USDA Natural Resources Conservation Service

Ecological site F093BY011MI
Dry Uplands

Last updated: 9/27/2023
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General information

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

MLRA notes

Major Land Resource Area (MLRA): 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 *Pinus strobus* – *Acer rubrum* / Vaccinium angustifolium – *Aralia nudicaulis* (PArVAa), and one site keys to to *Pinus strobus* – *Acer rubrum* / Vaccinium angustifolium (PArV).

Biophysical Setting (Landfire, 2014): This ES is mapped as Laurentian-Acadian Northern Hardwoods Forest – Hemlock and Laurentian-Acadian Northern Hardwoods Forest; though, it is not well represented by these descriptions.

WDNR Natural Communities (WDNR (2015): This ES is most similar to the Northern Dry-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

The Dry Uplands ecological site is an uncommon site in MLRA 93B, located on outwash plains, outwash terraces, and eskers. These sites are characterized by very deep, excessively drained soils that formed in sandy and gravelly outwash. Precipitation and runoff from adjacent uplands are the primary sources of water. Soils range from strongly acid to moderately acid.

The characteristic trait of Dry Uplands is their excessive drainage, distinguishing this site from all other sites in MLRA 93B. Vegetation must be tolerant of dry, sandy soils.

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 Dry 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 lower on the drainage sequence than Dry Uplands.
F093BY007MI	**Sandy Uplands** Sandy Uplands occur on upland sites in deep sandy outwash deposits, sometimes with a thin loamy mantle of alluvium or loess. Argillic horizons are neither present nor forming in these soils. These soils are moderately well to somewhat excessively drained. These sites may occur slightly lower on the drainage sequence than Dry Uplands.

Similar sites

F093BY007MI	**Sandy Uplands** Sandy Uplands occur on upland sites in deep sandy outwash deposits, sometimes with a thin loamy mantle of alluvium or loess. Argillic horizons are neither present nor forming in these soils. Textures and landscapes positions are similar between these two sites, but Dry Uplands are exclusively excessively drained, whereas Sandy Uplands are moderately well to somewhat excessively drained. Despite this, vegetative communities supported by these two sites are similar, hovering somewhere around dry-mesic with medium nutrient requirements.

Table 1. Dominant plant species

Tree	(1) *Pinus strobus* (2) *Pinus resinosa*
Shrub	(1) *Corylus cornuta* (2) *Lonicera canadensis*
Herbaceous	(1) *Trientalis borealis* (2) *Pteridium aquilinum*

Physiographic features

These sites are found on outwash plains and terraces and on esker sin backslope, shoulder, and summit positions. Slope ranges from 0 to 45 percent. These sites are subject to neither ponding nor flooding. Surface runoff of these highly permeable sites is negligible to medium.

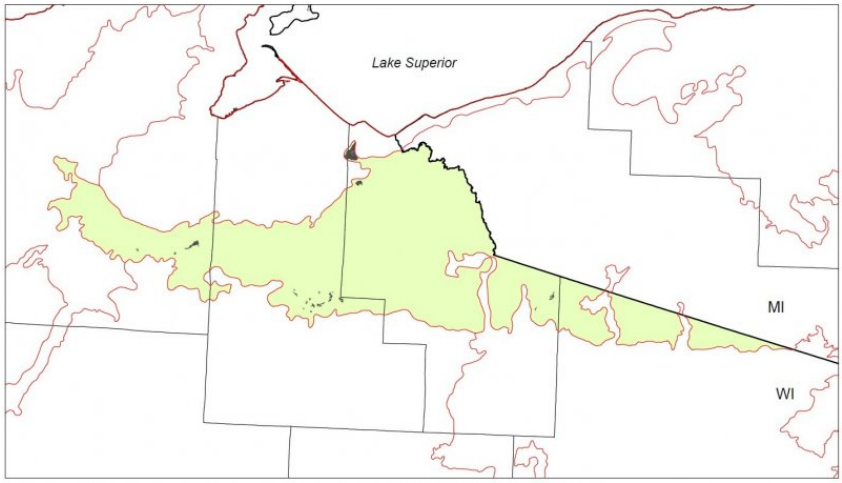


Figure 1. Distribution of Dry Uplands in the Superior Stoney and Rocky Loamy Plains and Hills, Eastern Part (93B)

Table 2. Representative physiographic features

Landforms	(1) Outwash plain (2) Outwash terrace (3) Esker
Runoff class	Negligible to medium
Flooding frequency	None
Ponding frequency	None
Elevation	656–820 ft
Slope	0–45%
Water table depth	78–80 in
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)	29-34 in
Frost-free period (actual range)	84-121 days
Freeze-free period (actual range)	120-157 days
Precipitation total (actual range)	28-36 in
Frost-free period (average)	104 days
Freeze-free period (average)	137 days
Precipitation total (average)	32 in

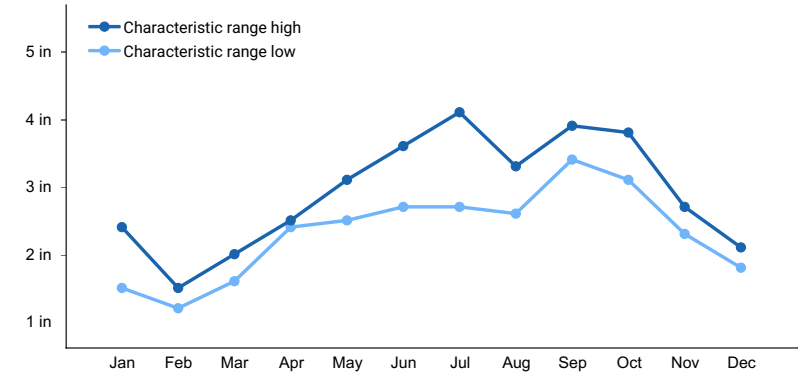


Figure 2. Monthly precipitation range

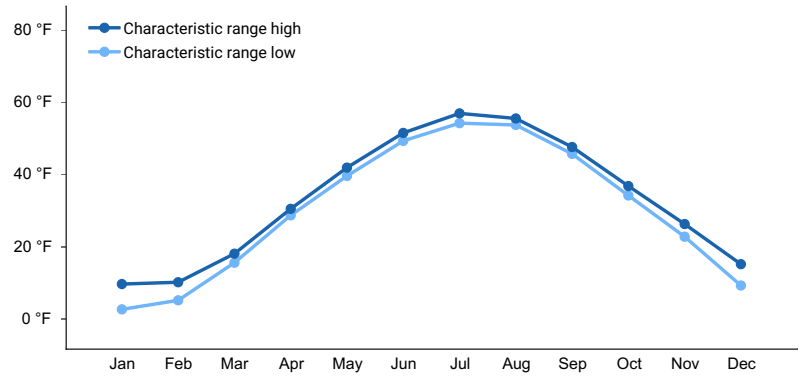


Figure 3. Monthly minimum temperature range

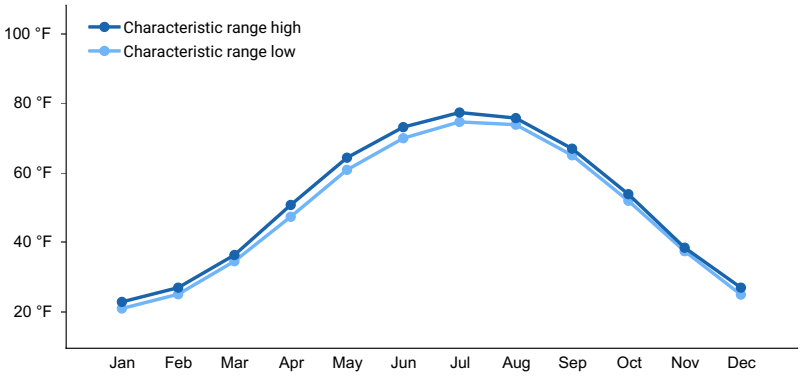


Figure 4. Monthly maximum temperature range

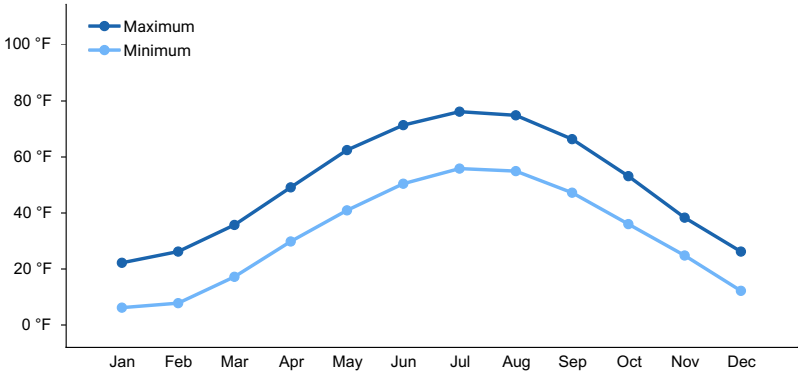


Figure 5. Monthly average minimum and maximum temperature

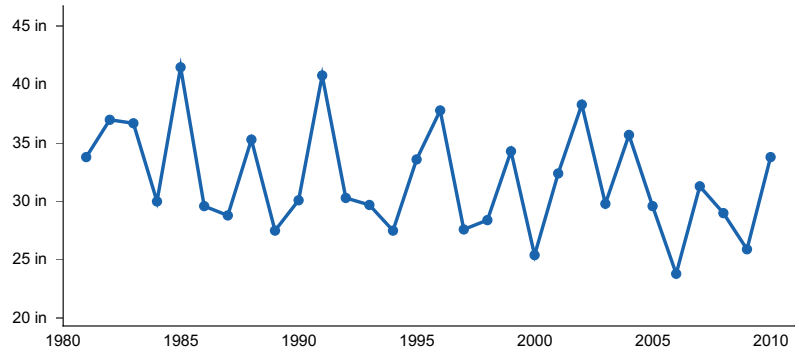


Figure 6. Annual precipitation pattern

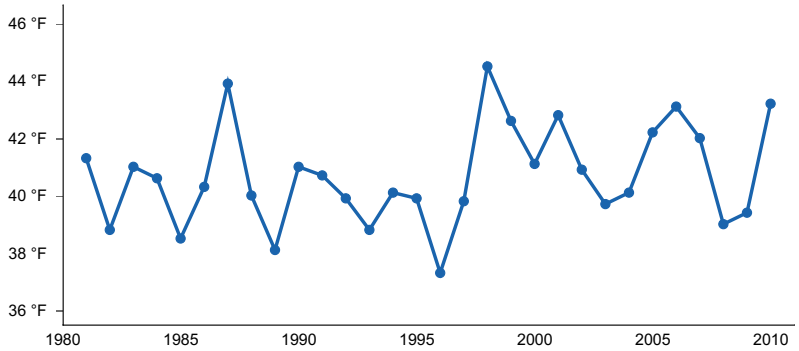


Figure 7. Annual average temperature pattern

Climate stations used

- (1) MELLEN 4 NE [USC00475286], Mellen, WI
- (2) 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 moderate or rapid. The hydrologic soil group of these sites is A.

Hydrologic Group: A
Hydrogeomorphic Wetland Classification: None
Cowardin Wetland Classification: None

Soil features

These sites are represented by the Sayner, Vilas, and Rubicon series, all of which are classified as Entic Haplorthods.

These sites are found in the sandiest, most permeable soils in the driest landscape positions in this MLRA. They form in sandy outwash with or without gravel. They are very deep and excessively drained. Permeability is moderate to rapid. They do not meet hydric soil requirements.

Surface texture is loamy sand. Subsurface textures range from coarse and to loamy sand. Soil pH ranges from strongly acid to moderately acid with values of 5.3 to 5.9. Carbonates are absent in these soils.

Parent Material--Kind: Sandy outwash, sandy and gravelly outwash
Parent Material--Origin: Outwash

Surface Texture: Loamy sand
Surface Texture Modifiers: None
Subsurface Texture: Coarse sand, sand, loamy sand
Subsurface Texture Modifiers: Gravelly, very gravelly
Soil Series: Vilas, Sayner, Rubicon
Drainage Class: Excessively drained
Permeability Class: Moderate, rapid
Hydric Soils: No
Hydric Soil Criterion: None

Table 4. Representative soil features

Parent material	(1) Outwash
Surface texture	(1) Gravelly, very gravelly loamy sand
Drainage class	Excessively drained
Permeability class	Moderate to rapid
Soil depth	78 in
Surface fragment cover <=3"	0–7%
Surface fragment cover >3"	0–5%
Available water capacity (Depth not specified)	3.1–4.24 in
Calcium carbonate equivalent (Depth not specified)	0%
Soil reaction (1:1 water) (Depth not specified)	5.3–5.9
Subsurface fragment volume <=3" (Depth not specified)	7–25%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

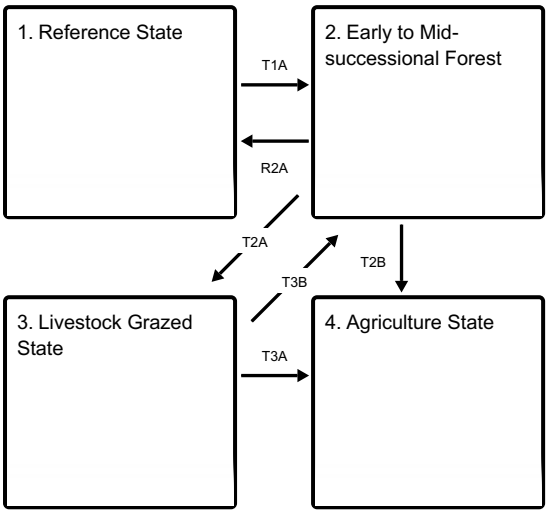
Perhaps the most important ecological characteristic of this Ecological Site, in terms of influence on forest community dynamics, is its limited capacity to support the high to moderate soil moisture and nutrient requiring species such as sugar maple, basswood and white ash, the shade-tolerant species, commonly known as the northern hardwoods, that typically dominate the more productive sites throughout northern Wisconsin. Although these species do occur sporadically on this Ecological Site, their regeneration capacity and growth rates are sub-optimal, thus precluding their canopy dominance.

In pre-European settlement time wildfire was the main controlling factor of forest community dynamics. Following a severe, stand-replacing fire, any of the naturally occurring species could become established, depending on the seed source and specific conditions of post-fire seedbed. The newly established young stands of any species were easily eliminated by recurring fires, but differences in fire-resisting properties among the species began to play a role in any species' survival success. White pine is best adapted for long-term success on this Ecological Site. Although vulnerable to damage or elimination by fire in early life it eventually develops thick fire-resistant bark which helps to extend its longevity, in some cases for up to four centuries or more. These survival properties assure the species' relatively continuous seed source in the region as a whole. White pine is also moderately shade-tolerant in early life which means that it can become established in some pioneer communities, such as aspen – white birch stands, or in poorly stocked oak and red maple dominated communities. Red pine had in the past been a common associate of white pine stands. It shares some of the fire-resisting properties of white pine, but it lacks shade-tolerance and does not become established in the understory. For this reason it has not maintained its presence in current stands and its seed source has been greatly reduced throughout its natural range following the unset of fire suppression.

Red maple (*Acer rubrum*) has not been identified by Finley (1976) as a component of pre-settlement pine forests, but it is a prominent member in current stands. Absence of fire since the end of the original logging era is probably the main reason. Red maple is extremely sensitive to fire, but is a prolific and early seed producer. Stems of 2-4 inches in diameter can produce large amounts of seed (USDA For. Serv. 1990). It is sufficiently shade-tolerant to become established in the understories of most communities on sandy soils. On this Ecological Site it behaves similarly to white pine, but because of its natural, much smaller stature at maturity, it does not compete with white pine in the upper canopy

State and transition model

Ecosystem states



T1A - Stand replacing disturbance e.g. blow-down and fire, or clear-cutting, followed by fire. Regeneration by natural seeding or planting.

R2A - Fire control, time, natural succession.

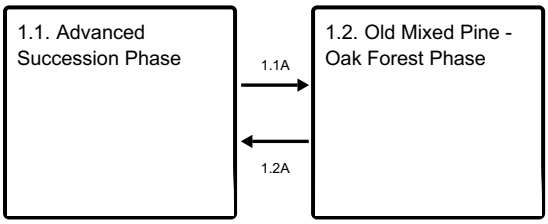
T2A - Grazing by livestock; tree regeneration and ground vegetation impacted

T2B - Removal of natural vegetation, plowing, fertilizing, irrigating, planting agricultural crops.

T3B - Livestock removed

T3A - Removal of natural vegetation, plowing, fertilizing, irrigating, planting agricultural crops.

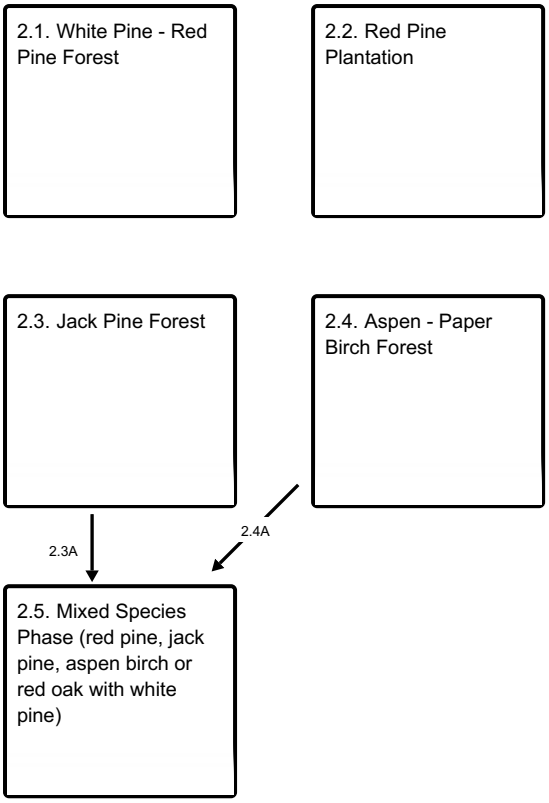
State 1 submodel, plant communities



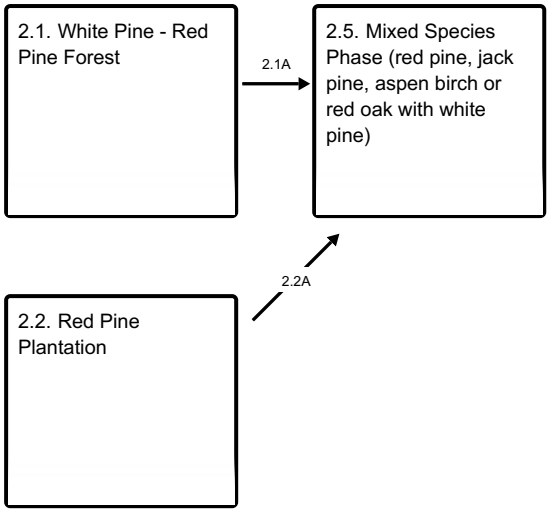
1.1A - Light to moderate intensity fires, reducing, or eliminating fire sensitive species such as red maple, balsam fir, and white spruce

1.2A - Time, natural succession

State 2 submodel, plant communities



Communities 1, 5 and 2 (additional pathways)



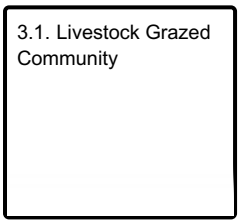
2.1A - White pine regeneration in mixed stand of white, red, and sometimes Jack pine.

2.2A - White pine seeding in from natural seed source, or under-planted.

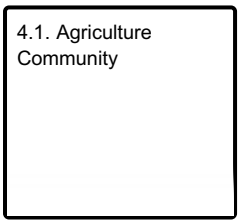
2.3A - White pine seeding in from natural seed source, or under-planted.

2.4A - White pine seeding in from natural seed source, or under-planted.

State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Reference State

In the long-term absence of stand replacing disturbance, the tree species composition of forest communities on this ecological site fluctuates among a relatively large number of species such as white pine (*Pinus strobus*), red pine (P. Resinosa), Jack pine (*P. banksiana*), red oak (*Quercus rubra*), red maple (*Acer rubrum*), balsam fir (*Abies balsamea*) and white spruce (Picea alba). This fluctuation is the result of a range of common, but less severe, disturbances, natural mortality and species differences in regeneration requirements and tolerance of understory conditions. While community species composition and structure can be viewed as a continuum, two distinct community phases can be described as representing the opposite ends of a continuum.

Dominant plant species

- eastern white pine (*Pinus strobus*), tree
- red pine (*Pinus resinosa*), tree
- jack pine (*Pinus banksiana*), tree
- northern red oak (*Quercus rubra*), tree
- red maple (*Acer rubrum*), tree
- balsam fir (*Abies balsamea*), tree
- white spruce (*Picea glauca*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- western brackenfern (*Pteridium aquilinum*), other herbaceous
- starflower (*Trientalis borealis*), other herbaceous

Community 1.1
Advanced Succession Phase

White pine, with varying admixtures of red pine and red oak, constitutes the dominant over-story. The sub-canopy is a mixture of balsam fir, white spruce and red maple. The shrub layer typically is well-developed and is dominated by beaked hazelnut, *Corylus cornuta*. Other important species are juneberry, Amalenchier spp., blueberries, Vaccinium angustifolum, blackberries/raspberries, Rubus spp.. Herbaceous layer typically is dominated by high cover of bracken fern (*Pteridium aquilinum*), American starflower (*Trientalis borealis*), and wintergreen (*Gaultheria procumbens*). Other well represented species include Canada mayflower (*Maianthemum canadense*) and wild sarasaparilla (*Aralia nudicaulis*).

Dominant plant species

- eastern white pine (*Pinus strobus*), tree
- red pine (*Pinus resinosa*), tree
- northern red oak (*Quercus rubra*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- honeysuckle (*Lonicera*), shrub
- western brackenfern (*Pteridium aquilinum*), other herbaceous
- starflower (*Trientalis borealis*), other herbaceous

Community 1.2
Old Mixed Pine - Oak Forest Phase

A mixture of mature and over-mature white and red pine and red oak, containing sporadic seedlings and saplings of white pine and red oak sprouts. Successful reproduction of red pine is rare.

Dominant plant species

- eastern white pine (*Pinus strobus*), tree
- red pine (*Pinus resinosa*), tree
- northern red oak (*Quercus rubra*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- honeysuckle (*Lonicera*), shrub
- starflower (*Trientalis borealis*), other herbaceous
- western brackenfern (*Pteridium aquilinum*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

Periodic moderate intensity fires, eliminating or reducing balsam fir and white spruce, but leaving at least the oldest and fire-resistant white and red pine trees.

Pathway 1.2A
Community 1.2 to 1.1

Slow encroachment of balsam fir and white spruce into stands, as part of common succession process on these sites.

State 2
Early to Mid-successional Forest

There are multiple community phases in this state including white pine-red pine; red pine plantation, jack pine forest; aspen-- paper birch forest and the mixed species phase.

Dominant plant species

- eastern white pine (*Pinus strobus*), tree
- red pine (*Pinus resinosa*), tree
- jack pine (*Pinus banksiana*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- blackberry (*Rubus*), shrub
- western brackenfern (*Pteridium aquilinum*), other herbaceous
- bigleaf aster (*Eurybia macrophylla*), other herbaceous

Community 2.1
White Pine - Red Pine Forest

Even-aged, naturally regenerated, mixed pine forest, sometimes with admixture of red oak of sprout origin. These stands often contain considerable amount of white pine regeneration, but with only sporadic presence of young red pine in locations with large canopy openings and absence of other competing vegetation.

Dominant plant species

- red pine (*Pinus resinosa*), tree
- eastern white pine (*Pinus strobus*), tree

Community 2.2
Red Pine Plantation

Planted red pine with varying spacing. Plantations with close spacing e.g. less than 8 x 8 feet typically are devoid of significant understory vegetation. However, if thinning is applied the shrub component, dominated by beaked hazelnut (*Corylus cornuta*), increases significantly. Other common shrubs may include blackberries and raspberries (Rubus spp.), juneberry (Amelanchier spp.) and blueberries (Vaccinium spp.). Depending on the proximity of seed sources, white pine regeneration, together with balsam fir and white spruce, becomes common. Herbaceous layer also increases, often dramatically, with bracken fern (*Pteridium aquilinum*) and large-leaf aster (*Eurybia macrophylla*) attaining strong dominance.

Dominant plant species

- red pine (*Pinus resinosa*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- blackberry (*Rubus*), shrub

Community 2.3
Jack Pine Forest

Unless planted, this community develops only if fire was included in the destruction of preceding community and jack pine trees were present to provide seed source. Young Jack pine communities often are very dense. Over time, natural mortality thins the stand and shrub and herb layers develop similarly as described for Community Phase 2.2.

Dominant plant species

- jack pine (*Pinus banksiana*), tree

Community 2.4
Aspen - Paper Birch Forest

Like the naturally developed jack pine forest, the aspen-paper birch forest community requires fire disturbance for establishment. Once in place it can be perpetuated by clear cutting, but paper birch presence drops off dramatically due to very dense stocking of aspen sprouts. Understory communities develop in a similar way as described in communities 2.2 and 2.3, but more quickly, because aspen mortality leads to faster self-thinning of stands and light penetration in aspen canopy is greater than that in conifer stands.

Dominant plant species

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

Community 2.5
Mixed Species Phase (red pine, jack pine, aspen birch or red oak with white pine)

This is a mid-successional community. The oldest tree cohort is made up of remnants of the pioneer communities of either Jack pine, red pine, or aspen-paper birch. This cohort is in the process of being replaced by more shade tolerant white pine and red maple. Red oak is also frequent associate. In absence of major disturbance this community phase transitions into Reference State Community.

Dominant plant species

- jack pine (*Pinus banksiana*), tree
- red pine (*Pinus resinosa*), tree
- red maple (*Acer rubrum*), tree

Pathway 2.1A
Community 2.1 to 2.5

Invasion of pioneer, or early successional communities by white pine where seed source is present.

Pathway 2.2A
Community 2.2 to 2.5

Invasion of pioneer, or early successional communities by white pine where seed source is present.

Pathway 2.3A
Community 2.3 to 2.5

Invasion of pioneer, or early successional communities by white pine where seed source is present.

Pathway 2.4A
Community 2.4 to 2.5

Invasion of pioneer, or early successional communities by white pine where seed source is present.

State 3
Livestock Grazed State

Livestock grazed forests are more often referred to as woodlands rather than forests because this long-term land use significantly changes some soil characteristics and nature of vegetative community. Species composition is altered by selective browsing and grazing as well as by distribution of seeds and other propagules by grazing animals. In addition, soil compaction differentially affects germination and establishment of plant species, including trees

Community 3.1
Livestock Grazed Community

Livestock grazed forests are more often referred to as woodlands rather than forests because this long-term land use significantly changes some soil characteristics and nature of vegetative community. Species composition is altered by selective browsing and grazing as well as by distribution of seeds and other propagules by grazing animals. In addition, soil compaction differentially affects germination and establishment of plant species, including trees

State 4
Agriculture State

Production of agricultural crops, most often potatoes, corn, and/or hay.

Dominant plant species

- Irish potato (*Solanum tuberosum*), other herbaceous
- corn (*Zea mays*), other herbaceous
- soybean (*Glycine max*), other herbaceous

Community 4.1
Agriculture Community

Production of agricultural crops, most often potatoes, corn and/or hay.

Dominant plant species

- Irish potato (*Solanum tuberosum*), other herbaceous
- corn (*Zea mays*), other herbaceous

Transition T1A
State 1 to 2

Stand-replacing disturbance, such as blow-down or ice storm, followed by fire; or clear-cut logging, followed by natural regeneration or site preparation and planting.

Restoration pathway R2A
State 2 to 1

Time. Natural succession by shade-tolerant species e.g.: red maple, balsam fir, white spruce and white pine.

Transition T2A
State 2 to 3

Prolonged grazing by livestock. Disruption of tree regeneration and ground vegetation.

Transition T2B
State 2 to 4

Elimination of forest cover and introduction of tilling, fertilizing and/or irrigation.

Restoration pathway T3B
State 3 to 2

Removal of livestock, natural succession.

Transition T3A

State 3 to 4

Elimination of forest cover and introduction of tilling, fertilizing and/or irrigation.

Additional community tables

Inventory data references

Sites key out to a few habitat types that range from dry to mesic, but are best represented by types in the dry to dry-mesic and nutrient poor groupings. STM based on PArVAa and PArV types.

Two sites key to ATM, but ESD is better represented by PArVAa and PArV types.
White pine is not recorded on these sites, but depending on seed source, it is likely an important component.

Other references

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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:**

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

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

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

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

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

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

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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:**
