USDA Natural Resources Conservation Service

Ecological site F093BY004MI
Wet Lowlands

Last updated: 9/27/2023
Accessed: 04/23/2024

General information

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

MLRA notes

Major Land Resource Area (MLRA): 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): All sites in this ES key out to *Fraxinus nigra* – Acer rubrum/ Impatiens capensis (FnArI).

Biophysical Setting (Landfire, 2014): This ES is mapped as Boreal White Spruce-Fir-Hardwood Forest – Inland, Laurentian-Acadian Northern Hardwoods Forest – Hemlock, Eastern Boreal Floodplain, Boreal Acidic Peatland System, and Laurentian-Acadian Alkaline Conifer-Hardwood Swamp; though, it is likely most represented by the latter.

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

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

The Wet Lowlands ecological site is scattered throughout MLRA 93B in depressions and drainageways on outwash and lake plains, moraines, and stream terraces. These sites are characterized by very deep, poorly drained soils formed in till, alluvium, and outwash deposits. Sites are subject to occasional ponding. Precipitation and runoff are the primary sources of water, but groundwater discharge may be a significant contribution. Sites remain saturated for long periods during the growing season and meet hydric soil requirements. Soils range from extremely acid to slightly alkaline. Some sites are wetlands.

The characteristic trait of Wet Lowlands the differentiates it from other sites is poor drainage. The organic sites (Acidic Poor Fens, and Mucky Swamps) also have poor drainage, but Wet Lowlands is in mineral soil. Other mineral soils outside this ecological site have improved drainage.

Associated sites

F093BY001MI	**Acidic Poor Fens** Acidic poor fens consist of deep herbaceous organic material. These soils are very poorly drained and remain saturated throughout the year. They are very strongly to extremely acidic. These sites are wetlands. If there is a lower landscape position bordering a Wet Lowland site, it's either an Acidic Poor Fen or a Mucky Swamp (described below).
F093BY002MI	**Mucky Swamps** Mucky swamps consist of deep, highly decomposed herbaceous organic material. These soils are very poorly drained and remain saturated throughout the year. Some sites are subject to occasional ponding and flooding. They are neutral to moderately acidic. These are wetlands. If there is a lower landscape position bordering a Wet Lowland site, it may be a Mucky Swamp site.
F093BY005MI	**Moist Lowlands** Moist Lowlands occur on footslope positions across the landscape. Unlike Wet Lowlands, they are subject to neither flooding nor ponding. These soils form in till, lacustrine deposits, or outwash deposits and may be loamy to sandy. These sites are somewhat poorly drained and occur higher on the drainage sequence than Wet Lowlands.
F093BY011MI	**Dry Uplands** Dry Uplands are found in the sandiest, most permeable soils on the driest landscape positions. They are very deep and excessively drained. They occur much higher on the drainage sequence than Wet Lowlands.

Similar sites

F093BY002MI	**Mucky Swamps** Mucky Swamps consist of deep, highly decomposed herbaceous organic material. These soils are very poorly drained and remain saturated throughout the year. Some sites are subject to occasional ponding and flooding. They are neutral to moderately acidic. These are wetlands. Some Mucky Swamp sites have a vegetative community very similar to that of Wet Lowlands.

Table 1. Dominant plant species

Tree	(1) *Fraxinus nigra* (2) *Abies balsamea*
Shrub	(1) *Corylus cornuta*
Herbaceous	(1) *Dryopteris carthusiana* (2) *Arisaema triphyllum*

Physiographic features

These sites occur on depressions, drainageways, outwash plains, stream terraces, lake plains, and moraines in toeslope and footslope positions. Slopes range from 0 to 2 percent.

Most sites are occasionally ponded in the spring. Ponding may also occur again in the fall on some sites. Ponding duration is usually brief (2-7 days) but may be long (7-30 days) in the spring. Ponding depth ranges from 0 to 12 inches. These sites are not subject to flooding. Most sites have an apparent seasonally high water table at the soil surface (0 inches). Though infrequent, perched water tables (episaturation) may be found in soils with densic contact or massive structure.

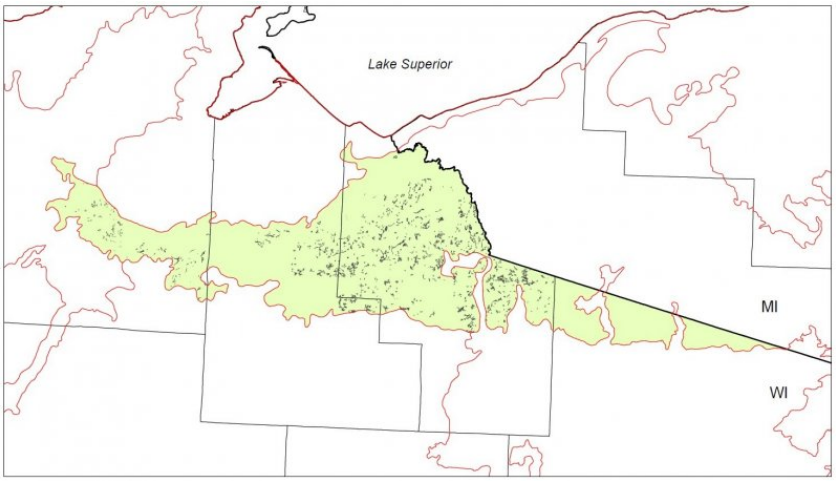


Figure 1. Distribution of Wet Lowlands in the Superior Stoney and Rocky Loamy Plains and Hills, Eastern Part (93B).

Table 2. Representative physiographic features

Landforms	(1) Depression (2) Drainageway (3) Outwash plain (4) Stream terrace (5) Lake plain (6) Moraine
Runoff class	Negligible
Flooding frequency	None
Ponding duration	Brief (2 to 7 days) to long (7 to 30 days)
Ponding frequency	None to occasional
Elevation	656–820 ft
Slope	0–2%
Ponding depth	0–13 in
Water table depth	0–24 in
Aspect	Aspect is not a significant factor

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)	89-111 days
Freeze-free period (characteristic range)	123-143 days
Precipitation total (characteristic range)	32-35 in
Frost-free period (actual range)	84-119 days
Freeze-free period (actual range)	120-155 days
Precipitation total (actual range)	30-36 in
Frost-free period (average)	100 days
Freeze-free period (average)	134 days
Precipitation total (average)	33 in

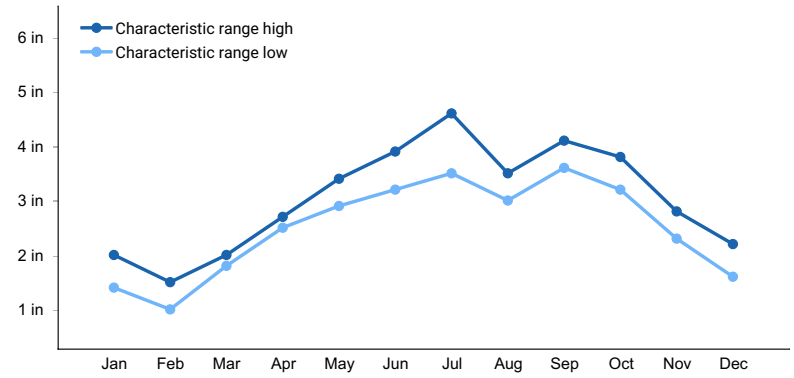


Figure 2. Monthly precipitation range

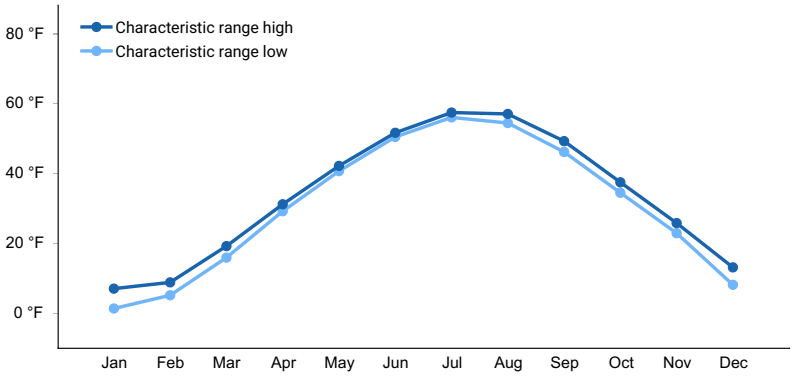


Figure 3. Monthly minimum temperature range

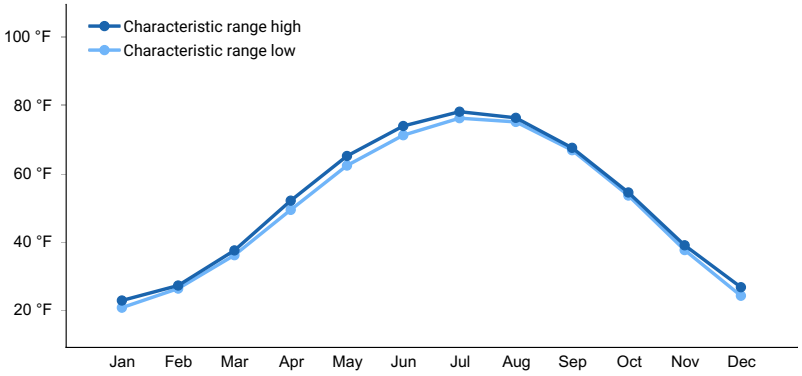


Figure 4. Monthly maximum temperature range

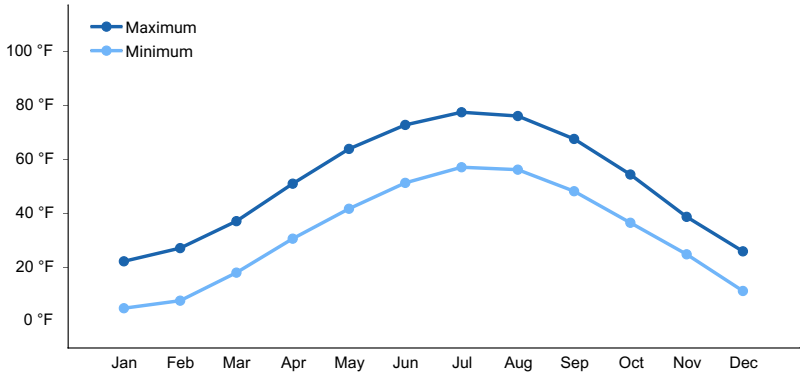


Figure 5. Monthly average minimum and maximum temperature

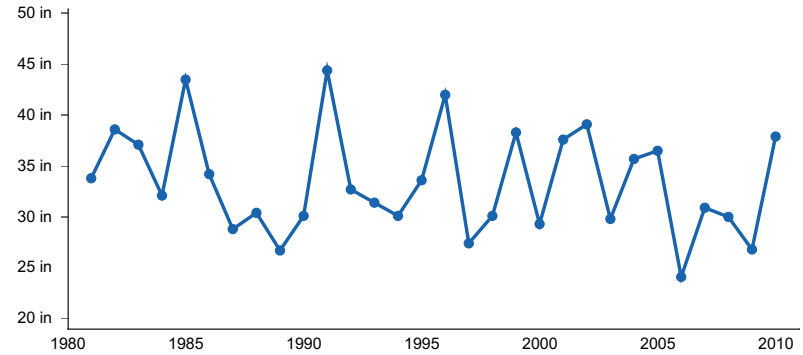


Figure 6. Annual precipitation pattern

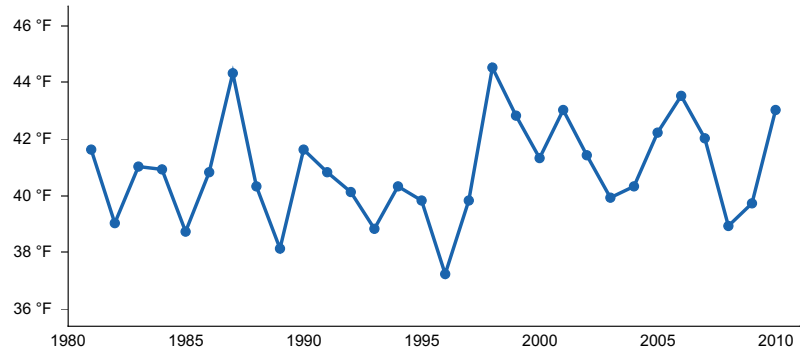


Figure 7. Annual average temperature pattern

Climate stations used

- (1) MELLEN 4 NE [USC00475286], Mellen, WI
- (2) DRUMMOND [USC00472240], Drummond, WI
- (3) MARQUETTE [USW00014838], Marquette, MI
- (4) HURLEY [USC00473800], Ironwood, WI

Influencing water features

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

Under the Cowardin System of Wetland Classification, or National Wetlands Inventory (NWI), the wetlands can be classified as:
1) Palustrine, forested, broad-leaved deciduous, saturated, or
2) Palustrine, forested, needle-leaved evergreen, saturated, or
3) Palustrine, scrub-shrub, broad-leaved deciduous, saturated, or
4) Palustrine emergent, persistent, saturated

Under the Hydrogeomorphic Classification System (HGM), the wetlands can be classified as:
1) Depressional, forested/organic, or
2) Depressional, scrub-shrub/organic

Permeability of the soils is very slow to moderately slow. The hydrologic group of these sites is B/D and C/D.

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

Soil features

These sites are represented by the Fowpaw, Cable, Minocqua, Tonkey, Gay, and Pleine soil series, classified as Typic Endoaquods, Typic Epiaquepts, Typic Endoaquepts, Mollic Endoaquepts, Aeric Endoaquepts, and Histic Humaquepts, respectively.

These soils form in loamy till or loamy alluvium underlain by dense sandy till or sandy and gravelly outwash. Bedrock is absent within 80 inches. These sites are poorly drained and meet hydric soil requirements.

Surface textures are primarily silt loam to very fine sandy loam, though some soils may have a mucky surface texture. Subsurface textures generally range from silt loam to fine sandy loam overlying coarser textures of loamy sand to coarse sand. In soils formed in outwash, deeper horizons are occasionally stratified. Surface fragments up to 10 inches in diameter are found on some sites. Subsurface fragments up to 10 inches in diameter are found on nearly all sites and may constitute 3 to 35 percent of all subsurface materials. Soil pH ranges from extremely acid to moderately alkaline with values of 4.0 to 7.9. Carbonates are generally absent, but some sites may have a calcium carbonate equivalency of up to 5 percent starting at a depth of 30 inches.

Table 4. Representative soil features

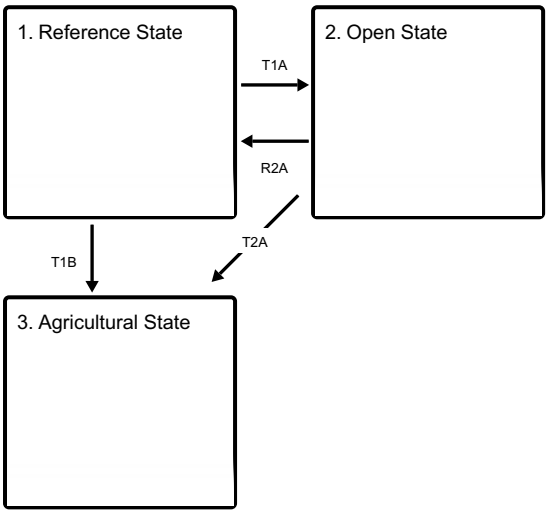
Parent material	(1) Alluvium (2) Till (3) Loess (4) Outwash
Surface texture	(1) Sandy loam (2) Very fine sandy loam (3) Loam (4) Silt loam
Drainage class	Poorly drained
Permeability class	Very slow to moderately slow
Soil depth	80 in
Surface fragment cover <=3"	0–7%
Surface fragment cover >3"	0–20%
Available water capacity (Depth not specified)	6.3–12.8 in
Calcium carbonate equivalent (Depth not specified)	0–5%
Soil reaction (1:1 water) (Depth not specified)	4–7.9
Subsurface fragment volume <=3" (Depth not specified)	3–33%
Subsurface fragment volume >3" (Depth not specified)	0–35%

Ecological dynamics

Because of the poorly drained soils, the historic fire disturbance has likely been less frequent and less severe than on the better drained sites. These sites represent the Northern Hardwood Swamp Community described in the Ecological Landscapes of Wisconsin. These forested wetlands are dominated by black ash (*Fraxinus nigra*) with other hardwood associates such as red maple and American elm. Conifer species such as balsam fir, black spruce, and northern white cedar are often present. Historically, these sites may have been dominated by conifers—specifically northern white-cedar—but after the state's period of heavy logging coupled with deer browse and other pressures, these communities have succeeded to hardwood swamps. This community relies heavily on soil moisture and nutrient regimes. These sites can support more nutrient demanding species, and the plants must tolerate seasonal ponding. The standing water drains, but soils remain saturated throughout the growing season. Tree species rely on the pit-and-mound microtopography to remain above the oversaturated rooting zones to avoid prolonged anaerobic conditions. Pit-and-mound topography is caused by tree species that have shallow roots and tip from windthrow. Seasonal ponding prevents other shade-tolerant species such as sugar maple from becoming competitive on these sites.

State and transition model

Ecosystem states



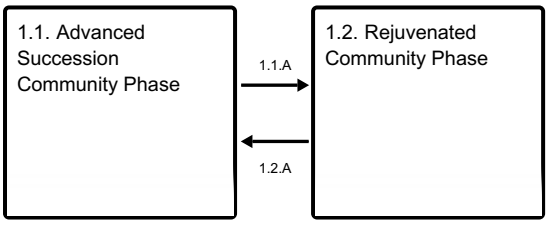
T1A - Major stand replacing disturbance

T1B - Site cleared; agricultural practices

R2A - Decreased frequency and duration ponding events

T2A - Elimination of forest cover, application of agricultural practices

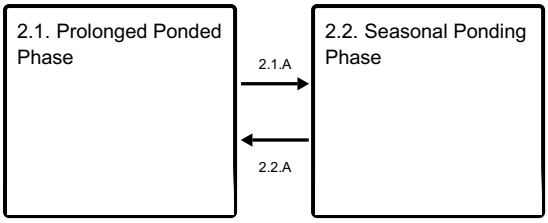
State 1 submodel, plant communities



1.1.A - Natural mortality in the oldest age classes or sporadic small-scale blow-downs and/or ice storms create canopy openings

1.2.A - Time; natural succession

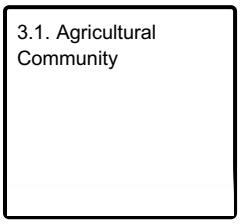
State 2 submodel, plant communities



2.1.A - Decrease in ponding allows encroachment of tree species such as black ash on mounds

2.2.A - Increase frequency and duration of ponding

State 3 submodel, plant communities



State 1
Reference State

Reference state is a forest community dominated by black ash (*Fraxinus nigra*) with scattered groups of balsam fir (*Abies balsamea*) and individuals of American elm (Ulmus Americana). Depending on history of disturbance, two community phases can be distinguished largely by differences in dominance of tree species and community age structure.

Dominant plant species

- black ash (*Fraxinus nigra*), tree
- balsam fir (*Abies balsamea*), tree
- American elm (*Ulmus americana*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- honeysuckle (*Lonicera*), shrub
- nannyberry (*Viburnum lentago*), shrub
- gray alder (*Alnus incana*), shrub
- spinulose woodfern (*Dryopteris carthusiana*), other herbaceous
- common ladyfern (*Athyrium filix-femina*), other herbaceous

Community 1.1
Advanced Succession Community Phase

In absence of stand replacing disturbance (major blow-downs, clearcutting, or prolonged ponding event), this community is dominated by black ash in all layers of the forest from canopy to shrub layer. Black ash has a shallow and fibrous root system that to tolerate seasonal ponding of stagnant water. Long duration of ponding will cause black ash to diminish. Balsam fir and American elm are common associates, both tolerant of high soil moisture, but not as tolerant as black ash. Shrub species include beaked hazelnut (*Corylus cornuta*) and honeysuckles, with other tall shrubs such as nannyberry (*Viburnum lentago*) and tag alder (*Alnus incana*) common. Forest floor cover is dominated by ferns, namely wood fern (*Dryopteris carthusiana*) and lady fern (Athyrium felix-femina), and Jack-in-the-pulpit (*Arisaema triphyllum*). Other species include many wet-tolerant plants such as dwarf raspberry (*Rubus pubescens*), marsh marigold (*Caltha palustris*), and sedges.

Dominant plant species

- black ash (*Fraxinus nigra*), tree
- balsam fir (*Abies balsamea*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- spinulose woodfern (*Dryopteris carthusiana*), other herbaceous

- Jack in the pulpit (*Arisaema triphyllum*), other herbaceous

Community 1.2
Rejuvenated Community Phase

The canopy of the rejuvenated community is still dominate by black ash, but balsam fir and American elm have entered canopy and sub-canopy to fill in canopy gaps created by small-scale disturbances. Advanced regeneration black ash saplings may also gain considerable size. Some additional less shade tolerant species may be able to enter the community.

Dominant plant species

- black ash (*Fraxinus nigra*), tree
- balsam fir (*Abies balsamea*), tree
- American elm (*Ulmus americana*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- Jack in the pulpit (*Arisaema triphyllum*), other herbaceous
- spinulose woodfern (*Dryopteris carthusiana*), 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 canopy openings, releasing advance regeneration and stimulating new seedling establishment. Shade-tolerant balsam fir and mid-tolerant American elm may enter openings.

Pathway 1.2.A
Community 1.2 to 1.1

Time and natural succession. Black ash tolerance to seasonal ponding and soil saturation continues its dominance as most competitive canopy species.

Context dependence. Natural succession

State 2
Open State

Open State consists of two main community phases. Phases are primarily driven by frequency and duration of ponding events that allow or deter establishment of woody, less tolerant species.

Dominant plant species

- gray alder (*Alnus incana*), tree
- gray alder (*Alnus incana*), shrub
- spirea (*Spiraea*), shrub
- sedge (*Carex*), grass

Community 2.1
Prolonged Ponded Phase

The Prolonged Ponding Phase is defined by the increased frequency and duration of ponding events. Communities are dominated by sedges and grasses that can tolerate constant saturation and long periods of standing, stagnant surface water.

Dominant plant species

- sedge (*Carex*), grass

Community 2.2
Seasonal Ponding Phase

Decreased frequency and duration of ponding events. Seasonal ponding where surface water usually drains by midsummer. Allows for establishment of less tolerant species, especially woody species like tag alder.

Dominant plant species

- gray alder (*Alnus incana*), shrub
- spirea (*Spiraea*), shrub
- sedge (*Carex*), grass

Pathway 2.1.A
Community 2.1 to 2.2

Decreased frequency and duration of ponding events. Seasonal ponding where surface water usually drains by midsummer. Allows for establishment of less tolerant species, especially woody species like tag alder.

Pathway 2.2.A
Community 2.2 to 2.1

Increased frequency and duration of ponding events. Community transitions to an open ponded community.

State 3
Agricultural State

These sites have often been put into agricultural production of various crops. Artificial drainage is common including tiling and ditching.

Community 3.1
Agricultural Community

Various crops may be grown on these sites. Most agricultural sites, especially row crop sites, have artificial drainage.

Transition T1A
State 1 to 2

Major stand-replacing disturbance, such as a blow-down or clear cutting. Removal of canopy causes water table to rise. Sites have more frequent and longer duration of ponding events. Other natural disturbance includes American beaver activity—flooding sites near streams by building dams.

Transition T1B
State 1 to 3

Elimination of forest cover and the application of agricultural practices, such as artificial drainage, tilling, and planting crops.

Restoration pathway R2A
State 2 to 1

Decreased frequency and duration of ponding events. Seasonal ponding where surface water drains by midsummer. Recruitment of tree species e.g. black ash on localized mounds or high points.

Transition T2A
State 2 to 3

Elimination of forest cover and the application of agricultural practices, such as artificial drainage, tilling, and planting crops.

Additional community tables

Inventory data references

Sites fit well into ESD and match FnArI Kotar Habitat Type. *Abies balsamea* very well represented on these sites, though that may not be reflected in habitat type. All sites sampled were in the same state—not representative of other states in the state-and-transition model.

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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.

Author(s)/participant(s)	
Contact for lead author	
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):**

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:**
