USDA Natural Resources Conservation Service

Ecological site F095XA007WI
Moist Clayey Lowland

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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): 095X–Eastern Wisconsin, Northern Illinois, and Upper Michigan Drift Plain

This MLRA is characterized by nearly level to rolling till plains, outwash plains, drumlin fields, and glacial lake plains. It is used to produce cash crops, feed grain, and livestock. It includes the shorelines of Lake Winnebago and Lake Michigan. This area is in Wisconsin (85 percent), Illinois (10 percent), and Michigan (5 percent). It makes up about 17,255 square miles (44,690 square kilometers). This area is in the Central Lowland province of the Interior Plains. Most of the area is in the Eastern Lake section. A narrow strip along the southwestern edge of the area is in the Wisconsin Driftless section. The southwestern quarter is in the Till Plains section. The nearly level to rolling till plains, glacial lake plains, and outwash plains are mixed with drumlin fields, ground moraines, end moraines, flood plains, lake terraces, beaches, dunes, swamps, and marshes. Most of the southern part of this area has belts of morainic hills and ridges and nearly level outwash terraces. Drumlins are prominent features in the central part of the area. Glaciokarst topography occurs in the east-central parts of the area influenced by underlying Niagara Dolomite. Lakes and streams are numerous, and streams generally form a dendritic drainage pattern. Elevation ranges from 530 to 1,580 feet (160 to 480 meters). Local relief is mainly 25 feet (8 meters), but the moraines, drumlins, and bedrock escarpments rise 80 to 330 feet (25 to 100 meters) above the adjacent valleys.

The annual precipitation ranges from 28 to 37 inches (700 to 950 millimeters) with a mean of 33 inches (840 millimeters). The annual temperature ranges from 41 to 48 degrees F (5.1 to 9.2 degrees C) with a mean of 46 degrees F (7.7 degrees C). The freeze-free period ranges from 115 to 185 days with a mean of 155 days. It decreases in length from south to north and from the shore of Lake Michigan inland. Lake Michigan helps to moderate the climate of the area.

This MLRA is mostly covered with glacial drift of Wisconsin age. Some of the higher areas are moraines that appear as arc-shaped ridges representing the retreat of the ice from south to north. Most of the bedrock in the area consists of Silurian, Ordovician, and Cambrian sandstone, limestone, and dolomite. Some igneous and metamorphic rocks underlie the northwestern edge of the area. Devonian limestone and shale occur at the far eastern edge in the Milwaukee area.

The dominant soil orders in this MLRA are Alfisols, Entisols, Histosols, Mollisols, and Spodosols. The soils in the area dominantly have a mesic or frigid temperature regime, an aquic or udic moisture regime, and mixed mineralogy. They are very deep, excessively drained to very poorly drained, and sandy to clayey. Areas of Spodosols and soils with a frigid soil temperature regime occur in the northern part of the MLRA.
The northern part of this MLRA supports natural stands of mixed northern hardwoods and pine. Sugar maple, oak, white ash, elm, yellow birch, white pine, red pine, and American beech are the principal species. Low-lying areas support both mixed hardwoods and conifers. Elm, soft maple, black ash, and northern white cedar are the major species. Brush and sedge meadows also occur in the low-lying areas.

The southern part of this MLRA supports hardwoods and prairie vegetation. Uplands support natural stands of oak, sugar maple, and hickory, and natural prairie vegetation is characterized by little bluestem and big bluestem. Many of the prairies have scattered oak and hickory trees. Low-lying areas support sedge and grass meadows and mixed

stands of hardwoods and conifers. Elm, ash, eastern cottonwood, soft maple, and white cedar are the major species in the low-lying areas. (USDA-NRCS, 2022)

LRU notes

The Northeastern Wisconsin Drift Plain LRU (Land Resource Unit - 95XA) corresponds closely to the Northern and Central Lake Michigan Coastal Ecological Landscapes. Some of the following brief overview is borrowed from the Wisconsin Department of Natural Resources Ecological Landscape publication (2015).

The Northeastern Wisconsin Drift Plain LRU is located along Wisconsin's northeastern and central coast of Lake Michigan and the Door Peninsula. This glacial landscape is comprised of approximately 3.6 million acres (5,715 square miles). It is dominated by till plains and glacial lake deposits. The Green Bay and Lake Michigan Lobes are responsible for the formation of the landscape. The Green Bay Lobe covered most of the LRU, excluding the eastern edge where the Lake Michigan Lobe advanced. The glaciers were separated by the Niagara Escarpment, a 650-mile-long dolomite ridge that begins in Wisconsin near the Illinois border, extends into Michigan's Upper Peninsula and down through Canada's Bruce Peninsula into Rochester, New York. Within LRU 95XA, the escarpment runs from Lake Winnebago northeast through the Door Peninsula. Much of the topography of this LRU is bedrock-controlled. Bedrock is generally deeper than 150cm except in the Door Peninsula, where bedrock is much shallower. Wetlands are common throughout this MLRA where drainage is impeded by fine-textured materials and shallow bedrock.

The northern portion of this LRU is dominated by an undulating till plain, gently sloping to the east, formed entirely by the Green Bay Lobe. This glacial lobe centered over the present-day city of Green Bay and flowed out in a fan shape, moving both south-southwest and south-southeast over the Door Peninsula. The lobe deposited loamy and coarse-loamy till mixed with dolomite fragments plucked from the bedrock. In some areas, the till has been reworked by Glacial Lake Oshkosh or overlain by its lacustrine deposits. Numerous drumlins formed, orientated to the south-southwest in the direction of glacial flow. Some eskers are present. Much of this area has dolomite and limestone within 50 ft of the surface. Proglacial streams formed small areas of pitted and unpitted outwash plains, terraces, and fans.

The Door Peninsula was formed primarily by the early advances of the Green Bay Lobe. The till found here is comprised of relatively old, calcareous loamy materials mixed with dolomite and limestone fragments plucked by the glacial lobe from the shallow bedrock. The till is thinly draped over the Niagara Escarpment that lies 1 to 3 meters below the surface. A drumlin field is oriented south-southeast, the direction of the ice flow over the peninsula. The eastern shore of the peninsula is composed of lake sediments that were reworked and deposited by Lake Michigan Lobe. The northern tip of the peninsula has glaciolacustrine beach terrace and ridge deposits and eolian sand dunes, which are remnants of the intra- and postglacial lakes Nipissing and Algonquin.

The central portion of this LRU is dominated by lacustrine deposits from Glacial Lake Oshkosh. In its largest stage, Glacial Lake Oshkosh covered 1.4 million acres. The lake formed from meltwater as the Green Bay Lobe receded between ice sheet advances. The glacial lobe stalled between present day Lake Winnebago and the city of Green Bay, blocking the drainage of meltwater north to the Lake Michigan Basin. Glacial Lake Oshkosh continued to rise until it found other drainage pathways, eventually draining into the Wisconsin River Valley. Glacial Lake Oshkosh reworked the till deposits of the Green Bay Lobe. Silty and clayey lacustrine deposits formed in the deepest area of the lakes, whereas sandy beach ridges, terraces, and dunes formed along the ancient shore.

The area east of Glacial Lake Oshkosh and south along the shore of Lake Michigan are dominated by a thin till sheet over the Niagara Escarpment that was deposited by the Green Bay and Lake Michigan Lobes. The Green Bay Lobe deposited calcareous clay and silty till reworked from lake sediments. The Lake Michigan Lobe deposited silt loam, loam, and compacted sandy clay loam till. Remnants of the intra- and postglacial lakes Nipissing and Algonquin are also found along Lake Michigan shore. Proglacial streams formed small areas of pitted and unpitted outwash plains, terraces, and fans.

Historically, the vegetation in this LRU was dominated by northern and central hardwood forests and wetlands. The northern hardwoods were comprised of eastern hemlock (Tsuga canadensis) and American beech (Fagus grandifolia). The central hardwoods were dominated by sugar maple (Acer saccharum), American basswood (Tilia Americana), and American beech (Fagus grandifolia). Forested wetlands were a major part of the landscape, covering more than 25% in some are

Classification relationships

Relationship to Established Framework and Classification Systems:

Biophysical Settings (Landfire, 2014): This ES is largely mapped as Laurentian-Acadian Alkaline Conifer-Hardwood Swamp Shrubland, Laurentian-Acadian Northern Hardwoods Forest, Eastern Cool Temperate Row Crop, Eastern Cool Temperate Close Grown Crop, Eastern Cool Temperate Wheat, Developed-Low Intensity, and Developed-Medium Intensity

Habitat Types of N. & S. Wisconsin (Kotar, 2002, 1996): The sites of this ES keyed out to Acer saccharum-Tilia-Fraxinus/Caullophyllum [ATiFrCa]

WDNR Natural Communities (WDNR, 2015): This ES is most similar to the Southern Mesic Forests described by the WDNR

Hierarchical Framework Relationships:

Major Land Resource Area (MLRA): 095X–Eastern Wisconsin, Northern Illinois, and Upper Michigan Drift Plain

USFS Subregions: Green Bay Clayey and Silty Lake Plain (212Zb), Manitowoc Till Plain (212Zc), Lake Winnebago Clay Plain (222Kc)

DNR Ecological Landscapes: Central Lake Michigan Coastal, Southeast Glacial Plains

Ecological site concept

The Moist Clayey Lowlands ecological site occurs primarily in the southern portion of LRU 95XA. These sites are represented by soils that are classified as Aquollic Hapludalfs and Aquic Argiudolls indicating their moist status, high availability of water, and productive status. These soils are primarily formed in clayey till (some in clayey lacustrine) and often have a loamy mantle of loess or alluvium on their surface. Soils are very deep, somewhat poorly drained, and do not meet hydric soil requirements. Water is received through precipitation, runoff from adjacent uplands, and groundwater discharge. Water levels are greatly influenced by precipitation rates and runoff from upland sites. These sites are slightly acid to moderately alkaline and are likely to contain carbonates.

Associated sites

F095XA011WI	**Clayey Upland** These sites consist of very deep, clayey till or lacustrine deposits. Some have a sandy eolian or loess mantle. Some are underlain by coarser-textured materials. They are moderately well to well drained. They may be found in higher positions on the same landform feature as Moist Clayey Lowlands. Like Moist Clayey Lowlands, these sites are common to the clayey till plains and lake plains in the southern portion of this MLRA.
F095XA004WI	**Wet Loamy or Clayey Lowland** These sites consist of shallow to very deep, loamy to clayey deposits of various origin. They are sometimes underlain by sandy outwash. They are very poorly to poorly drained. They are sometimes found on the same landform and share particle size classes with Moist Clayey Lowlands, but occupy a lower, wetter position on the landscape.

Similar sites

F095XA005WI	**Moist Sandy Lowland** These sites consist of deep sandy outwash or lacustrine deposits, sometimes underlain by finer-textured materials. They are somewhat poorly drained. They'll be found on different landforms with coarser particle size classes than Moist Clayey Lowlands, though they occupy the same position on the landscape.

F095XA006WI	**Moist Loamy Lowland** These sites consist of moderately deep to very deep, loamy lacustrine, till, or outwash deposits. Some have a loess mantle. Some are underlain by sandy outwash. They are somewhat poorly drained. They'll be found on different landforms with somewhat coarser particle size classes than Moist Clayey Lowlands, though they occupy the same position on the landscape.

Table 1. Dominant plant species

Tree	(1) *Acer saccharum* (2) *Tilia americana*
Shrub	(1) *Fraxinus* (2) *Ribes*
Herbaceous	(1) *Impatiens capensis* (2) *Parthenocissus quinquefolia*

Physiographic features

This site occurs in drainageways and depressions on clayey lake plains and till plains, mostly in the southwest portion of the Northeastern Wisconsin Drift Plain. Landform shape is linear or concave, and sites are in the footslope position. Slopes range from 0 to 6 percent.

Some sites are subject to brief flooding or ponding. Inundation generally lasts two to seven days and is most common in the spring. The water table of most sites is perched by the heavy clay substratum (episaturation) and found at 6 inches (15 cm). Sites with a sandy substratum have apparent seasonally high water tables (endosaturation). The seasonally high water table is usually found within 12 inches (30 cm) but may be as deep as 24 inches (61 cm) in some sites. Runoff is low to high.

Table 2. Representative physiographic features

Landforms	(1) Drainageway (2) Depression (3) Glacial lake (relict) (4) Ground moraine (5) Lake terrace (6) Stream terrace
Runoff class	Low to high
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to rare
Ponding duration	Brief (2 to 7 days)
Ponding frequency	None to occasional
Elevation	656–902 ft
Slope	0–6%
Ponding depth	0–12 in
Water table depth	6–24 in
Aspect	Aspect is not a significant factor

Climatic features

The continental climate of the Northeastern Wisconsin Drift Plain is typical of central Wisconsin – cold winters and warm summers. The climate is moderated by the thermal mass of Lake Michigan, especially in coastal areas. Fall and early winter temperatures are slightly warmer and spring and early summer temperatures are slightly cooler along the Lake Michigan coastline. Lake effect snow occurs along the coastline.

Table 3. Representative climatic features

Frost-free period (characteristic range)	119-125 days
Freeze-free period (characteristic range)	155-158 days
Precipitation total (characteristic range)	31-32 in
Frost-free period (actual range)	116-125 days
Freeze-free period (actual range)	153-159 days
Precipitation total (actual range)	30-33 in
Frost-free period (average)	121 days
Freeze-free period (average)	156 days
Precipitation total (average)	32 in

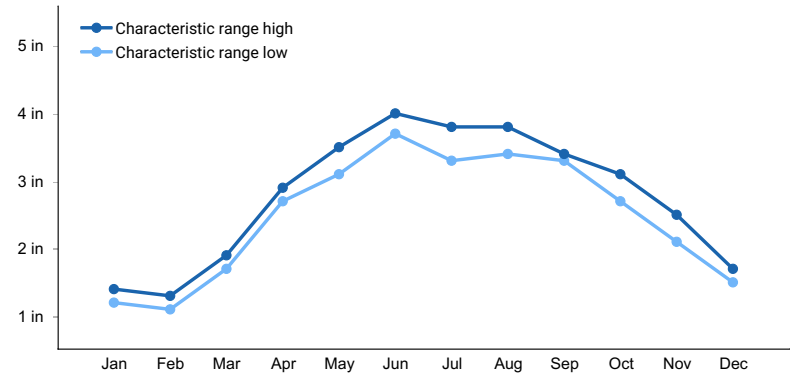


Figure 1. Monthly precipitation range

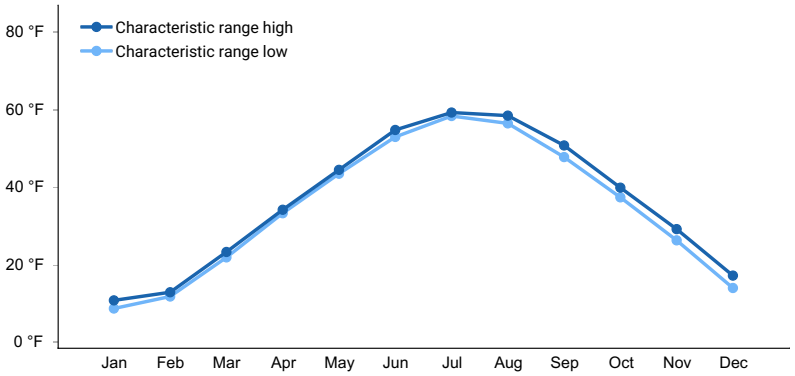


Figure 2. Monthly minimum temperature range

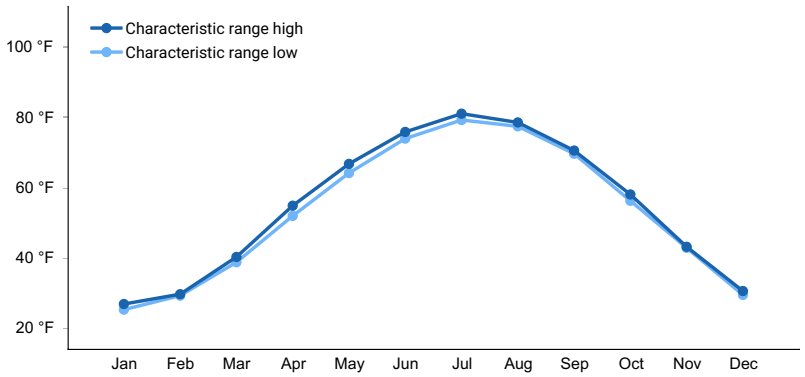


Figure 3. Monthly maximum temperature range

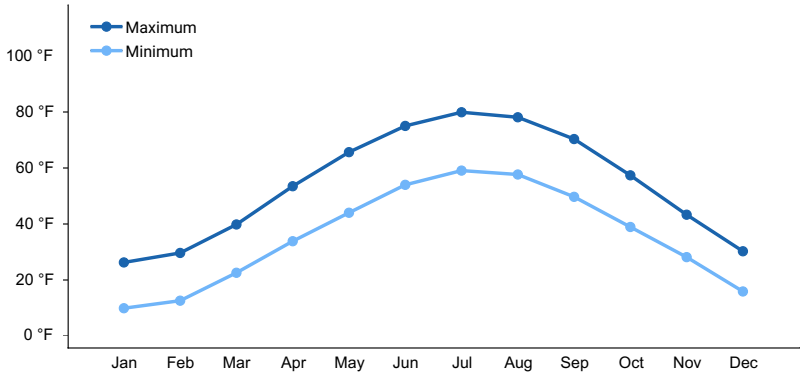


Figure 4. Monthly average minimum and maximum temperature

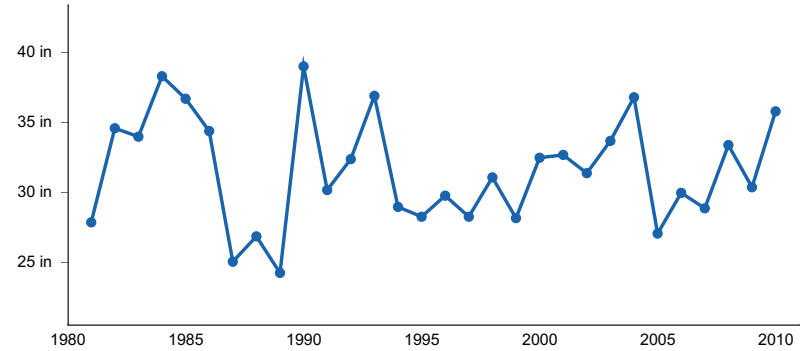


Figure 5. Annual precipitation pattern

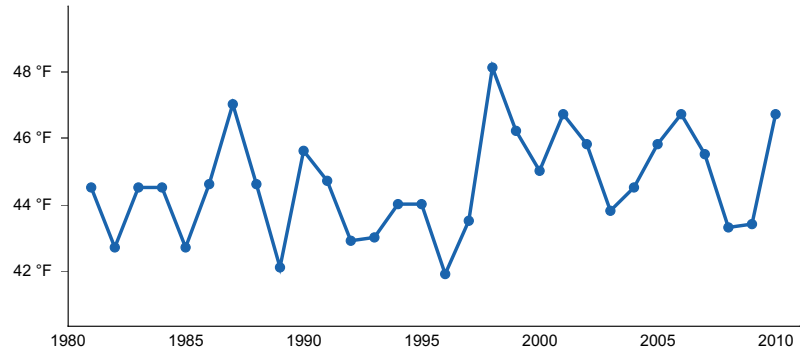


Figure 6. Annual average temperature pattern

Climate stations used

- (1) DENMARK WWTP [USC00472055], Denmark, WI
- (2) STURGEON BAY EXP FARM [USC00478267], Sturgeon Bay, WI
- (3) EPHRAIM 1NE-WWTP [USC00472626], Sister Bay, WI
- (4) GIBBSVILLE [USC00473116], Sheboygan Falls, WI
- (5) NEW LONDON [USC00475932], Hortonville, WI
- (6) BRILLION [USC00471064], Brillion, WI

Influencing water features

Water is received through precipitation, runoff from adjacent uplands, and groundwater discharge. Water levels are greatly influenced by precipitation rates and runoff from upland sites. Water is lost from the site primarily through runoff, evapotranspiration, and groundwater recharge.

Permeability of the soil is impermeable to slow. The hydrologic group of this site is D or C/D.

Wetland description

Hydrogeomorphic Wetland Classification: None
Cowardin Wetland Classification: None

Soil features

The soils of this site are represented by the Manawa, Martinton, Neenah, and Zittau series. They are all classified as Aquollic Hapludalfs except for Zittau, which is an Aquic Argiudoll. The Hapludalfs make up 69% of the acreage of this site, and the Argiudolls make up 31%.

These soils primarily formed in clayey till, often overlain by a loamy mantle of loess or alluvium. Some soils west of Lake Winnebago formed in clayey lacustrine deposits, often underlain by silty to sandy lacustrine deposits. Soils are very deep, somewhat poorly drained, and do not meet hydric soil requirements. They are slightly acid to moderately alkaline. These sites are not necessarily characterized by a layer of significant clay accumulation (an argillic horizon), but such a layer is present on all sites.

The surface texture of these sites ranges from sandy loam to clay but is most often silt loam or silty clay loam. Subsurface horizon textures are mostly clays or silty clays. Sandy substratum is sometimes found in sites west of Lake Winnebago.

Surface fragments are generally absent in these soils. Subsurface fragments smaller than 3 inches in diameter may occupy up to 7 percent volume. Larger fragments may occupy up to 3 percent volume. Fragments may be stratified (in the case of lacustrine deposits) or unstratified (in the case of till). Some of these fragments may be pieces of limestone and dolomite plucked from the bedrock by glacial ice and mixed in with the mineral glacial deposits. Secondary carbonates are generally present in these soils. CaCO3 equivalency is usually around 20 percent.

Figure 7. Nenno (variant) Soil Series sampled on 06/18/2020 in Door County, Wisconsin.

Table 4. Representative soil features

Parent material	(1) Till (2) Lacustrine deposits (3) Glaciofluvial deposits (4) Loess
Surface texture	(1) Sandy loam (2) Silt loam (3) Silty clay loam (4) Silty clay (5) Clay
Drainage class	Somewhat poorly drained
Permeability class	Slow
Soil depth	80–100 in

Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-59.1in)	1.83–4.09 in
Calcium carbonate equivalent (0-39.4in)	5–20%
Soil reaction (1:1 water) (0-39.4in)	6.3–8
Subsurface fragment volume <=3" (0-39.4in)	0–7%
Subsurface fragment volume >3" (0-39.4in)	0–3%

Ecological dynamics

Mature forests on this ecological site were likely composed of a mixture of Sugar maple, Basswood, and Ashes. Several other associates including elms, oaks, and birches may occur as well. Shrub layers are usually poorly developed on this ES and may only contain gooseberries and regenerating tree species. Ground flora is likely to consist of jewelweed, wild geranium, virginia creeper, and ferns.

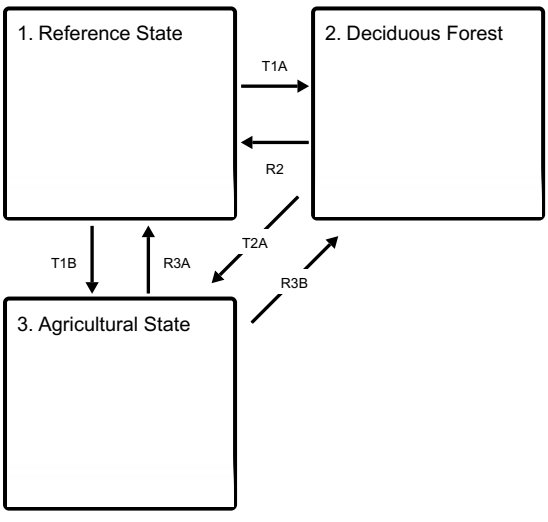
While these sites at present are wetter than may be optimal for Sugar maple, once established in full succession canopy trees are likely to “dry” the site due to increased evapotranspiration allowing Sugar maple to become a dominant canopy member on these sites. The opposite condition of “swamping” has been noted on these sites, where heavy cutting on these sites leads to an elevated water table. Due to their connection to water table elevation, soil wetness, and evapotranspiration of a full canopy these sites have a variety of species mixtures at present. Additionally many soils in this ES may experience infrequent flooding that could affect species composition. Greater soil wetness may tilt this site towards species such as Black ash rather than Sugar maple.

Current stands on this Ecological Site can represent a broad array of species composition and all potential successional stages, however, the Advanced Successional stage of the Reference State is uncommon and instead the Deciduous Forest State (Aspen – Red maple) is likely to be the most common state that one finds.

While this ES is similar to Moist Loamy Lowlands it is distinctly more nutrient rich and often wetter leading to an increased abundance of Black ash. Due to increased wetness from the fine textured soils of this ES there is often decreased productivity in spite of the richness of the soils in this ES.

State and transition model

Ecosystem states



T1A - Stand replacing disturbance that includes fire.

T1B - Removal of forest cover and tilling for agricultural crop production.

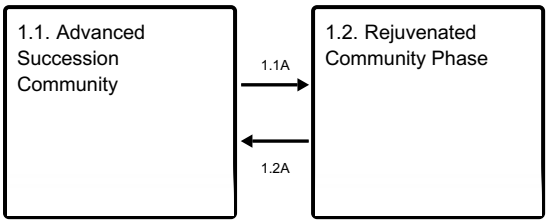
R2 - Deciduous forest community is slowly taken over by shade tolerant maples and other species.

T2A - Removal of forest cover and tilling for agricultural crop production.

R3A - Cessation of agricultural practices leads to natural reforestation, or site is replanted.

R3B - Cessation of agricultural practices leads to natural reforestation, or site is replanted.

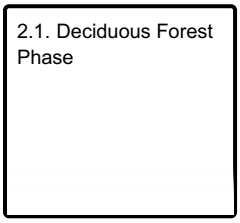
State 1 submodel, plant communities



1.1A - Blow-downs and ice storms leaving canopy openings.

1.2A - Disturbance-free period for 30+ years.

State 2 submodel, plant communities



State 1
Reference State

The reference plant community is categorized as mesic to wet-mesic forest community dominated by mixed deciduous species, primarily Sugar maple, Basswood, and Ashes. Several other associates including elms, oaks, and birches may occur as well. Shrub layers are usually poorly developed on this ES and may only contain gooseberries and regenerating tree species. Ground flora is likely to consist of jewelweed, wild geranium, virginia creeper, and ferns. Although forest communities can vary greatly in terms of species composition and stand structure, depending on type, degree, and frequency of disturbance, two common phases predominate.

Community 1.1
Advanced Succession Community

In the absence of major, stand-replacing disturbance this community is dominated by sugar maple, basswood, and ashes. The tree sapling and shrub layer in this community is not well developed due to dense shade created by multi-story tree canopy. Commonly the shrub layer may contain only gooseberries. The herb layer is likely to consist of ferns, jewelweed, wild geranium, and virginia creeper.

Dominant plant species

- sugar maple (*Acer saccharum*), tree
- American basswood (*Tilia americana*), tree
- ash (*Fraxinus*), tree
- currant (*Ribes*), shrub
- sensitive fern (*Onoclea sensibilis*), other herbaceous
- jewelweed (*Impatiens capensis*), other herbaceous
- geranium (*Geranium*), other herbaceous
- Virginia creeper (*Parthenocissus quinquefolia*), other herbaceous

Community 1.2
Rejuvenated Community Phase

Disturbances described in Pathway 1.1A lead to increased species and structural diversity of the forest community. Depending on seed source, red maple, ashes, oaks, elms, and basswood regenerate in the canopy openings and in time join sugar maple in the dominant canopy. The relative density of the shrub and herb layers may increase during this stage. Many herb layer species that were present with very low abundance in the advanced-succession community typically form much larger population clusters as there is more light penetrating the canopy.

Dominant plant species

- sugar maple (*Acer saccharum*), tree
- white ash (*Fraxinus americana*), tree
- northern red oak (*Quercus rubra*), tree
- red maple (*Acer rubrum*), tree
- chokecherry (*Prunus virginiana*), shrub
- currant (*Ribes*), shrub
- sensitive fern (*Onoclea sensibilis*), other herbaceous
- jewelweed (*Impatiens capensis*), other herbaceous
- Virginia creeper (*Parthenocissus quinquefolia*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

Natural mortality in the oldest age classes—sporadic small-scale blow-downs and ice storms—create openings for entry of red maple, oaks, ashes, elms, and basswood.

Pathway 1.2A
Community 1.2 to 1.1

In the absence of canopy reducing disturbances natural succession leads to community dominance by the most shade-tolerant species resulting in return to community phase 1.1. The longer the time without disturbance the more likely that Sugar maple will dominate.

State 2
Deciduous Forest

Post disturbance pioneer community of aspen and red maple with mixtures of other species from available seed sources (ashes, elms, oaks, and white birch) are common in this state. This state can have broad variation depending on what seed sources are available as these sites readily supply water and nutrients in quantities that many species can thrive with. Depending on age and tree species composition the shrub and herb layer in this state can vary considerably. Namely with the dominance of aspen there is likely to be very little in the shrub layer.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- paper birch (*Betula papyrifera*), tree

Community 2.1
Deciduous Forest Phase

Figure 8. Image courtesy of UWSP taken on 06/18/2020 in Door County, Wisconsin.

A pure aspen, sometimes with paper birch, community replaces the reference state community. If seed source is present, red maple and readily becomes a member of this community. Early in this phase the shrub and herb layer may be minimal with the presence of an aspen thicket. Other trees likely to be present as long as the seed source is present include ashes, oaks, and elms.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- paper birch (*Betula papyrifera*), tree
- red maple (*Acer rubrum*), tree

State 3
Agricultural State

Indefinite period of applying agricultural practices. Cropping systems vary on these sites and likely include tillage, row crops, hay or pasture, and specialty crops.

Transition T1A
State 1 to 2

Major stand-replacing disturbance. In pre-European settlement time, the event was most often a severe blow down, sometimes followed by fires. Such blow downs have been estimated to occur in this part of Wisconsin every 300 to 400 years (Schulte and Mladenoff, 2005). In post settlement virtually every acre has been logged either by clear cutting or successive cuts targeting species marketable at that time. Post logging slash fires also have been a significant factor in most areas. These disturbances created the environment suitable for natural regeneration of many shade-intolerant species and for commercial planting.

Transition T1B
State 1 to 3

Removal of forest cover and tilling for agricultural crop production

Restoration pathway R2
State 2 to 1

Deciduous forest community is slowly invaded by shade tolerant species. Deciduous forest community is slowly invaded by conifers.

Transition T2A
State 2 to 3

Removal of forest cover and tilling for agricultural crop production.

Restoration pathway R3A
State 3 to 1

Abandonment of agricultural practices and allowing natural vegetation to colonize the site or apply artificial afforestation. The site can return much more quickly to the Deciduous Forest State as compared to the Reference State.

Restoration pathway R3B
State 3 to 2

Cessation of agricultural practices leads to natural reforestation, or site is replanted.

Additional community tables

Inventory data references

Plot and other supporting inventory data for site identification and community phases is located on a NRCS North Central Region shared and one drive folder. University Wisconsin-Stevens Point described soils, took photographs, and inventoried vegetation data at community phases within the reference state. The data sources include WI ESD Plot Data Collection Form - Tier 2, Releve Method, NASIS pedon description, NRCS SOI 036, photographs, and Kotar Habitat Types.

Other references

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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	05/11/2025
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:**

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17. **Perennial plant reproductive capability:**
