USDA Natural Resources Conservation Service

Ecological site F092XY011WI
Moist Loamy Lowlands

Last updated: 4/09/2020
Accessed: 05/12/2025

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): 092X–Superior Lake Plain

The Wisconsin portion of the Superior Lake Plain (MLRA 92) corresponds very closely to the Superior Coastal Plain Ecological Landscape published by Wisconsin Department of Natural Resources (WDNR 2015). The following brief overview of this MLRA is borrowed from that publication.

The Superior Coastal Plain is bordered on the north by Lake Superior and on the south by the Northwest Sands, Northwest Lowlands, and North Central Forest Ecological Landscapes. The total land area is approximately 1.2 million acres, which mostly consists of privately-owned forestland. The climate is strongly influenced by Lake Superior, resulting in cooler summers, warmer winters, and greater precipitation compared to more inland locations. The most extensive landform in this ecological landscape is a nearly level plain of lacustrine clays that slopes gently northward toward Lake Superior. The coastal plain is cut by deeply incised stream drainages and interrupted by the comparatively rugged Bayfield Peninsula.

During the Late Wisconsin glacial period, this area was covered with the advancing and retreating lobes of Superior and Chippewa. The landscape was rippled with moraines, but they were subdued by deposition of lacustrine materials. As the glaciers receded, glacial lakes riddled the landscape—most notably, Glacial Lake Duluth. The glacier receded eastward, exposing the western Lake Superior Basin. The ice covered the eastern basin, blocking the outlet of the lake, and continued to recede and contribute meltwaters that filled the glacial lake. The deep, red clays were deposited during this period of glacial lakes. The meltwaters from the glacier also contained sands which were deposited along the edge of the glacial lakes as beach deposits. Deep, narrow valleys have since been carved by rivers and streams flowing north into Lake Superior.

Historically, the Superior Coastal Plain was almost entirely forested. Various mixtures of eastern white pine (*Pinus strobus*), white spruce (*Picea glauca*), balsam fir (*Abies balsamea*), white birch (*Betula papyrifera*), balsam poplar (Populus balsamifera), quaking aspen (*Populus tremuloides*), and northern white-cedar (*Thuja occidentalis*) occurred on the fine-textured glacio-lacustrine deposits bordering much of the Lake Superior coast. Sandy soils, sometimes interlayered with clays, occur in some places. Such areas supported forests dominated by eastern white pine and red pine (Pinus resinosa). Eastern white pine was strongly dominant in some areas, according to mid-19th century notes left by surveyors of the federal General Land Office (Finley, R. 1976). Dry-mesic to wet-mesic northern hardwoods or hemlock-hardwood forests were prevalent on the glacial tills of the Bayfield Peninsula. Large peatlands occurred along the Lake Superior shoreline, associated with drowned river mouths.

Classification relationships

Habitat Types of N. Wisconsin (Kotar, 2002): Three sites in this ES key out to *Acer rubrum – Abies balsamea* / Vaccinium spp. – Cornus canadensis [ArAbVCo], three sites key out to *Acer rubrum – Abies balsamea* / Sanicula spp. [ArAbSn], and two sites key out to Acer saccharum / Sanicula spp. - Mitchella repens [ASnMi].

Biophysical Setting (Landfire, 2014): This is ES is mapped as Larentian – Acadian Northern Hardwoods Forest –

Hemlock, Laurentian – Acadian Sub-boreal Mesic Balsam Fir-Spruce Forest, and Laurentian – Acadian – Pine – Hemlock – Hardwood Forest. The ES is not well represented by any of these, but most similar to Sub-Boreal Mesic Balsam Fir - Spruce Forest.

WDNR Natural Communities (WDNR, 2015): This ES is not well represented by any of the described natural communities, but bears some resemblance to Northern Wet-Mesic Forest and Boreal Forest.

USFS Subregions: Superior-Ashland Clay Plain Subsection (212Ya); May contain small areas of Ewen Dissected Lake Plain Subsection (212Jo), Winegar Moraines Subsection (212Jc), Gogebic-Penokee Iron Range Subsection (212Jb), and NorthShore Highlands Subsection (212Lb)*

Major Land Resource Area (MLRA): Superior Lake Plain (92)

Ecological site concept

Moist Loamy Lowlands has a small extent across MLRA 92. These sites have soils with some variability, but the central concept is finer materials throughout or at some depth in the soil profile, upland position, and are somewhat poorly drained, so they remain moist except in dry periods. The soils formed in loamy and silty till, in stratified silty glaciolacustrine deposits, in stratified loamy glaciolacustrine or glaciofluvial deposits, or in a sandy glaciofluvial mantle over the loamy to silty deposits. The soils range from extremely acid to moderately alkaline.

Historically, shade tolerant balsam fir and white spruce were best represented tree species on this ES, but scattered white and red pines were also common. Following early logging, trembling aspen became the dominant forest type, but succession to balsam fir and, to a lesser degree, white spruce and red maple is evident everywhere where seed sources are present. While there is no good record of the degree of red maple representation in the pre European settlement forests, the species is well represented and successfully reproducing today. Ground flora includes ferns, sedges, grasses, raspberries, horsetail, and yellow bead-lily.

This ES differs from other loamy ES' based on its drainage class and remaining moist for most of the growing season. It differs from Moist Sandy Lowlands and Moist Clayey Lowlands based on soil texture, parent material, and the height of seasonally high water table. Moist Sandy Lowlands often has a seasonally high water table of 30 to 76 cm, the clayey uplands has a depth of 0 to 30 cm, and this loamy uplands has a depth of 0 to 76 cm. The range in characteristics of Moist Loamy Lowlands is based on its range in parent materials—mainly the presence of a sandy mantle on some sites.

Associated sites

F092XY007WI	**Wet Loamy or Clayey Lowlands** These sites are poorly drained soils formed in mainly clayey though sometimes loamy glaciofluvial and silty glaciolacustrine sediments. They have a seasonally high water table and remain saturated for much of the growing season, creating hydric conditions. HGM criteria: recharge, Depressional. The loamy sites are often adjacent to Moist Loamy Lowlands, but located on a lower landscape position in the drainage sequence.
F092XY014WI	**Loamy Uplands** These sites are deep, moderately well to well drained loamy soils. They formed in loamy and silty till, glaciolacustrine, or glaciofluvial deposits. Some sites have a sandy mantle. Many sites have a seasonally high water table, but does not remain saturated for the growing season. Soils range from strongly acid to strongly alkaline, and some sites have carbonates present. These sites are often adjacent to Moist Loamy Lowlands, but located on a higher landscape position in the drainage sequence.
F092XY009WI	**Loamy Sandstone Uplands** These sites are shallow loamy soils that overly sandstone bluffs along the shore of Lake Superior. They are moderately well drained soils, but have a seasonally high water table. The soils range from strongly acid to neutral. These sites may occur adjacent to Moist Loamy Lowlands, but located on a higher landscape position in the drainage sequence.

Similar sites

F092XY010WI	**Moist Sandy Lowlands** Moist Sandy Lowlands have a sandy mantle overlying finer glaciofluvial materials. The finer materials can cause episaturation in spring and fall, allowing the site to remain moist for some of the growing season, but does not remain saturated, nor does it have hydric conditions. Sites are characterized by the ArAbVCo Habitat Type. These sites are found in a similar landscape to Moist Loamy Lowlands, but are coarser textured and in a different drainage sequence.
F092XY012WI	**Moist Clayey Lowlands** These sites are somewhat poorly drained soils with fine textures that formed in clayey deposits. Some sites have a sandy or loamy mantle. The fine materials cause episaturation in spring and fall and remain saturated for extended period, but the water table can reach depths of 152cm during dry periods. Soils range from strongly acid to strongly alkaline. Carbonates present in some soils beginning at 30cm. Sites are characterized by the ArAbVCo Habitat Type. These sites are found in a similar landscape to Moist Loamy Lowlands, but are finer textured and in a different drainage sequence.

Table 1. Dominant plant species

Tree	(1) *Acer rubrum* (2) *Abies balsamea*
Shrub	(1) *Corylus cornuta* (2) *Alnus incana ssp. rugosa*
Herbaceous	(1) *Pteridium aquilinum* (2) *Eurybia macrophylla*

Physiographic features

This site occurs on plains, drainageways, terraces, and footslopes located on till plains, lake plains, and outwash plains. Landform shape is predominantly linear, but can be concave on footslopes. Elevation of the landforms range from 185 to 330 meters above sea level. Slopes are 0 to 4 percent. This site occurs on all slope aspects.

Table 2. Representative physiographic features

Landforms	(1) Till plain > Drainageway (2) Till plain > Terrace (3) Lake plain (4) Outwash plain
Runoff class	Medium to high
Elevation	185–330 m
Slope	0–4%
Water table depth	76 cm
Aspect	Aspect is not a significant factor

Climatic features

The Moist Loamy Lowlands PESD is located throughout the MLRA, but most concentrated along the southern extent with some sites extending up into the Bayfield Peninsula. The annual average precipitation ranges from 29-34 inches, with a range of 56-167 inches of annual average snowfall (PRISM, 1981-2010). The annual average minimum temperature ranges from 28-33oF, and the maximum temperature ranges from 47-52oF (PRISM, 1981-2010). The length of the freeze free period ranges from 156 to 194 days, with an average of 171 days (Table 2). The length of the frost-free period ranges from 130 to 166 days, with an average of 144 days (Table 2).

Table 3. Representative climatic features

Frost-free period (characteristic range)	80-113 days
Freeze-free period (characteristic range)	116-137 days

Precipitation total (characteristic range)	787-813 mm
Frost-free period (actual range)	69-114 days
Freeze-free period (actual range)	107-138 days
Precipitation total (actual range)	762-838 mm
Frost-free period (average)	95 days
Freeze-free period (average)	126 days
Precipitation total (average)	787 mm

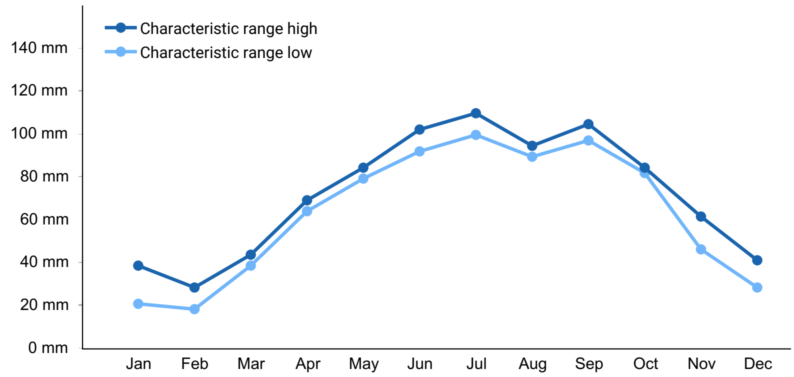


Figure 1. Monthly precipitation range

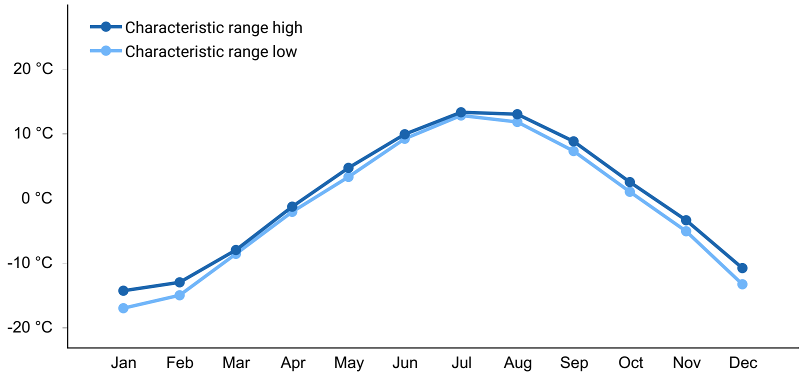


Figure 2. Monthly minimum temperature range

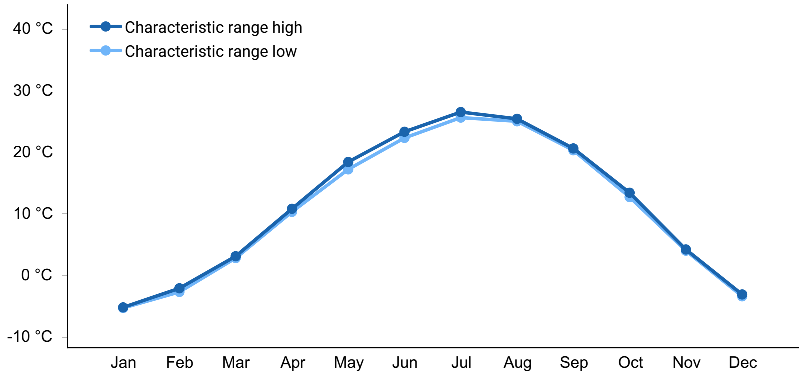


Figure 3. Monthly maximum temperature range

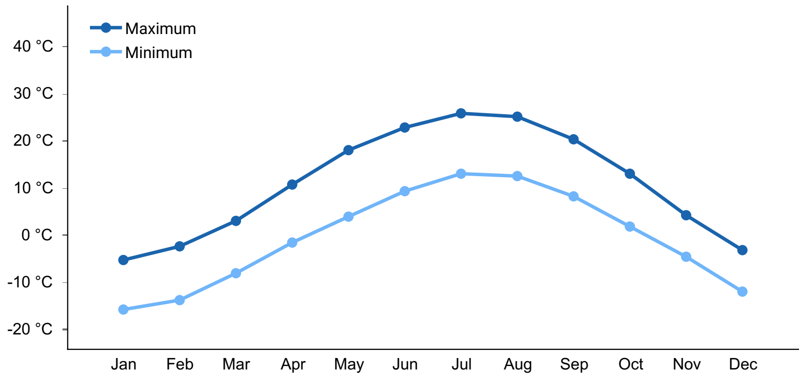


Figure 4. Monthly average minimum and maximum temperature

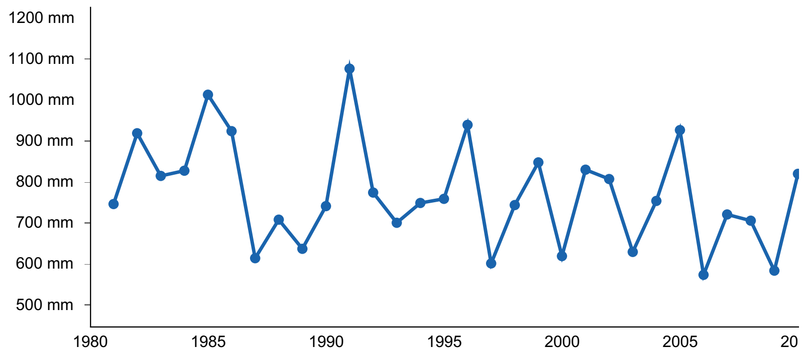


Figure 5. Annual precipitation pattern

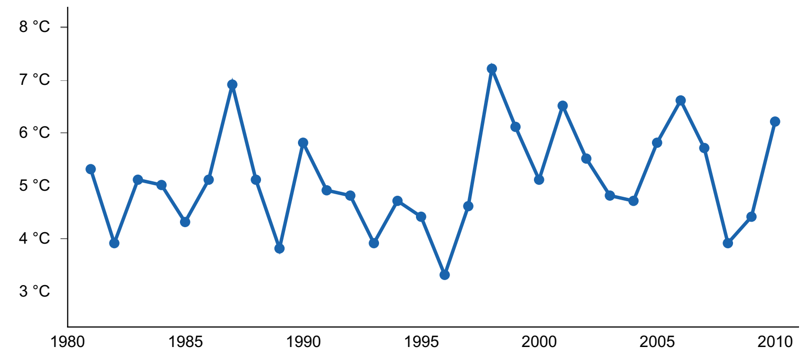


Figure 6. Annual average temperature pattern

Climate stations used

- (1) ASHLAND 3S [USC00470347], Ashland, WI
- (2) ASHLAND KENNEDY MEM AP [USW00094929], Ashland, WI
- (3) ASHLAND EXP FARM [USC00470349], Ashland, WI
- (4) BAYFIELD 6 N [USC00470603], Bayfield, WI
- (5) FOXBORO [USC00472889], Foxboro, WI
- (6) MADELINE ISLAND [USC00474953], La Pointe, WI

Influencing water features

Water is received primarily through precipitation, from runoff from adjacent uplands, and from ground water. Water is lost from the site primarily through runoff, evapotranspiration, and ground water recharge.

Permeability of the soil is slow to moderately slow. Runoff potential is medium to high. The hydrologic group of this site is either C or D.

Enough water will percolate into the soil resulting in a perched seasonally high water table (episaturation), or an apparent seasonally high water table (endosaturation), at a depth of 0 to 76 cm during spring, but will range to greater than 152 cm under dry conditions. Water that percolates into the soil is generally lost through plant uptake and evapotranspiration. There is potential for significant ground water recharge.

Soil features

The soils of this site are represented by the Brimley, Iosco, Oronto, Robago, and Spear soil series. These soils are classified as Glossaqualfs (Oronto), Endoaquods (Brimley, Iosco, and Robago), and Glossudalfs (Spear).

This ecological site is characterized by very deep, somewhat poorly drained soils formed in loamy and silty till (Oronto), in stratified silty glaciolacustrine deposits (Spear), in stratified loamy glaciolacustrine or glaciofluvial deposits (Brimley and Robago), or in a sandy glaciofluvial mantle over the loamy to silty deposits (Iosco).

The average gravel content within the soil can be as much as 7 percent, while the average content of cobbles and stones can be as much as 2 percent. Soil reaction (pH) in the upper 100 cm ranges from extremely acid to moderatrely alkaline. Carbonates occur as shallow as 56 cm, but may be absent within 200 cm.

Table 4. Representative soil features

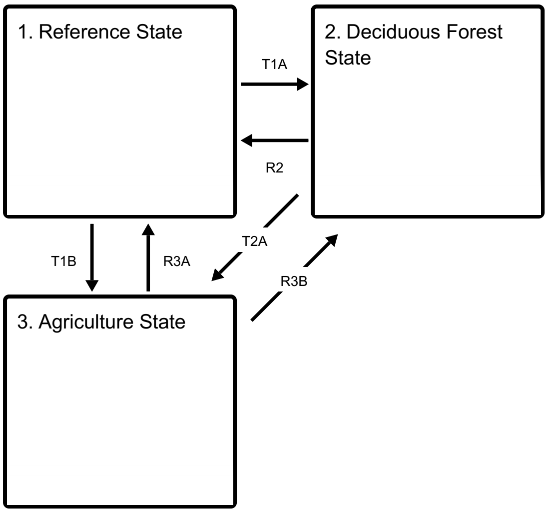
Parent material	(1) Glaciolacustrine deposits (2) Glaciofluvial deposits
Surface texture	(1) Silty clay loam (2) Silt loam (3) Fine sandy loam (4) Loamy sand
Drainage class	Somewhat poorly drained
Permeability class	Slow to moderately slow
Soil depth	203 cm
Available water capacity (0-152.4cm)	10.62–19.25 cm
Calcium carbonate equivalent (0-101.6cm)	0–13%
Soil reaction (1:1 water) (0-101.6cm)	4.4–8.1
Subsurface fragment volume <=3" (0-101.6cm)	1–7%
Subsurface fragment volume >3" (0-101.6cm)	0–2%

Ecological dynamics

Because of relatively poorly drained soils historic fire disturbance has likely been less frequent and less severe than on the 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 that includes fire.

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

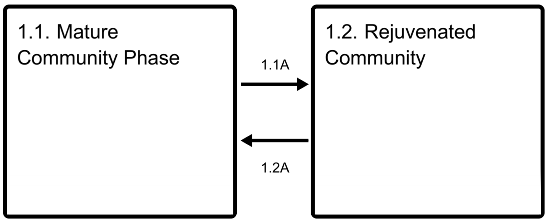
R2 - Deciduous forest community is slowly invaded by conifers.

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.

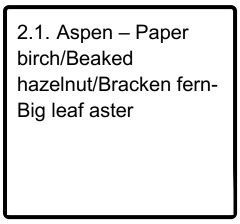
State 1 submodel, plant communities



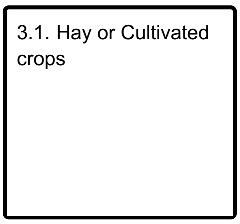
1.1A - Blow-down, severe ice storm, or large-scale mortality in overstory.

1.2A - 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*, or white pine

(*Pinus strobus*), often with admixture of several deciduous species, most often trembling aspen (*Populus tremuloides*), paper birch (*Betula papyrifera*), or red maple (*Acer rubrum*). Understory vegetation, both shrub and herb layers, is well developed and diverse. Principle shrubs include beaked hazelnut (*Corylus cornuta*), speckled alder (*Alnus incana*) and red-osier dogwood (Cornus stolonifera). Herb layer typically is dominated by bracken fern (*Pteridium aquilinum*) and big-leaf aster (Aster macrophyllum). Other common species include wild strawberry (*Fragaria virginiana*), wild sarsaparilla (*Aralia nudicaulis*), bunchberry (Cornus Canadensis), snakeroot (*Sanicula marilandica*) and horsetails (Equisitum spp.). Depending on history of disturbance, two distinct community phases can be recognized.

Community 1.1
Mature Community Phase

In the 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 is 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. 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 the degree of canopy openings resulting from natural mortality, or small scale disturbance by wind and ice storms. 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 speckled alder (*Alnus incana*), red osier dogwood (Cornus stolonifera) and wild rose (Rosa spp.). The herb layer often is well developed and species rich. Bracken fern (Pteridiun equilinum) and large-leaved aster (Aster macrophyllus) typically are most abundant herbs. Other common species include wild strawberry (Fragaria spp.), wild sarsaparilla (*Aralia nudicaulis*), bunchberry (Cornus Canadensis,) and horsetails (Equisitum spp.).

Community 1.2
Rejuvenated Community

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

Pathway 1.1A
Community 1.1 to 1.2

A major canopy disturbance. Blow-down, severe ice storm, or large-scale mortality in overstory due to old age.

Pathway 1.2A
Community 1.2 to 1.1

A long period without major canopy disturbances again leads to mature conifer community, similar to community phase 1.1, but without significant presence of aspen and birch.

State 2
Deciduous Forest State

Pure, or mixed, aspen – paper birch community replaces the reference state community 1.1. If seed source is present, red maple readily becomes member of this community.

Community 2.1
Aspen – Paper birch/Beaked hazelnut/Bracken fern-Big leaf aster

This deciduous forest phase is most commonly composed of pure or mixed aspen and paper birch after some disturbance (cutting or fire). Red maple may be part of this community if the seed source is present.

State 3

Agriculture State

On clayey soils in MLRA 92 the most common agricultural activity is cultivation of hay.

Community 3.1
Hay or Cultivated crops

This community phase includes cleared land for agriculture and is most likely in hay production.

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, 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 R2
State 2 to 1

Deciduous forest community is slowly invaded by conifers (balsam fir, white spruce, black spruce, white pine, white cedar) and red maple.

Transition T2A
State 2 to 3

Removal of forest cover and tilling for agricultural crop production.

Restoration pathway R3A
State 3 to 1

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

Restoration pathway R3B
State 3 to 2

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

Additional community tables

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Approval

Chris Tecklenburg, 4/09/2020

Acknowledgments

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	05/12/2025
Approved by	Chris Tecklenburg
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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

17. **Perennial plant reproductive capability:**