USDA Natural Resources Conservation Service

Ecological site F093BY010MI
Loamy Uplands

Last updated: 9/27/2023
Accessed: 11/24/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 093B–Superior Stony and Rocky Loamy Plains and Hills

The Wisconsin portion of this MLRA is a mixture of high-relief moraines and flat till plains with interspersed glacial meltwater deposits. It is bordered on the north by glaciolacustrine deposits of Glacial Lake Duluth and on the south by extensive pitted and unpitted outwash plains. The approximate land area is just under 600,000 acres (935 sq miles). The Penokee-Gogebic Iron Range runs through the middle of the Wisconsin portion of this MLRA and into Michigian. The range is a hilly, bedrock-controlled moraine. The bedrock outcropping is composed of igneous and metamorphic materials and was created by inland folding and faulting of the ancient Superior continent when it collided with the Marshfield continent about 1.8 billion years ago (Dott & Attig, 2004). Volcanic and intrusive bedrock occurs in some places. This bedrock is overlain by a thin layer of glacial till deposited by the Chippewa Lobe.

To the north of the range is a former spillway for Glacial Lake Ontonagon. The flowing meltwater cut deep channels into the morainal systems. Glaciofluvial landforms here include old beaches and dunes. South of the range, along the southern edge of this MLRA, are rolling collapsed end moraines, pushed to their extent by the Chippewa and Ontonagon Lobes. The landscape is dotted with abundant kettle lakes and swamps, especially in the eastern portion. Ice-walled lake plains and eskers are also found along these collapsed moraines.

The climate is influenced by Lake Superior in areas near the lake, resulting in cooler summers, warmer winters, and greater precipitation – especially snowfall – compared to more inland locations. Historically, mixtures of eastern hemlock (*Tsuga canadensis*), sugar maple (Acer saccharum), yellow birch (*Betula alleghaniensis*), eastern white pine (Pinus strobus), and red pine (Pinus resinosa) covered the area. In wetter pockets (such as the swamps that dot the moraines to the south) white cedar (Thuja occidentalis), black spruce (Picea mariana), and tamarack (Larix laricina) were common (Finley, R., 1976).

Classification relationships

Relationship to Established Frameworks and Classification Systems:
Habitat Types of N. Wisconsin (Kotar, 2002): Two sites key out to Acer saccharum – *Tsuga canadensis*/ *Maianthemum canadense* (ATM), one site keys to Acer saccharum – *Tsuga canadensis*/ Dryopteris spinulosa (ATD), and one site keys to Acer saccharum / Ozmmorhiza claytonia – Caulophyllum thalictroides (AOCa).

Biophysical Setting (Landfire, 2014): This ES is mapped as Boreal White Spruce-Fir-Hardwood Forest - Inland, Laurentian-Acadian Northern Hardwoods Forest – Hemlock, and Laurentian-Acadian Northern Hardwoods Forest; though, it is likely best represented by the latter.

WDNR Natural Communities (WDNR (2015): This ES is most similar to the Northern Mesic Forest.

Hierarchical Framework Relationships:
Major Land Resource Area (MLRA): Superior Stoney and Rocky Loamy Plains and Hills, Eastern Part (93B)

USFS Subregions: Winegar Moraines (212Jc)
Small sections occur in the Gogebic-Penokee Iron Range (212Jb) subregion

Wisconsin DNR Ecological Landscapes: North Central Forest

Ecological site concept

Loamy Uplands is an uncommon site in MLRA 93B, located on hills, moraines, eskers, kames, lake and outwash plains, and stream terraces. These sites are characterized by moderately deep to very deep, moderately well to well drained soils formed in loamy glaciofluvial, till and eolian deposits, and residuum. Precipitation and runoff from adjacent uplands are the primary sources of water. Soils range from extremely acid to moderately acid.

Loamy Uplands lacks any significant layer of accumulated clay (an argillic horizon) or a dense, reversibly-cemented, root-restrictive layer (a fragipan), distinguishing it from Alfic Loamy Uplands and Fragic Loamy Uplands, respectively. The lack of these layer results in a lower available water capacity, but most sites do not have root growth restriction. Some sites do have lithic contact that does restrict root growth. Loamy textures differ Loamy Uplands from other upland sites. Loamy materials have a higher pH and available water capacity than sandy materials, which may promote more vegetative growth.

Associated sites

F093BY004MI	**Wet Lowlands** Wet Lowlands occur on depressions and drainageways and form in loamy till or loamy alluvium underlain by dense sandy till or sandy and gravelly outwash. These sites are poorly drained and occur lower on the drainage sequence than Loamy Uplands.
F093BY005MI	**Moist Lowlands** Moist Lowlands occur on footslope positions across the landscape. They are not subject to flooding nor ponding. Soils form in till, lacustrine deposits, or outwash deposits and may be loamy to sandy. These sites are somewhat poorly drained and occur slightly lower on the drainage sequence than Loamy Uplands.

Similar sites

F093BY009MI	**Alfic Loamy Uplands** Alfic Loamy Uplands occur on upland sites in loamy glaciofluvial deposits. Unlike Loamy Uplands, these soils have a layer of significant clay accumulation. They are moderately well to well drained.
F093BY008MI	**Fragic Loamy Uplands** Fragic Loamy Uplands occur on uplands sites in deep loamy till often overlain by loess. In these soils, a fragipan is either present or developing. The root restrictive Fragic layer is often impermeable and the water table is often perched above it (episaturation).
F093BY007MI	**Sandy Uplands** Sandy Uplands occur on upland sites in deep sandy outwash deposits, sometimes with a thin loamy mantle of alluvium or loess. Like Loamy Uplands, argillic horizons are neither present nor forming in these soils. While their landscape position and drainage classes are comparable, the soils of Sandy Uplands have much coarser textures and can hold less water. These differences are reflected in the vegetative communities: Loamy Uplands support mesic (ie. slightly wetter) species with higher nutrient requirements than Sandy Uplands.

Table 1. Dominant plant species

Tree	(1) *Acer saccharum* (2) *Tilia americana*
Shrub	(1) *Acer saccharum*
Herbaceous	(1) *Maianthemum racemosum* (2) *Athyrium filix-femina*

Physiographic features

These sites are found primarily on moraines, but may also be found on eskers, lake plains, outwash plains, stream terraces, and kames in backslope, shoulder, and summit positions. Slope ranges from 0 to 75 percent.

These sites are subject to neither ponding nor flooding. There generally do not have water table contact within 80 inches though some sites may have a seasonally high water table as high as 18 inches. Surface runoff is low to very high and greatly depends on slope and landscape position.

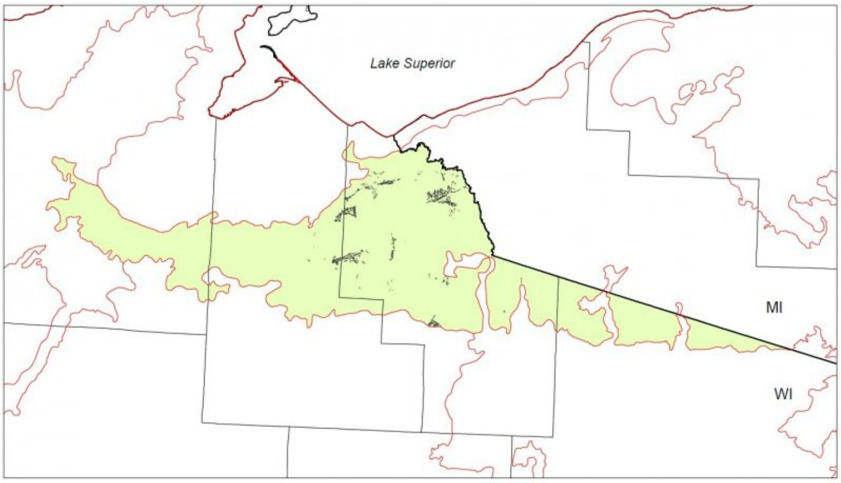


Figure 1. Distribution of Loamy Uplands in the Superior Stoney and Rocky Loamy Plains and Hills, Eastern Part (93B).

Table 2. Representative physiographic features

Landforms	(1) Moraine (2) Esker (3) Lake plain (4) Outwash plain (5) Stream terrace (6) Kame
Runoff class	Low to very high
Flooding frequency	None
Ponding frequency	None
Elevation	198–250 m
Slope	0–75%
Water table depth	46–203 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

The continental climate of the Superior Stoney and Rocky Loamy Plains and Hills, Eastern Part MLRA is characterized by long, cold winters and short, warm summers where precipitation exceeds evapotranspiration. Neither average annual precipitation nor average annual minimum and maximum temperatures vary greatly within this MLRA, though the climate of the northern tip is somewhat affected by Lake Superior and receives higher annual precipitation in the form of lake effect snow.

Table 3. Representative climatic features

Frost-free period (characteristic range)	89-119 days
Freeze-free period (characteristic range)	123-149 days
Precipitation total (characteristic range)	737-864 mm
Frost-free period (actual range)	84-121 days
Freeze-free period (actual range)	120-157 days

Precipitation total (actual range)	711-914 mm
Frost-free period (average)	104 days
Freeze-free period (average)	137 days
Precipitation total (average)	813 mm

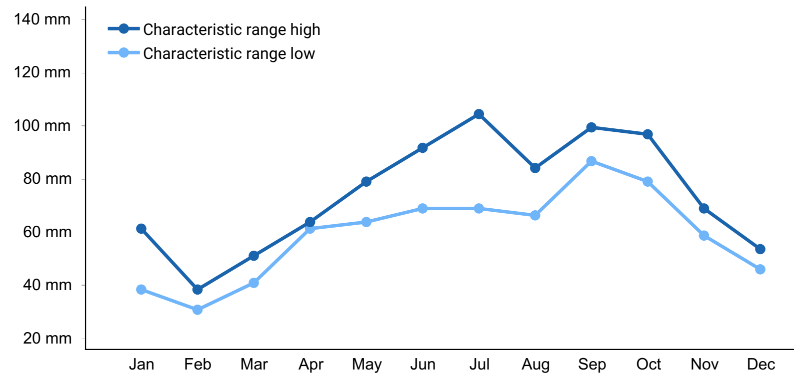


Figure 2. Monthly precipitation range

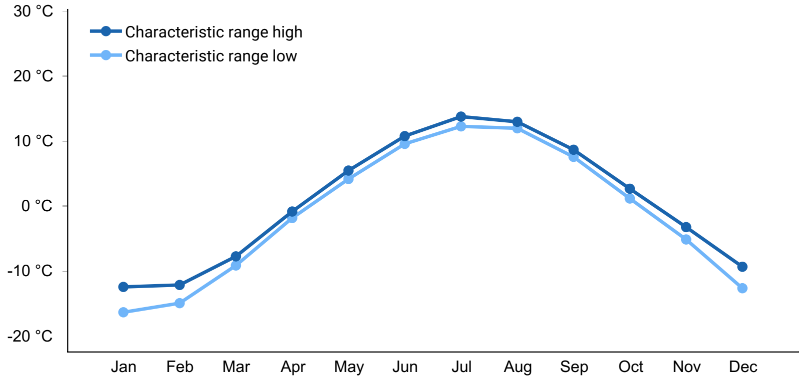


Figure 3. Monthly minimum temperature range

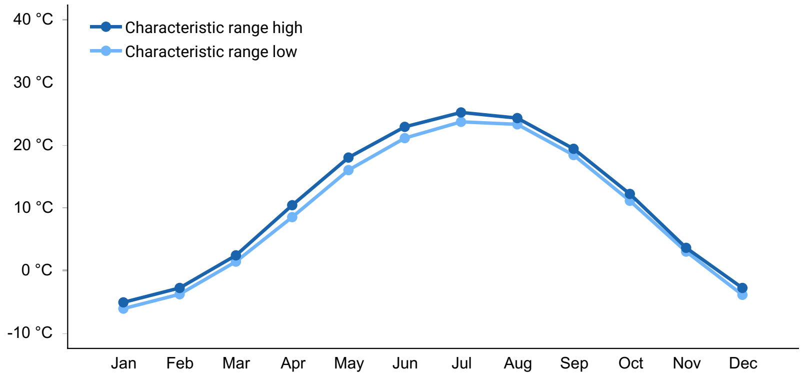


Figure 4. Monthly maximum temperature range

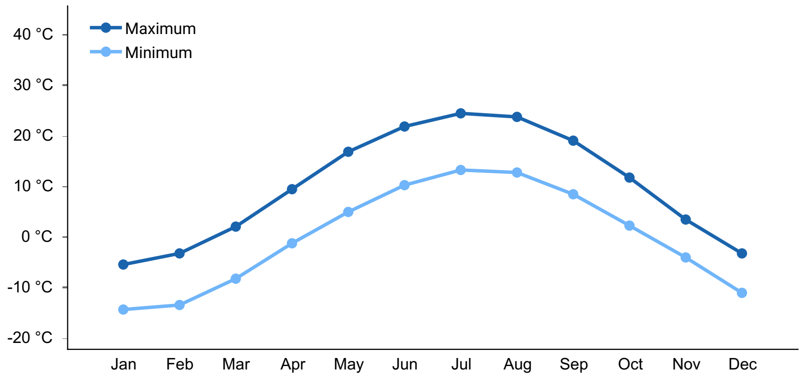


Figure 5. Monthly average minimum and maximum temperature

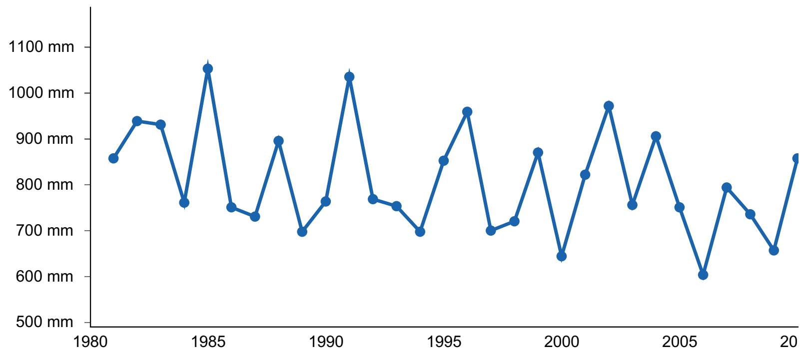


Figure 6. Annual precipitation pattern

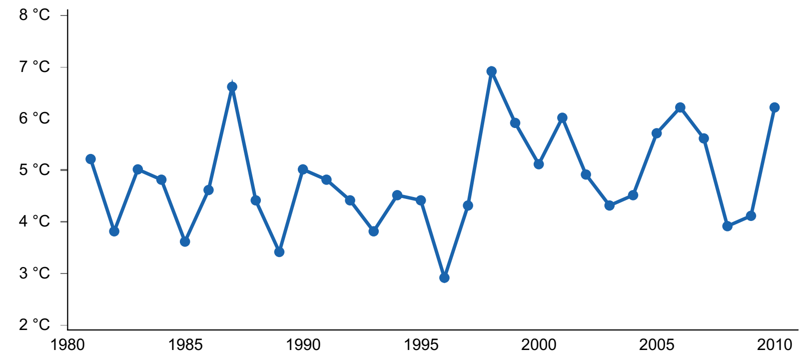


Figure 7. Annual average temperature pattern

Climate stations used

- (1) MELLEN 4 NE [USC00475286], Mellen, WI
- (2) HURLEY [USC00473800], Ironwood, WI
- (3) WATTON [USC00208706], Watton, MI
- (4) HANCOCK HOUGHTON CO AP [USW00014858], Calumet, MI
- (5) MARQUETTE [USW00014838], Marquette, MI

Influencing water features

Water is received through precipitation and runoff from adjacent uplands. Water is lost from the site primarily through runoff, evapotranspiration, and groundwater recharge.
Permeability of the soils is impermeable or moderately slow. The hydrologic soil group of these sites is B, C, D, or B/D.

Hydrologic Group: B, C, D, B/D
Hydrogeomorphic Wetland Classification: None
Cowardin Wetland Classification: None

Soil features

These sites are represented by the Dishno, Chabeneau, Metonga, Amasa, and Peshekee series. Dishno and Chabeneau are classified as Oxyaquic Haplorthods, while Metonga, Amasa, and Peshekee are classified as Entic, Typic, and Lithic Haplorthods, respectively.
These soils lack significant clay accumulation. They form in loamy till, sometimes with a loamy or silty eolian mantle and sometimes underlain by sandy and gravelly glaciofluvial deposits or by igneous or metamorphic bedrock. These soils may be shallow to very deep, with depth to bedrock ranging from 19 inches to over 80 inches. They are moderately well to well drained and do not meet hydric soil requirements.

Surface textures are fine sandy loam to silt loam. Subsurface textures range from coarse sand to silt loam. Carbonates are absent in these soils.

Table 4. Representative soil features

Parent material	(1) Glaciofluvial deposits (2) Till (3) Eolian deposits (4) Residuum
Surface texture	(1) Fine sandy loam (2) Silt loam
Drainage class	Moderately well drained to well drained
Depth to restrictive layer	48–203 cm
Surface fragment cover <=3"	0–2%
Surface fragment cover >3"	1–45%
Available water capacity (Depth not specified)	7.57–16.28 cm
Calcium carbonate equivalent (Depth not specified)	0%
Soil reaction (1:1 water) (Depth not specified)	3.8–5.9
Subsurface fragment volume <=3" (Depth not specified)	8–40%
Subsurface fragment volume >3" (Depth not specified)	2–25%

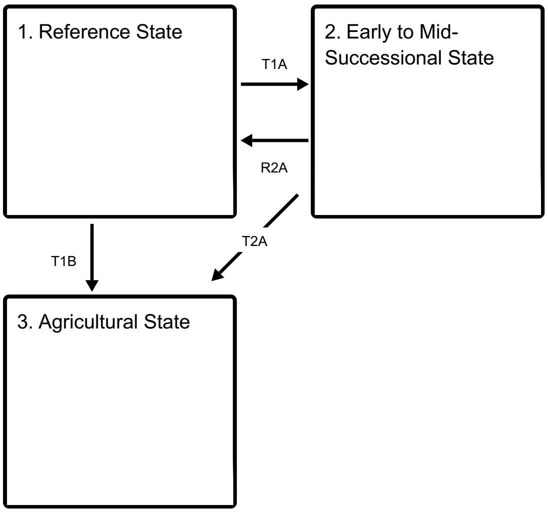
Ecological dynamics

Historically, mature forests on this ecological site were dominated by shade tolerant sugar maple and hemlock, often with an admixture of yellow birch (Wilde, 1933, Finley, 1976). This association was self-maintained with new cohorts of advanced regeneration gaining canopy status through gaps formed by small-scale disturbances and natural mortality in the dominant canopy. Scattered large individuals of less shade tolerant white pine were also common components of mesic hardwood forests. These presumably became established following relatively rare disturbances that included fire (Schulte and Mladenoff, 2005).

Current stands on this Ecological Site represent the entire array of potential successional stages from pure aspen, or aspen-white birch, stands to sugar maple dominated mixed northern hardwoods stands. Succession to sugar maple dominance is evident everywhere where seed sources are present and disturbance remains infrequent.

State and transition model

Ecosystem states

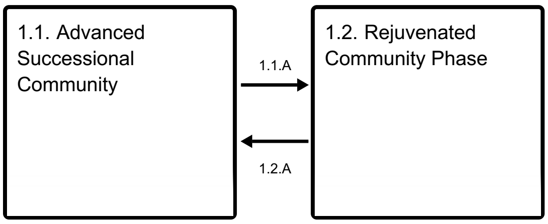


T1A - Large scale disturbance

T1B - Clearing of site; agricultural production

T2A - Elimination of forest cover, application of agricultural practices

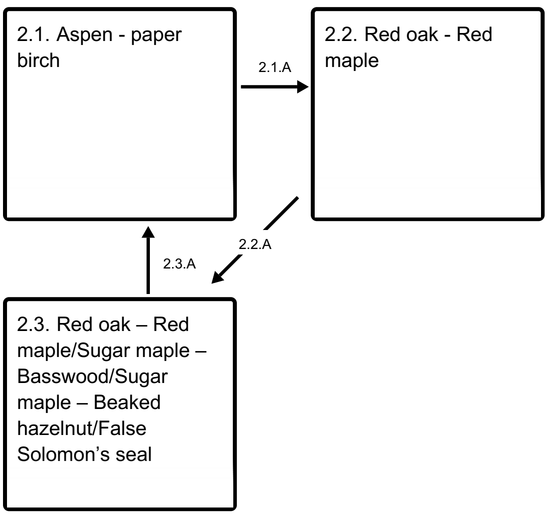
State 1 submodel, plant communities



1.1.A - Natural mortality in the oldest age classes, sporadic small-scale blow-downs and ice storms, create openings for entry of mid-tolerant species

1.2.A - Time and natural succession

State 2 submodel, plant communities



2.1.A - Red oak and red maple regenerate under aspen-paper birch canopy

2.2.A - Time and natural succession

State 3 submodel, plant communities

3.1. Agricultural Community

State 1
Reference State

Dominant plant species

- sugar maple (*Acer saccharum*), tree
- American basswood (*Tilia americana*), tree
- sugar maple (*Acer saccharum*), shrub
- feathery false lily of the valley (*Maianthemum racemosum*), other herbaceous
- common ladyfern (*Athyrium filix-femina*), other herbaceous

Community 1.1
Advanced Successional Community

In the absence of major, stand-replacing disturbance this community is dominated by sugar maple, American basswood, and yellow birch (*Betula alleghaniensis*), with scattered occurrence of old white pines, balsam fir (*Abies balsamea*), and eastern hemlock (*Tsuga canadensis*). This was the most common condition in pre-European settlement forests. The tree sapling and shrub layer in this community is not well developed due to dense shade created by multi-story tree canopy. Most common, but low coverage shrub species are beaked hazelnut (*Corylus cornuta*), fly-honeysuckle (*Lonicera canadensis*) and American hophornbeam (*Ostrya virginiana*). The herb layer is relatively species rich, but moderate in abundance. The dominant herbs typically include false Solomon's seal (*Maianthemum racemosum*), lady fern (Athyrium Felix-femina), large-leaved aster (*Eurybia macrophylla*), yellow beadlily (*Clintonia borealis*), rosey twisted stalk (Streptopus roseus), and Canada mayflower (*Maianthemum canadense*). It is important to note that in most current mature stands hemlock is significantly under-represented compared to historic conditions. This apparently is due to seed source elimination during the early logging era and herbivory by currently high white tail deer populations.

Dominant plant species

- sugar maple (*Acer saccharum*), tree
- American basswood (*Tilia americana*), tree
- sugar maple (*Acer saccharum*), shrub
- feathery false lily of the valley (*Maianthemum racemosum*), other herbaceous
- common ladyfern (*Athyrium filix-femina*), 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 oak and red maple regenerate in the canopy openings and in time join sugar maple and basswood in the dominant canopy. The relative density of the shrub and herb layers also increases during this stage. Species composition remains relatively unchanged, but abundance changes can be significant. Particularly beaked hazelnut can form dense thickets and big leaf aster often forms continuous carpets. Many other herb species that were present with very low abundance in the advanced-succession community typically form much larger population clusters.

Dominant plant species

- sugar maple (*Acer saccharum*), tree
- American basswood (*Tilia americana*), tree
- green ash (*Fraxinus pennsylvanica*), tree

- honeysuckle (*Lonicera*), shrub
- hophornbeam (*Ostrya virginiana*), shrub
- feathery false lily of the valley (*Maianthemum racemosum*), other herbaceous
- common ladyfern (*Athyrium filix-femina*), other herbaceous

Pathway 1.1.A
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 mid-tolerant species such as red oak and red maple.

Pathway 1.2.A
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.

State 2
Early to Mid-Successional State

Following disturbances described in Transition T1A a wide range of forest community phases may come into temporary existence, the three most common ones are red oak -red maple-sugar maple -basswood, red oak - red maple, and aspen paper birch.

Dominant plant species

- northern red oak (*Quercus rubra*), tree
- red maple (*Acer rubrum*), tree
- sugar maple (*Acer saccharum*), tree
- balsam fir (*Abies balsamea*), tree
- sugar maple (*Acer saccharum*), shrub
- honeysuckle (*Lonicera*), shrub
- common ladyfern (*Athyrium filix-femina*), other herbaceous
- feathery false lily of the valley (*Maianthemum racemosum*), other herbaceous

Community 2.1
Aspen - paper birch

These two species have a very narrow window of environmental and ecological conditions for successful establishment. Main requirements are exposed mineral soil and elimination, most effectively by fire, of on-site seed sources of potential competing vegetation. In addition, adequate soil moisture must be available for initial seedling development. Once seedlings are firmly established height growth of both species is relatively rapid and able to outgrow most competitive species. Paper birch seedlings and saplings tolerate partial shade and often become members of mixed species communities. This is not true for aspen which requires continuous full-sun exposure for survival. Aspen stands are initially very dense due to sprouting from extensive lateral roots, but rapid natural thinning ensues as stems compete for available light.

Dominant plant species

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

Community 2.2
Red oak - Red maple

This community phase may occur via two different origins: 1. By sprouting from stumps or by local seed source, following stand-leveling disturbance, or 2. By invading and succeeding a pioneer aspen-birch community. For this reason, tree species composition and community structure in early stages of development vary considerably, from pure canopy dominance by red oak and red maple, singly, or in combination, to modest, or strong presence of mature, or decaying, aspen and/or paper birch. The shrub layer, dominated by beaked hazelnut (*Corylus cornuta*), typically reaches its best development in this community phase.

Dominant plant species

- northern red oak (*Quercus rubra*), tree
- red maple (*Acer rubrum*), tree
- beaked hazelnut (*Corylus cornuta*), shrub

Community 2.3
Red oak – Red maple/Sugar maple – Basswood/Sugar maple – Beaked hazelnut/False Solomon's seal

This community phase represents distinct transition into mid-successional state, by strong presence in second canopy, or in reproductive layers, of shade-tolerant species, sugar maple, basswood, eastern hemlock, or balsam fir and white spruce. Sporadic occurrence of individual white pine trees also is common. Eastern hemlock, although historically a prominent member of mature communities on this site, is today under-represented presumably due to lack of seed source and selective browsing by the white-tailed deer.

Dominant plant species

- northern red oak (*Quercus rubra*), tree
- red maple (*Acer rubrum*), tree
- sugar maple (*Acer saccharum*), tree
- white spruce (*Picea glauca*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- sugar maple (*Acer saccharum*), shrub
- feathery false lily of the valley (*Maianthemum racemosum*), other herbaceous

Pathway 2.1.A
Community 2.1 to 2.2

Aspen and paper birch do not reproduce under their own canopies and, depending on seed source, are succeeded by either mid-shade-tolerant species such as red oak, red maple and white pine, - or directly by very tolerant species such as sugar maple, basswood, balsam fir and white spruce (Pathway 2.1A).

Pathway 2.2.A
Community 2.2 to 2.3

Succession by shade-tolerant species, sugar maple, basswood and in some cases also balsam fir and white spruce.

Pathway 2.3.A
Community 2.3 to 2.1

State 3
Agricultural State

This community phase is composed of crops, hay, or pasture.

Community 3.1
Agricultural Community

This community phase is composed of crops, hay, or pasture.

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

Elimination of forest cover, application of agricultural practices.

Restoration pathway R2A
State 2 to 1

The time required for forest community to reach the reference state conditions may exceed 100 years.

Context dependence. Time and natural succession

Transition T2A
State 2 to 3

Removal of forest cover, tilling and application of other agricultural techniques to grow agricultural crops.

Additional community tables

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Approval

Suzanne Mayne-Kinney, 9/27/2023

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.

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Date	09/27/2023
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):

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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:**
