USDA Natural Resources Conservation Service

Ecological site F093BY005MI
Moist Lowlands

Last updated: 9/27/2023
Accessed: 08/17/2024

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:
Wetland Forest Habitat Types (Kotar, 2017): The sites in this ES keyed out to the following types: *Acer rubrum- Abies balsamea*/Cornus canadensis (ArAbCo), *Acer rubrum- Abies balsamea*/Vaccinium spp. – Coptis trifolia (ArAbVC), *Tsuga canadensis*/*Maianthemum canadense* – Coptis trifolia (TMC), and Acer saccharum – *Tsuga canadensis*/ Athyrium felix-femina – Onoclea sensibilis (ATAtOn).

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

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

Moist Lowlands is a common ecological site throughout MLRA 93B, located on outwash terraces, stream terraces, moraines, and outwash and lake plains. These sites are characterized by very deep, somewhat poorly drained soils that formed in eolian, glaciofluvial, and till deposits. Precipitation and runoff from adjacent uplands are the primary sources of water, but groundwater discharge may be a significant contribution. Soils range from extremely acid to neutral.

The characteristic trait that distinguishes Moist Lowlands from other ecological sites is somewhat poor drainage. These sites have improved drainage over Wet Lowlands, but poorer drainage than upland sites.

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 will typically border Moist Lowlands. They occur slightly lower on the drainage sequence.
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 and occur higher on the drainage sequence than Moist Lowlands.

Similar sites

F093BY003MI	**Floodplains** These sites occur exclusively on Floodplains and form in sandy and loamy alluvium. They are poorly to moderately well drained. Moist Lowlands occupy a unique position on the landscape; they are neither decidedly upland nor lowland, neither dry nor wet. Floodplain sites share this characteristic ambiguity and may sometimes host similar vegetative communities as Moist Lowlands, though Floodplain sites are subject to ponding and flooding whereas Moist Lowland sites are not.

Table 1. Dominant plant species

Tree	(1) *Acer rubrum* (2) *Abies balsamea*
Shrub	(1) *Corylus cornuta* (2) *Lonicera canadensis*
Herbaceous	(1) *Maianthemum canadense* (2) *Trientalis borealis*

Physiographic features

These sites occur on stream terraces, moraines, outwash plains, and lake plains in footslope positions. Slopes range from 0 to 4 percent.

Moist though they may be, these sites are not subjected to flooding nor ponding. Most sites have an apparent seasonally high water table within 15 inches. Perched water tables (episaturation) may occur within 6 inches on sites with fragipans.

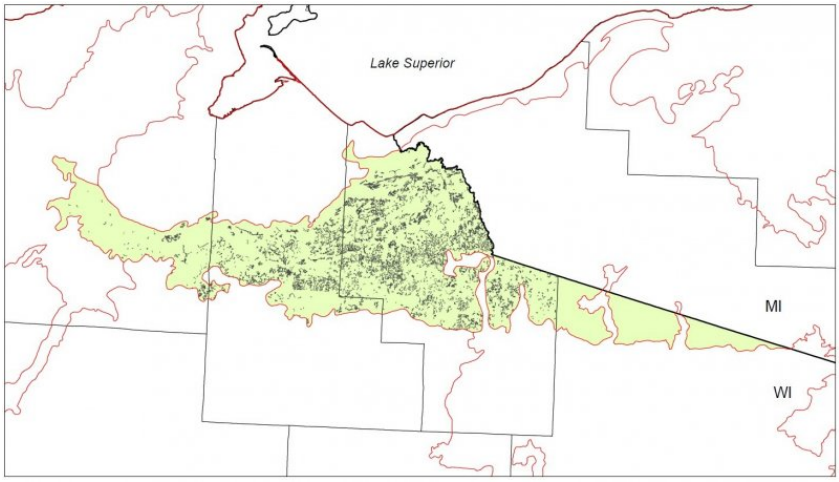


Figure 1. Distribution of Moist Lowlands in the Superior Stoney and Rocky Loamy Plains and Hills, Eastern Part (93B).

Table 2. Representative physiographic features

Landforms	(1) Moraine (2) Outwash plain (3) Stream terrace (4) Lake plain (5) Outwash terrace
Runoff class	Negligible to high
Flooding frequency	None
Ponding frequency	None
Elevation	200–250 m
Slope	0–4%
Water table depth	0–38 cm
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)	76-107 days
Freeze-free period (characteristic range)	115-137 days
Precipitation total (characteristic range)	813-914 mm
Frost-free period (actual range)	56-118 days
Freeze-free period (actual range)	105-154 days
Precipitation total (actual range)	762-940 mm
Frost-free period (average)	90 days
Freeze-free period (average)	127 days
Precipitation total (average)	864 mm

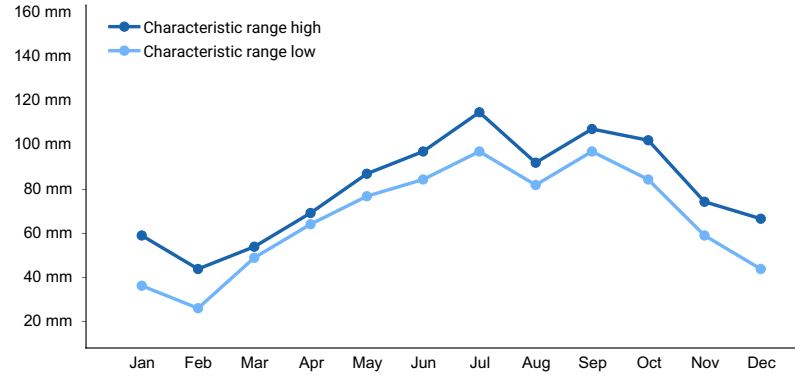


Figure 2. Monthly precipitation range

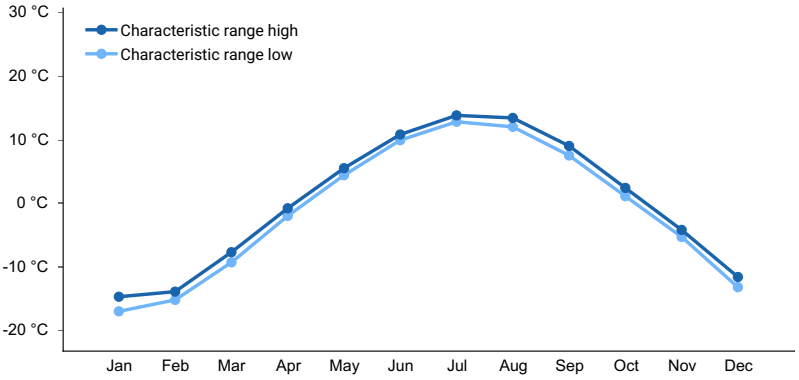


Figure 3. Monthly minimum temperature range

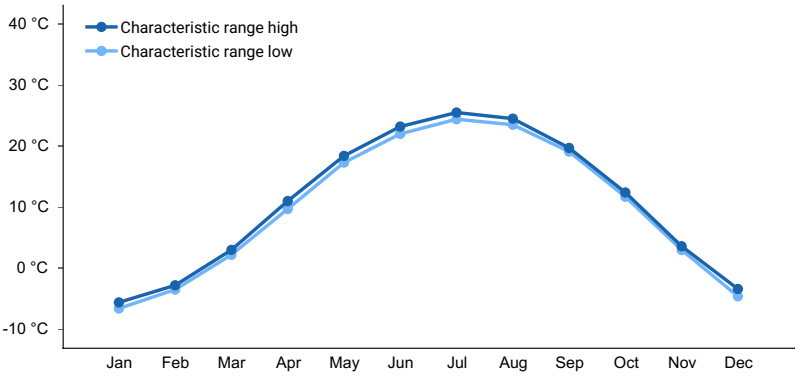


Figure 4. Monthly maximum temperature range

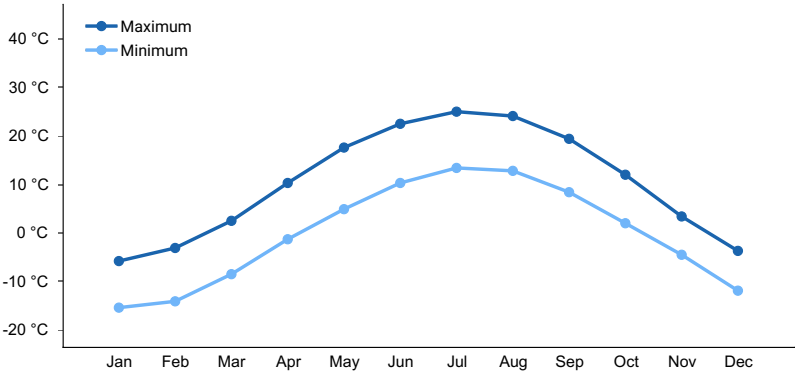


Figure 5. Monthly average minimum and maximum temperature

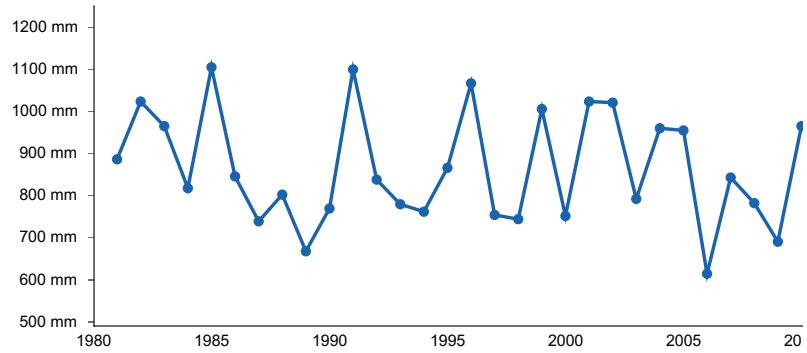


Figure 6. Annual precipitation pattern

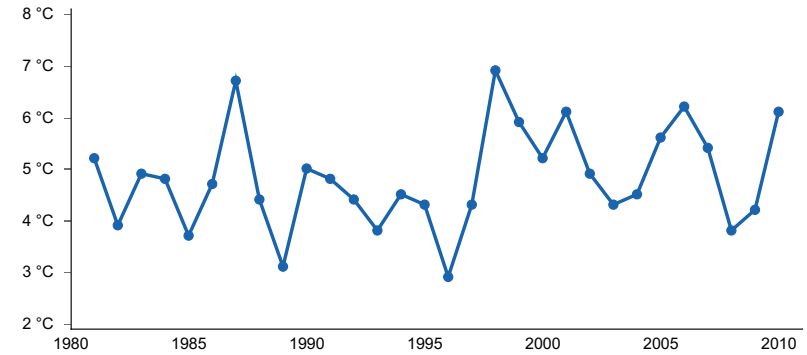


Figure 7. Annual average temperature pattern

Climate stations used

- (1) HURLEY [USC00473800], Ironwood, WI
- (2) MELLEN 4 NE [USC00475286], Mellen, WI
- (3) DRUMMOND [USC00472240], Drummond, WI
- (4) HERMAN [USC00203744], Lanse, MI
- (5) MARQUETTE [USW00014838], Marquette, MI

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 soils is impermeable to moderately slow. The hydrologic soil group of these sites is A/D, B/D, or C/D.

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

Soil features

These sites are represented by the Wormet, Channing, Robago, and Tula series. Wormet and Channing are classified as Typic Endoaquods, while Robgao and Tula are classified as Argic Endoaquods and Argic Fragiorthods, respectively. These soils form in loamy till, loamy lacustrine, or sandy and gravelly outwash. A loamy mantle 16 to 35 inches thick composed of till, loess, or alluvium is often present. Bedrock is absent within 80 inches. These sites are somewhat poorly drained and do not meet hydric soil requirements.

Surface textures are generally sandy loam to very fine sandy loam. Subsurface textures are generally sandy loam to very fine sandy loam, sometimes underlain by gravelly sand or fine sandy loam. Stratification may occur within 20 to 40 inches and may consist of coarse sand to silt loam, sometimes with gravel. Cobbles are sometimes present at

the surface. Subsurface gravel and cobbles are often present and may constitute 2 to 35 percent of all subsurface materials. Soil pH ranges from extremely acid to neutral with values of 4.3 to 6.8. Carbonates are generally absent in these soils.

Parent Material--Kind: Loamy glaciofluvial, sandy and gravelly glaciofluvial, loamy eolian, loamy till
Surface Texture Modifiers: Cobbly
Subsurface Texture: Coarse sand, sand, fine sand, very fine sand, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam
Subsurface Texture Modifiers: Gravelly, very gravelly, cobbly

Table 4. Representative soil features

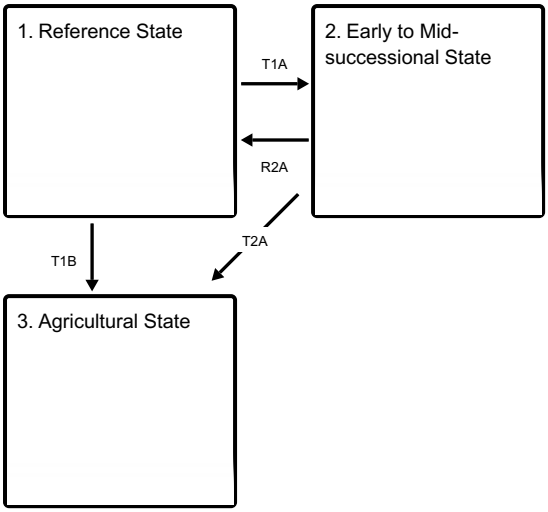
Parent material	(1) Glaciofluvial deposits (2) Eolian deposits (3) Till
Surface texture	(1) Cobbly sandy loam (2) Fine sandy loam (3) Very fine sandy loam
Drainage class	Somewhat poorly drained
Permeability class	Very slow to moderately slow
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0–2%
Available water capacity (Depth not specified)	11.94–24.38 cm
Soil reaction (1:1 water) (Depth not specified)	4.3–6.8
Subsurface fragment volume <=3" (Depth not specified)	7–35%
Subsurface fragment volume >3" (Depth not specified)	0–20%

Ecological dynamics

Because of relatively poorly drained soils, historic fire disturbance has likely been less frequent and less severe than on better drained sites. This is evident by the presence (historic and current) of shade-tolerant and fire sensitive species such as red maple, balsam fir and white spruce. Aspen stands are common in current communities, but they are largely the result of fires associated with past logging. Red maple and balsam fir are the most obvious succeeding species, but white pine and white spruce may also become more important in the future as seed source availability increases. Although the shade-tolerant sugar maple occurs sporadically in some stands its competitive ability is reduced by excessive soil moisture and relatively low nutrient availability. For these reasons it is likely to remain only as a sporadic associate rather than the dominant component of mature forest communities as is typically the case on all mesic sites throughout northern Wisconsin.

State and transition model

Ecosystem states



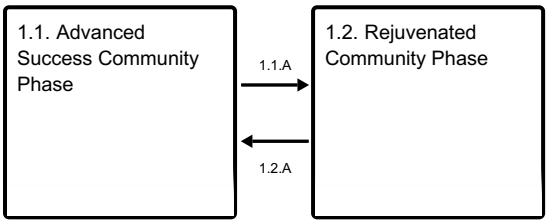
T1A - Stand replacing disturbance

T1B - Clearing; agricultural production

R2A - Natural restoration

T2A - Clearing; agriculture production

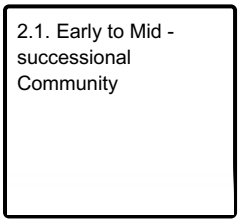
State 1 submodel, plant communities



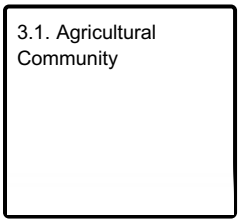
1.1.A - Large disturbance

1.2.A - Advanced regeneration response to canopy disturbance

State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference State

Reference state is a forest community dominated by mixed conifers, principally balsam fir (*Abies balsamea*) and white spruce (*Picea glauca*) and scattered individuals of northern white cedar (*Thuja occidentalis*), eastern hemlock (*Tsuga canadensis*), or white pine (*Pinus strobus*), often with admixture of several deciduous species, typically red maple (*Acer rubrum*), paper birch (*Betula papyrifera*), or trembling aspen (*Populus tremuloides*). 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

- balsam fir (*Abies balsamea*), tree
- red maple (*Acer rubrum*), tree
- white spruce (*Picea glauca*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- honeysuckle (*Lonicera*), shrub
- Canada mayflower (*Maianthemum canadense*), other herbaceous
- starflower (*Trientalis borealis*), other herbaceous

Community 1.1
Advanced Success Community Phase

In absence of stand replacing disturbance (period of 60-80 years) this community is dominated entirely by conifers, or it contains an admixture of old and decaying stems of aspen and/or paper birch. This mixture would be a result of typical succession process of conifer invasion of pioneer aspen-birch stands. In some areas, white pine, northern red cedar, or red maple are common associates. Pre-European settlement forests often contained scattered very large, old white pines that had survived one or more stand-replacing fires in the past. The tree reproduction layer is dominated by balsam fir, with lesser abundance of white spruce and/or red maple. The density of the reproduction is strongly dependent on degree of canopy openings resulting from natural mortality, or small-scale disturbance by wind and ice storms. On some sites today, we see red maple has potential of becoming a dominant canopy tree species, not only an associate to balsam fir or other conifer. The shrub and herb layers also depend on the degree of canopy opening. The dominant shrub typically is beaked hazel (*Corylus cornuta*). Common associates are mountain maple (*Acer spicatum*), juneberry (Amelanchier spp.), bush-honeysuckle (*Diervilla lonicera*), fly-honeysuckle (Lonicera Canadensis) and blueberries (Vaccinium spp.). The herb layer often is well developed and species rich. Canada mayflower (*Maianthemum canadense*) and American starflower (*Trientalis borealis*) typically dominate the layer. Other well-represented species include: bracken fern (*Pteridium aquilinum*), big leaf aster (*Eurybia macrophylla*), wild sarsaparilla (*Aralia nudicaulis*), bunchberry (Cornus Canadensis), twisted stalk (Streptopus roseus), yellow Bead-lily (*Clintonia borealis*) and sweet-scented bedstraw (*Galium triflorum*).

Dominant plant species

- balsam fir (*Abies balsamea*), tree
- red maple (*Acer rubrum*), tree
- white spruce (*Picea glauca*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- honeysuckle (*Lonicera*), shrub
- Canada mayflower (*Maianthemum canadense*), other herbaceous
- starflower (*Trientalis borealis*), other herbaceous

Community 1.2
Rejuvenated Community Phase

Disturbance described in 1.1A typically removes over-mature trees, especially old aspen and birch, from the overstory and releases advanced regeneration of balsam fir and red maple, leading to community dominated by these species. Some presence of white spruce, white pine, and some deciduous species may also result under favorable conditions, but trembling aspen and paper birch regeneration typically is not successful if disturbances do not include fire.

Dominant plant species

- paper birch (*Betula papyrifera*), tree
- balsam fir (*Abies balsamea*), tree
- red maple (*Acer rubrum*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- honeysuckle (*Lonicera*), shrub

- starflower (*Trientalis borealis*), other herbaceous
- Canada mayflower (*Maianthemum canadense*), other herbaceous

Pathway 1.1.A
Community 1.1 to 1.2

Blow-down, severe ice storm, or large-scale mortality in overstory.

Pathway 1.2.A
Community 1.2 to 1.1

Rejuvenated community matures into Community Phase 1.1 in a self-replacement process.

State 2
Early to Mid-successional State

Pure, or mixed, aspen – paper birch community replaces the reference state community 1. If seed source is present, red maple readily becomes member of this community.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- red maple (*Acer rubrum*), tree
- paper birch (*Betula papyrifera*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- Canada mayflower (*Maianthemum canadense*), other herbaceous
- starflower (*Trientalis borealis*), other herbaceous

Community 2.1
Early to Mid -successional Community

Pure, or mixed, aspen – paper birch community replaces the reference state. Red maple may be in this community if seed sources are available.

Dominant plant species

- paper birch (*Betula papyrifera*), tree
- quaking aspen (*Populus tremuloides*), tree
- red maple (*Acer rubrum*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- Canada mayflower (*Maianthemum canadense*), other herbaceous
- starflower (*Trientalis borealis*), other herbaceous

State 3
Agricultural State

This state focuses on agricultural production. Many species are possible. Plant selection depends on landowner goals and objectives.

Community 3.1
Agricultural Community

Various crops can be grown on these sites. Species selection will depend on landowner goals and objectives.

Transition T1A
State 1 to 2

Stand replacing disturbance that may include blow-down or ice storm, but must include fire to eliminate slash and

competing vegetation and expose mineral soil to allow aspen and/or paper birch to colonize the site by seed. Alternatively, if the disrupted reference state community included aspen trees, the species may become re-established by vegetative means, which typically is more successful than colonization by seed.

Transition T1B
State 1 to 3

Removal of forest cover and tilling for agricultural crop production

Restoration pathway R2A
State 2 to 1

Deciduous forest community is slowly invaded by conifers

Transition T2A
State 2 to 3

Removal of forest cover and tilling for agricultural crop production

Additional community tables

Inventory data references

Seven sites were sampled in this ESD, with quite a bit of variance in Kotar Habitat Type. Habitat types keyed out to a general grouping of wet-mesic and nutrient poor-medium sites. State-and-Transition model based on the ArAbCo Habitat Type. Not all sites are best represented by this habitat type.

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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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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:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
