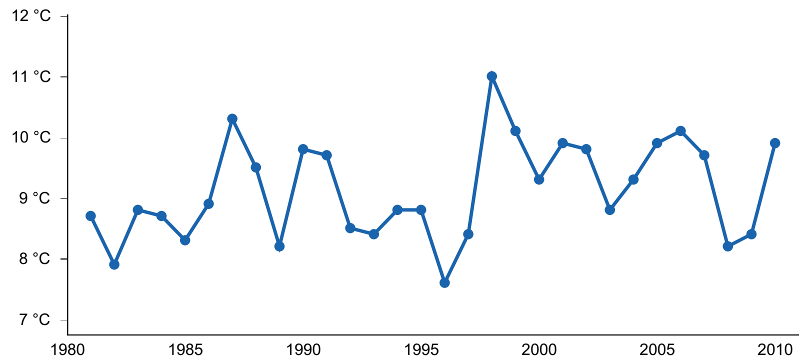


Figure 7. Annual average temperature pattern

Climate stations used

- (1) WATSEKA 2 NW [USC00119021], Watseka, IL
- (2) JOLIET BRANDON RD DAM [USC00114530], Joliet, IL
- (3) MCHENRY-WG STRATTON LD [USC00115493], McHenry, IL
- (4) LAKE GENEVA [USC00474457], Lake Geneva, WI
- (5) GERMANTOWN [USC00473058], Germantown, WI

Influencing water features

Dry Glacial Drift Upland Forests are not influenced by wetland or riparian water features. Precipitation is the main source of water for this ecological site. Infiltration is moderate (Hydrologic Group B), and surface runoff is low to very high. Surface runoff contributes some water to downslope ecological sites.

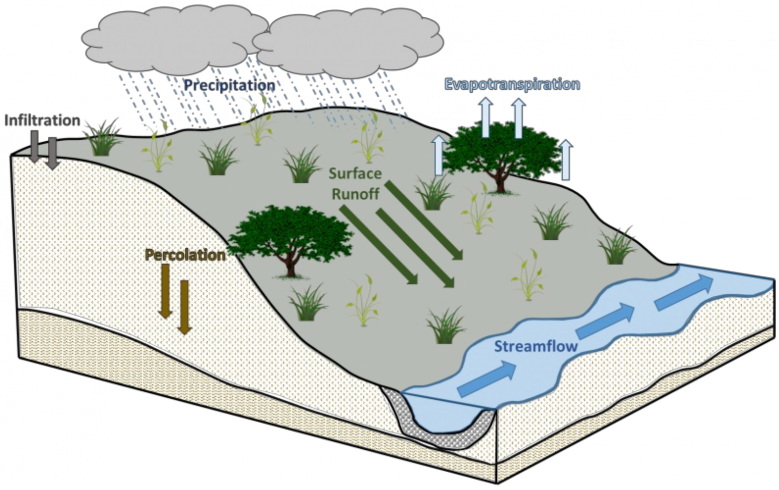


Figure 8. Hydrologic cycling in Dry Glacial Drift Upland Forest ecological site.

Soil features

Soils of Dry Glacial Drift Upland Forests are in the Alfisols order, further classified as Typic Hapludalfs and Oxyaquic Hapludalfs with moderate infiltration and low to very high runoff potential. The soil series associated with this site includes Fox, Hebron, Martinsville, Ockley, Ozaukee, Rush, Saylesville, Senachwine, Sisson, Somonauk, Strawn, St. Clair, and Zurich. The parent material is loess or other silty or loamy material, loamy outwash, glacial till, or lacustrine deposits, and the soils are moderately well to well drained and very deep. Soil pH classes are very strongly acid to strongly alkaline. No rooting restrictions are noted for the soils of this ecological site.

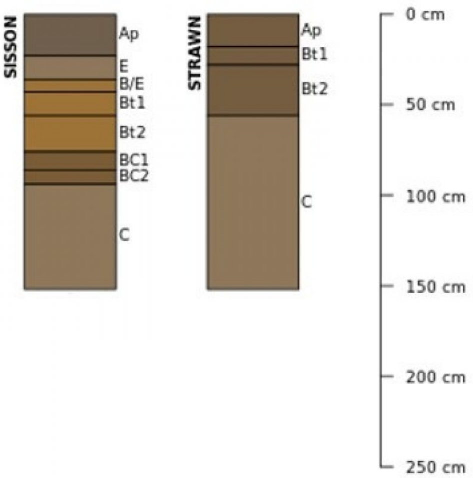


Figure 9. Profile sketches of soil series associated with Dry Glacial Drift Upland Forest.

Table 4. Representative soil features

Parent material	(1) Loess (2) Outwash (3) Till (4) Lacustrine deposits
Family particle size	(1) Fine (2) Fine-silty (3) Fine-loamy (4) Fine-loamy over sandy or sandy-skeletal
Drainage class	Moderately well drained to well drained
Permeability class	Very slow to moderately slow
Depth to restrictive layer	203 cm

Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	5.08–20.32 cm
Calcium carbonate equivalent (Depth not specified)	0–60%
Electrical conductivity (Depth not specified)	0–2 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (Depth not specified)	4.5–9
Subsurface fragment volume <=3" (Depth not specified)	2–33%
Subsurface fragment volume >3" (Depth not specified)	1–6%

Ecological dynamics

The information in this Ecological Site Description, including the state-and-transition model (STM), was developed based on historical data, current field data, professional experience, and a review of the scientific literature. As a result, all possible scenarios or plant species may not be included. Key indicator plant species, disturbances, and ecological processes are described to inform land management decisions.

The MLRA lies within the tallgrass prairie ecosystem of the Midwest, but a variety of environmental and edaphic factors resulted in landscape that historically supported prairies, savannas, forests, and various wetlands. Glacial Drift Upland Forests form an aspect of this vegetative continuum. This ecological site occurs on uplands on well-drained soils. Species characteristic of this ecological site consist of a closed canopy of oaks with shade-tolerant herbaceous vegetation.

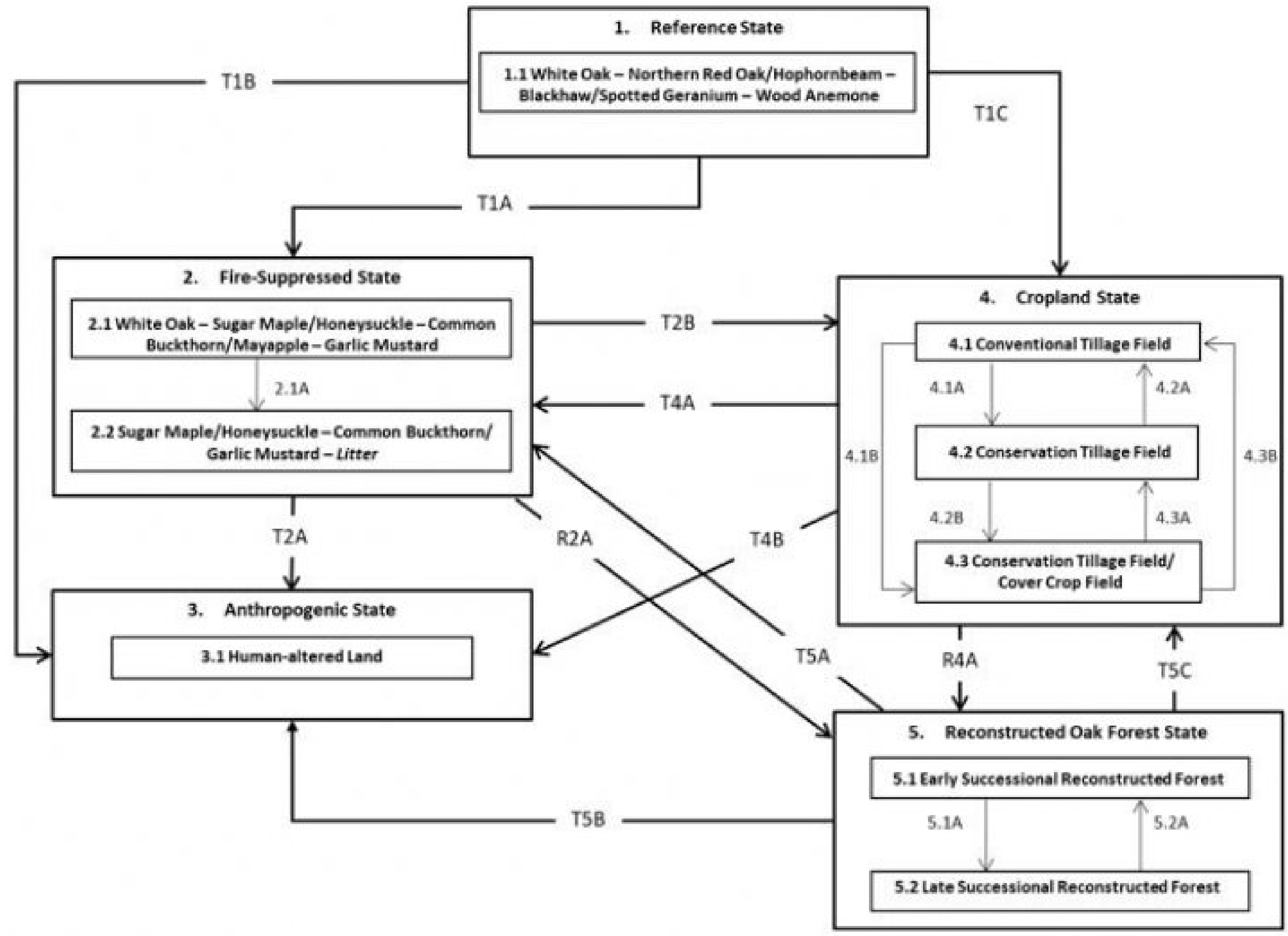
Fire is a critical factor that maintains Dry Glacial Drift Upland Forests. Fire typically consisted of low-severity surface fires every 25 to 50 years (LANDFIRE 2009). Ignition sources included summertime lightning strikes from convective storms and bimodal, human ignitions during the spring and fall seasons. Native Americans regularly set fires to improve sight lines for hunting, drive large game, improve grazing and browsing habitat, agricultural clearing, and enhance vital ethnobotanical plants (Barrett 1980; LANDFIRE 2009).

Drought and storm damage have also played a role in shaping this ecological site. 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. Drought can also slow the growth of plants and result in dieback of certain species. Damage to trees from wind and ice storms can vary from minor, patchy effects of individual trees to stand effects that temporarily affect community structure and species richness and diversity (Irland 2000; Peterson 2000). When coupled with fire, periods of drought and catastrophic storm damage can greatly delay the establishment and maturation of woody vegetation (Pyne et al. 1996).

Today, Dry Glacial Drift Upland Forests have been reduced as they have been type-converted to agricultural or other human-modified landscape. Remnants that do exist have experienced long-term fire suppression and overbrowsing resulting in significant changes to the forest structure. A return to the historic plant community may not be possible following extensive land modification, but long-term conservation agriculture or forest reconstruction efforts can help to restore some biotic diversity and ecological function. The state-and-transition model that follows provides a detailed description of each state, community phase, pathway, and transition. This model is based on available experimental research, field observations, literature reviews, professional consensus, and interpretations.

State and transition model

F110XY011IL DRY GLACIAL DRIFT UPLAND FOREST



Code	Process
T1A, T4A, T5A	Long-term fire suppression and/or land abandonment
2.1A	Continued fire suppression and increasing deer populations
T1B, T2A, T4B, T5B	Vegetation removal and human alterations/transportation of soils
T1C, T2B, T5C	Agricultural conversion via tillage, seeding, and non-selective herbicide
4.1A	Less tillage, residue management
4.1B	Less tillage, residue management, and implementation of cover cropping
4.2B	Implementation of cover cropping
4.2A, 4.3B	Intensive tillage, remove residue, and reinitiate monoculture row cropping
4.3A	Remove cover cropping
R2A, R4A	Site preparation, tree planting, non-native species control, and native seeding
5.1A	Invasive species control and implementation of disturbance regimes
5.2A	Drought or improper timing/use of management actions

State 1
Reference State

The reference plant community is categorized as an oak forest, dominated by deciduous trees and shade-tolerant herbaceous vegetation. The one community phase within the reference state is dependent on recurring fire intervals. The severity and intensity of fire alters species composition, cover, and extent, while regular fire intervals keep the canopy from succeeding to mesophytic, fire-intolerant species. Drought and catastrophic storm damage have more localized impacts in the reference phases, but do contribute to overall species composition, diversity, cover, and productivity.

Community 1.1
White Oak - Northern Red Oak/Hophornbeam - Blackhaw/Spotted Geranium - Wood Anemone

Sites in this reference community phase are a closed canopy forest. White oak and northern red oak are the dominant species, but black oak and shagbark hickory are common canopy associates. Trees are large (21 to 33-inch DBH), and cover is approximately 80 percent (LANDFIRE 2009). Hophornbeam is regularly found in the subcanopy, and tall shrubs – e.g., blackhaw and American hazelnut (*Corylus americana* Walter) – can be present. The herbaceous layer is nearly continuous with shade-tolerant species such as spotted geranium, wood anemone, largeflower bellwort (*Uvularia grandiflora* Sm.), Jack in the pulpit (*Arisaema triphyllum* (L.) Schott), and American hogpeanut (*Amphicarpaea bracteata* (L.) Fernald). Low-severity surface fires every 25 to 50 years will maintain this community phase.

Dominant plant species

- white oak (*Quercus alba*), tree
- northern red oak (*Quercus rubra*), tree
- hophornbeam (*Ostrya virginiana*), shrub
- blackhaw (*Viburnum prunifolium*), shrub
- spotted geranium (*Geranium maculatum*), other herbaceous
- wood anemone (*Anemone quinquefolia*), other herbaceous

State 2
Fire-Suppressed State

Fire suppression can transition the reference plant community from an oak forest to an oak-maple mesophytic forest. As the natural fire regime is removed from the landscape, encroachment and dominance by shade-tolerant, fire-intolerant species ensues. This results in a positive feedback loop of mesophication whereby plant community succession continuously creates cool, damp shaded conditions that perpetuate a closed canopy ecosystem (Nowacki and Abrams 2008). Succession to this forested state can occur in as little as 50 years from the last fire (LANDFIRE 2009). Overbrowsing by an unnaturally abundant deer population can also lead to changes in the composition, diversity, and production of the forest. Continuous browsing has been reported to prevent the regeneration of the historic canopy, which is replaced by mid-level and invasive species (Gubanyi et al. 2008; VerCauteren and Hygnstrom 2011). Similarly, herbaceous diversity and composition is also affected by selective browsing pressure (Gubanyi et al. 2008).

Community 2.1
White Oak - Sugar Maple/Honeysuckle - Common Buckthorn/Mayapple - Garlic Mustard

This community phase represents the early stages of long-term fire suppression and overbrowsing. Mature oaks are still present, but the more shade tolerant sugar maple (*Acer saccharum* Marshall) begins to co-dominate. The tree canopy closes to 100 percent cover and basal area increases (LANDFIRE 2009). Non-native shrubs, such as honeysuckle (Lonicera L.) and common buckthorn (*Rhamnus cathartica* L.), can rapidly colonize. The herbaceous layer continues to support shade-tolerant species, but diversity is reduced as the fully closed canopy results in favorable conditions mostly by spring ephemerals. Grazing pressure alters species composition, allowing plants such as mayapple to increase as it is commonly avoided by deer (Gubanyi et al. 2008; Rawbinski 2008). Non-native invasive species, such as garlic mustard (Alliaria petiolate (M. Bieb.) Cavara & Grande), can begin to gain a foothold in the understory community as well.

Dominant plant species

- white oak (*Quercus alba*), tree
- sugar maple (*Acer saccharum*), tree
- honeysuckle (*Lonicera*), shrub
- common buckthorn (*Rhamnus cathartica*), shrub
- mayapple (*Podophyllum peltatum*), other herbaceous
- garlic mustard (*Alliaria petiolata*), other herbaceous

Community 2.2

Sugar Maple/Honeysuckle - Common Buckthorn/Garlic Mustard - Litter

Sites falling into this community phase have a well-established, fire-intolerant canopy dominated by sugar maple. Oak seedlings are virtually absent from the understory due to the lack of available light. Without recurring fire, downed woody debris and leaf litter are frequently encountered on the forest floor.

Dominant plant species

- sugar maple (*Acer saccharum*), tree
- honeysuckle (*Lonicera*), shrub
- common buckthorn (*Rhamnus cathartica*), shrub
- garlic mustard (*Alliaria petiolata*), other herbaceous

Pathway 2.1A
Community 2.1 to 2.2

Continued fire suppression and increasing deer populations.

State 3
Anthropogenic State

The anthropogenic state occurs when the reference state is cleared and developed for human use and inhabitation, such as for commercial and housing developments, landfills, parks, golf courses, cemeteries, earthen spoils, etc. The native vegetation has been removed and soils have either been altered in place (e.g. cemeteries) or transported from one location to another (e.g. housing developments). Most of the soils in this state have 50 to 100 cm of overburden on top of the natural soil. This natural material can be determined by observing a buried surface horizon or the unaltered subsoil, till, or lacustrine parent materials. This state is generally considered permanent.

Community 3.1
Human-altered land

Sites in this community phase have had the native plant community removed and soils heavily re-worked in support of human development projects.

State 4
Cropland State

The continuous use of tillage, row-crop planting, and chemicals (i.e., herbicides, fertilizers, etc.) has effectively eliminated the reference community and many of its natural ecological functions in favor of crop production. Corn and soybeans are the dominant crops for the site, and common wheat (*Triticum aestivum* L.) and alfalfa (*Medicago sativa* L.) may be rotated periodically. These areas are likely to remain in crop production for the foreseeable future.

Community 4.1
Conventional Tillage Field

Sites in this community phase typically consist of monoculture row-cropping maintained by conventional tillage practices. They are cropped in either continuous corn or corn-soybean rotations. The frequent use of deep tillage, low crop diversity, and bare soil conditions during the non-growing season negatively impacts soil health. Under these practices, soil aggregation is reduced or destroyed, soil organic matter is reduced, erosion and runoff are increased, and infiltration is decreased, which can ultimately lead to undesirable changes in the hydrology of the watershed (Tomer et al. 2005).

Community 4.2
Conservation Tillage Field

This community phase is characterized by rotational crop production that utilizes various conservation tillage methods to promote soil health and reduce erosion. Conservation tillage methods include strip-till, ridge-till, vertical-till, or no-till planting systems. Strip-till keeps seedbed preparation to narrow bands less than one-third the width of the row where crop residue and soil consolidation are left undisturbed in-between seedbed areas. Strip-till planting may be completed in the fall and nutrient application either occurs simultaneously or at the time of planting. Ridge-till uses specialized equipment to create ridges in the seedbed and vegetative residue is left on the surface in between the ridges. Weeds are controlled with herbicides and/or cultivation, seedbed ridges are rebuilt during cultivation, and soils are left undisturbed from harvest to planting. Vertical-till systems employ machinery that lightly tills the soil and cuts up crop residue, mixing some of the residue into the top few inches of the soil while leaving a large portion on the surface. No-till management is the most conservative, disturbing soils only at the time of planting and fertilizer application. Compared to conventional tillage systems, conservation tillage methods can improve soil ecosystem function by reducing soil erosion, increasing organic matter and water availability, improving water quality, and reducing soil compaction.

Community 4.3
Conservation Tillage Field/Alternative Crop Field

This community phase applies conservation tillage methods as described above as well as adds cover crop practices. Cover crops typically include nitrogen-fixing species (e.g., legumes), small grains (e.g., rye, wheat, oats), or forage covers (e.g., turnips, radishes, rapeseed). The addition of cover crops not only adds plant diversity but also promotes soil health by reducing soil erosion, limiting nitrogen leaching, suppressing weeds, increasing soil organic matter, and improving the overall soil ecosystem. In the case of small grain cover crops, surface cover and water infiltration are increased, while forage covers can be used to graze livestock or support local wildlife. Of the three community phases for this state, this phase promotes the greatest soil sustainability and improves ecological functioning within a cropland system.

Pathway 4.1A
Community 4.1 to 4.2

Tillage operations are greatly reduced, crop rotation occurs on a regular interval, and crop residue remains on the soil surface.

Pathway 4.1B
Community 4.1 to 4.3

Tillage operations are greatly reduced or eliminated, crop rotation occurs on a regular interval, crop residue remains on the soil surface, and cover crops are planted following crop harvest.

Pathway 4.2A
Community 4.2 to 4.1

Intensive tillage is utilized, and monoculture row-cropping is established.

Pathway 4.2B
Community 4.2 to 4.3

Cover crops are implemented to minimize soil erosion.

Pathway 4.3B
Community 4.3 to 4.1

Intensive tillage is utilized, cover crop practices are abandoned, monoculture row-cropping is established, and crop rotation is reduced or eliminated.

Pathway 4.3A
Community 4.3 to 4.2

Cover crop practices are abandoned.

State 5
Reconstructed Oak Forest State

The combination of natural and anthropogenic disturbances occurring today has resulted in numerous forest health issues, and restoration back to the historic reference condition may not be possible. Forests are being stressed by non-native diseases and pests, habitat fragmentation, changes in soil conditions, and overabundant deer populations on top of naturally occurring disturbances (severe weather and native pests) (IFDC 2018). However, these habitats provide multiple ecosystem services including carbon sequestration; clean air and water; soil conservation; biodiversity support; wildlife habitat; timber, fiber, and fuel products; as well as a variety of cultural activities (e.g., hiking, camping, hunting) (Millennium Ecosystem Assessment 2005; IFDC 2018). Therefore, conservation of forests and woodlands should still be pursued. Forest reconstructions are an important tool for repairing natural ecological functioning and providing habitat protection for numerous species associated with Dry Glacial Drift Upland Forests. Therefore, ecological restoration should aim to aid the recovery of degraded, damaged, or destroyed ecosystems. A successful restoration will have the ability to structurally and functionally sustain itself, demonstrate resilience to the ranges of stress and disturbance, and create and maintain positive biotic and abiotic interactions (SER 2002). The reconstructed oak forest state is the result of a long-term commitment involving a multi-step, adaptive management process.

Community 5.1
Early Successional Reconstructed Forest

This community phase represents the early community assembly from forest reconstruction. It is highly dependent on the current condition of the site based on past and current land management actions, invasive species, and proximity to land populated with non-native pests and diseases. Therefore, no two sites will have the same early successional composition. Technical forestry assistance should be sought to develop suitable conservation management plans.

Community 5.2
Late Successional Reconstructed Forest

Appropriately timed management practices (e.g., prescribed fire, hazardous fuels management, forest stand improvement, continuing integrated pest management) applied to the early successional community phase can help increase the stand maturity, pushing the site into a late successional community phase over time. A late successional reconstructed forest will have an uneven-aged canopy and a well-developed shrub layer and understory.

Pathway 5.1A
Community 5.1 to 5.2

Application of stand improvement practices in line with a developed management plan.

Pathway 5.2A
Community 5.2 to 5.1

Reconstruction experiences a setback from extreme weather event or improper timing of management actions.

Transition T1A
State 1 to 2

Long-term fire suppression in excess of 50 years transitions the site to the fire-suppressed state (2).

Transition T1B
State 1 to 3

Vegetation removal and human alterations/transportation of soils transitions the site to the anthropogenic state (3).

Transition T1C
State 1 to 4

Tillage, seeding of agricultural crops, and non-selective herbicide transition this site to the cropland state (4).

Transition T2A
State 2 to 3

Vegetation removal and human alterations/transportation of soils transitions the site to the anthropogenic state (3).

Transition T2B
State 2 to 4

Tillage, seeding of agricultural crops, and non-selective herbicide transition this site to the cropland state (4).

Restoration pathway R2A
State 2 to 5

Site preparation, tree planting, invasive species control, seeding native species, and deer management transition this site to the reconstructed oak forest state (5).

Transition T4A
State 4 to 2

Land abandonment transitions the site to the fire-suppressed state (2).

Transition T4B
State 4 to 3

Vegetation removal and human alterations/transportation of soils transitions the site to the anthropogenic state (3).

Restoration pathway R4A
State 4 to 5

Site preparation, tree planting, invasive species control, and seeding native species transition this site to the reconstructed oak forest state (5).

Transition T5A
State 5 to 2

Fire suppression and removal of active management transitions this site to the fire-suppressed state (2).

Transition T5B
State 5 to 3

Vegetation removal and human alterations/transportation of soils transitions the site to the anthropogenic state (3).

Transition T5C
State 5 to 4

Tillage, seeding of agricultural crops, and non-selective herbicide transition this site to the cropland state (4).

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 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 these plots and the sources identified in this ecological site description.

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Table 6. List of primary contributors and reviewers.
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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	05/12/2025
Approved by	Chris Tecklenburg
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:**