USDA Natural Resources Conservation Service

Ecological site F146XY031ME
Mucky Peat Bottom

Last updated: 9/27/2024
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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): 146X–Aroostook Area

This area is entirely in Maine and it makes up about 1,275 square miles (3,305 square kilometers). Presque Isle is the largest city in the area. Interstate 95 ends in the town of Houlton, at the border with New Brunswick, Canada. Aroostook State Park, Fort Kent Historic Site, and Loring Commerce Center are in this area. The Big Rock ski area is in the middle of this MLRA and is on the highest point, which is Mars Hill Mountain.

Ecological site concept

This site typically occurs on relatively-flat areas where water saturates organic peat and muck deposits for most of the growing season. The surface soil surface consists of poorly-drained hummocks and very poorly-drained depressions. The above watershed provides significant water to this soil, often ponding within depressions. The plant community is characterized by an overstory of Northern white cedar and small diameter mixed hardwoods and softwoods, with a productive herbaceous understory. Trees grow mostly on the hummocks, and diverse understory species occupy various niches associated with the complex microtopography.

Associated sites

F146XY032ME	**Loamy Till Bottom** The Loamy Till Bottom site grades into the Mucky Peat Bottom as the depth of organic peat and muck increases.
F146XY021ME	**Marsh** The Marsh ecological site often grades into the Mucky Peat Bottom as wetness decreases. Both sites are very wet, but Marsh is too wet for tree persistence.

Similar sites

F146XY032ME	**Loamy Till Bottom** The Loamy Till Bottom always has mineral soil within 16 inches of the organic soil surface, while the Mucky Peat Bottom has greater than 16 inches of organic material. The Loamy Till Bottom is overall drier than the Mucky Peat Bottom.

Table 1. Dominant plant species

Tree	(1) *Thuja Occidentalis* (2) *Acer rubrum*
Shrub	(1) *Alnus incana* (2) *Ilex verticillata*

Herbaceous	(1) *Osmunda cinnamomea* (2) *Carex trisperma*

Physiographic features

This ecological site occurs primarily in swamps on glaciated uplands and lowlands, however they can occur on floodplains. This site is characterized by pit and mound topography, resulting in frequent ponding of water in the pits and drier conditions on the mounds. Pit and mound topography is formed by the natural process of uprooted trees. As trees fall and are uprooted, soil attached to the roots is removed from the ground creating a pit. As the tree decays over time, the soil is slowly redeposited onto the ground creating a mound. This results in increased species diversity from the high variability in soil and plant growing conditions associated with this ecological process.

In the pits, the water table is typically near the soil surface (or above when ponded), while on the mounds, the water table may be a foot or more below the soil surface. Slopes are typically less than 1 percent for this site and can be as high as 2 percent.

Table 2. Representative physiographic features

Landforms	(1) Swamp (2) Marsh
Runoff class	Negligible to low
Flooding frequency	None
Ponding duration	Long (7 to 30 days)
Ponding frequency	Frequent
Elevation	10–2,100 ft
Slope	0–1%
Water table depth	0 in
Aspect	Aspect is not a significant factor

Climatic features

The climate of this site is characterized by cold, snowy winters, and cool summers. Precipitation is nearly equally distributed throughout the year, with slightly more moisture falling in June-October. During winter months, and sometimes fall and spring, cold winds from the north bring severe weather events. The effects of a relatively short growing season are somewhat mitigated by long summer days associated with the high latitudes of the region. Occasionally high winds, microbursts, or freezing rain events damage vegetation over small portions of the landscape.

Table 3. Representative climatic features

Frost-free period (characteristic range)	80-94 days
Freeze-free period (characteristic range)	126-134 days
Precipitation total (characteristic range)	37-42 in
Frost-free period (actual range)	61-107 days
Freeze-free period (actual range)	103-141 days
Precipitation total (actual range)	36-42 in
Frost-free period (average)	85 days
Freeze-free period (average)	127 days
Precipitation total (average)	39 in

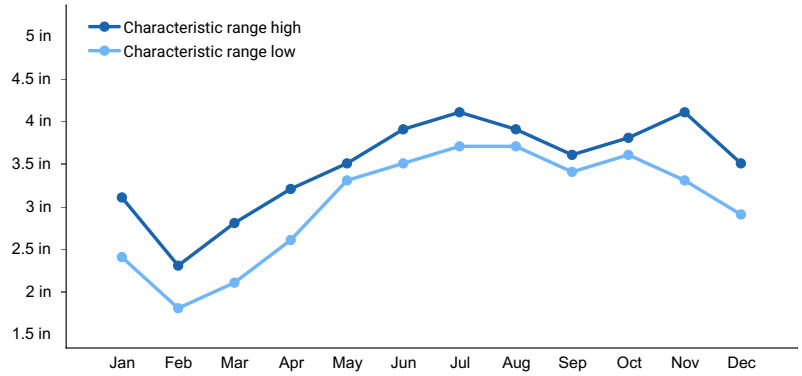


Figure 1. Monthly precipitation range

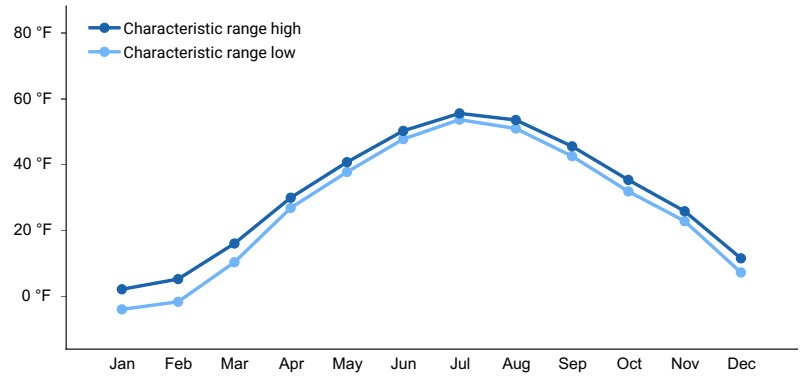


Figure 2. Monthly minimum temperature range

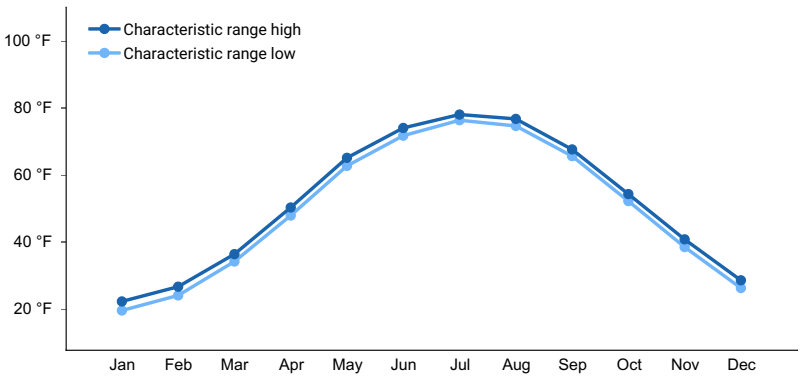


Figure 3. Monthly maximum temperature range

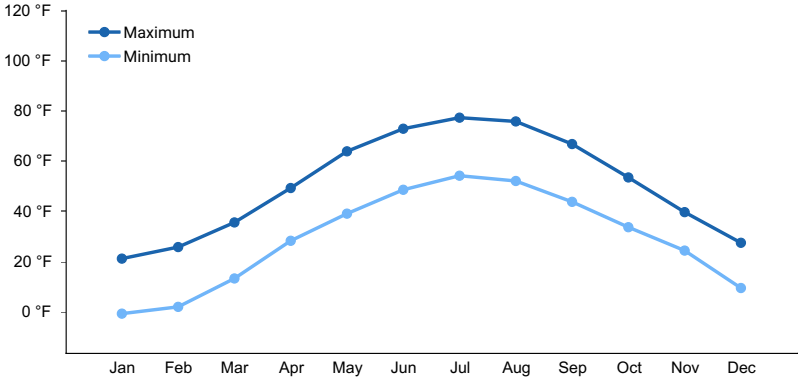


Figure 4. Monthly average minimum and maximum temperature

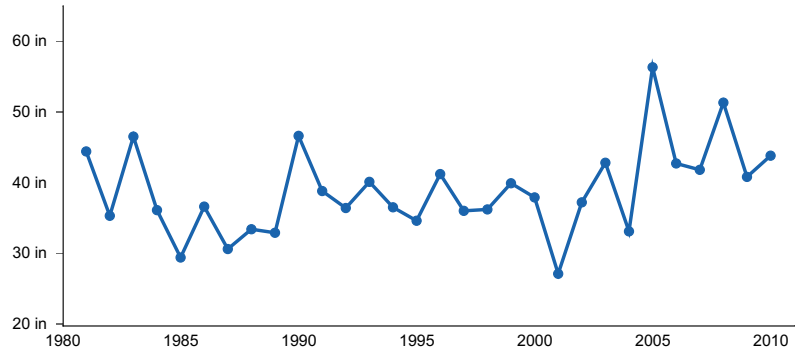


Figure 5. Annual precipitation pattern

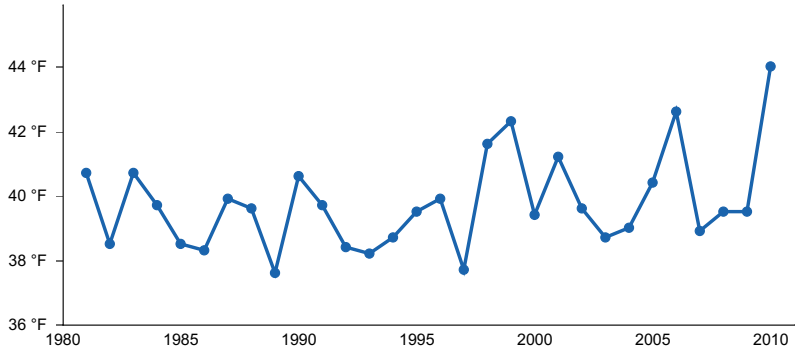


Figure 6. Annual average temperature pattern

Climate stations used

- (1) BRIDGEWATER [USC00170833], Bridgewater, ME
- (2) FT KENT [USC00172878], Fort Kent, ME
- (3) HOULTON 5N [USC00173944], Houlton, ME
- (4) PRESQUE ISLE [USC00176937], Presque Isle, ME
- (5) HOULTON INTL AP [USW00014609], Houlton, ME
- (6) ALLAGASH [USC00170200], Saint Francis, ME
- (7) CARIBOU MUNI AP [USW00014607], Caribou, ME

Influencing water features

This site receives extra moisture from neighboring watersheds which causes soil saturation for much of the growing season. The water table fluctuates throughout the year, often with ponding in depressions following spring runoff or large storm events. During dry periods, the water table may drop up to about 1 foot beneath the soil surface.

Soil features

Mucky peat bottom consists of very deep, very poorly-drained soils that formed in a mantle of well-decomposed organic soil material over loamy mineral deposits. Most often the muck layer is between 16 and 60 inches thick, and is often associated with even thicker patches of organic soil material. There are typically no rock fragments on the soil surface and throughout the muck layer. Soil pH ranges from strongly to slightly acidic, and water holding capacity is very high. The soil moisture regime is Aquic, and the soil temperature regime is Frigid.

Table 4. Representative soil features

Parent material	(1) Organic material
Surface texture	(1) Muck (2) Loam
Family particle size	(1) Loamy

Drainage class	Very poorly drained
Permeability class	Slow
Soil depth	65 in
Surface fragment cover <=3"	0–1%
Surface fragment cover >3"	0–1%
Available water capacity (0-40in)	6.8–15.99 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	4.5–7
Subsurface fragment volume <=3" (Depth not specified)	0–2%
Subsurface fragment volume >3" (Depth not specified)	0–12%

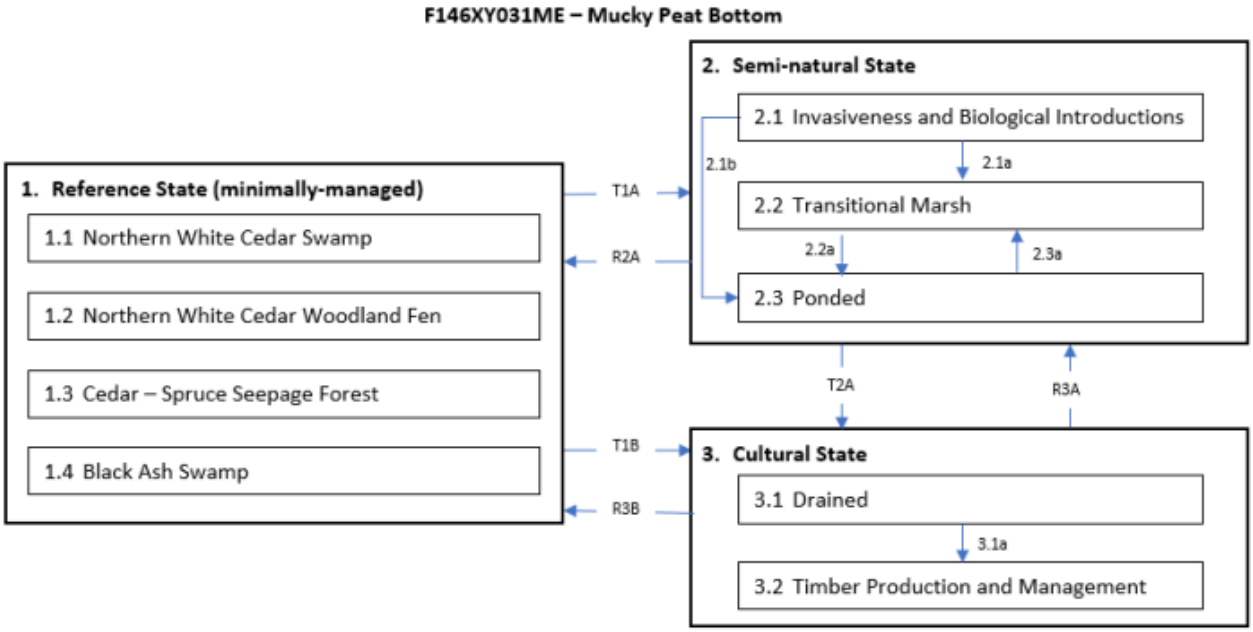
Ecological dynamics

[Caveat: The vegetation information contained in this section and is only provisional, based on concepts, and future projects support validation through field work. *] The vegetation groupings described in this section are based on the terrestrial ecological system classification and vegetation associations developed by NatureServe, 2018 and localized associations provided by the Maine Natural Areas Program (Gawler and Cutko, 2010).

The mucky peat bottom site is dominated by Northern white cedar, with small-diameter softwood and hardwood species often present, including balsam fir, brown ash, yellow birch, and red maple. Wind often blows down small patches or individual trees. Beaver activity or man-made structures (e.g. roads, dams) may inundate this site temporarily or permanently, killing trees and forming an open water pond. Following inundation, this site may succeed through a series of open marsh types before eventually returning to Northern White Cedar dominance. Beaver activity is expected to be limited by proximity to areas where poplar or aspen species are present. When these species are not present on or near this site, beavers are not expected to induce ponding.

This site is resistant to most other disturbances, including fire and insect damage. Drainage and cultivation are not typically present on this wet, mucky soil. However, winter logging is possible on these otherwise inaccessible stands, and can reduce tree density and increase herbaceous production. The cedar is resilient and expected to eventually recover dominance of the site following timber harvest.

State and transition model



Transition	*Drivers/practices*
T1A	hydrological alteration (beaver activity), increased annual precipitation or flooding events, introduction of invasive species, pests, and pathogens, wind (blow-down)
T1B, T2A	hydrological alteration (anthropogenic), actively managed site for timber production, harvesting, and reproduction, seeding/planting, forest stand improvement
R2A	remediation of hydrological alteration (obstruction removal or diversion), actively managed restoration, invasive species, pest, and pathogen management
R3A, R3B	remediation of hydrological alteration (obstruction removal to restore surface water), native plant establishment, seeding/planting, overstory canopy removal (reduction to 50-75%)
2.1a, 2.1b	introduction of non-native species, pests, and/or pathogens; shifts in community composition
2.2a, 2.3a	hydrologic alteration (natural), increase in annual precipitation or significant flooding; remediation of hydrologic alteration, drought, warmer annual temperatures (decadal)
3.1a	active forest management plan, planting, timber stand improvement, overstory improvement

State 1
Reference State (minimally-managed)

These sites can either be cedar swamps or cedar bog woodlands. Cedar swamps are closed-canopy forests in enriched peatland basins in the Northern Maine. They typically occur in small forested basins, or along lakes or streams, but may rarely occur in the enriched portions of larger peatlands where there is an influence of minerotrophic groundwater. They often occur in areas of calcareous or at least circumneutral bedrock. The soils are organic and range widely in depth of the peat. Canopy closure ranges from somewhat open to closed, and the forest floor is typically dark and cool. Shrub and herb coverage may be sparse to locally dense, with increased cover in canopy gaps. The herb layer is often diverse and scattered thinly over the abundant Bryophytes that form a mossy carpet. Northern white-cedar bog woodlands of basin peatlands are open canopy forests in Northern Maine. They occur on shallow to deep peat in depressional wetlands in glacial till. Canopy is usually under 60% closure which allows for the development of fairly extensive dwarf-shrub and/or herbaceous layers.

Characteristics and indicators. They often occur in areas of calcareous or at least circumneutral bedrock. The soils are organic and range widely in depth of the peat. *Thuja occidentalis* is the canopy dominant.

Dominant plant species

- arborvitae (*Thuja occidentalis*), tree
- black spruce (*Picea mariana*), tree
- balsam fir (*Abies balsamea*), tree
- red maple (*Acer rubrum*), tree
- tamarack (*Larix laricina*), tree

- eastern hemlock (*Tsuga canadensis*), tree
- American fly honeysuckle (*Lonicera canadensis*), shrub
- common winterberry (*Ilex verticillata*), shrub
- highbush blueberry (*Vaccinium corymbosum*), shrub
- catberry (*Ilex mucronata*), shrub
- gray alder (*Alnus incana*), shrub
- possumhaw (*Viburnum nudum*), shrub
- lowbush blueberry (*Vaccinium angustifolium*), shrub
- sheep laurel (*Kalmia angustifolia*), shrub
- black huckleberry (*Gaylussacia baccata*), shrub
- threeseeded sedge (*Carex trisperma*), grass
- upright sedge (*Carex stricta*), grass
- bluejoint (*Calamagrostis canadensis*), grass
- softleaf sedge (*Carex disperma*), grass
- bristlystalked sedge (*Carex leptalea*), grass
- longstalk sedge (*Carex pedunculata*), grass
- threeleaf false lily of the valley (*Maianthemum trifolium*), other herbaceous
- cinnamon fern (*Osmunda cinnamomea*), other herbaceous
- threeleaf goldthread (*Coptis trifolia*), other herbaceous
- sensitive fern (*Onoclea sensibilis*), other herbaceous
- royal fern (*Osmunda regalis*), other herbaceous
- creeping snowberry (*Gaultheria hispidula*), other herbaceous
- twinflower (*Linnaea borealis*), other herbaceous
- naked miterwort (*Mitella nuda*), other herbaceous
- twoleaf miterwort (*Mitella diphylla*), other herbaceous
- heartleaf foamflower (*Tiarella cordifolia*), other herbaceous
- sidebells wintergreen (*Orthilia secunda*), other herbaceous
- common sheep sorrel (*Rumex acetosella*), other herbaceous
- western oakfern (*Gymnocarpium dryopteris*), other herbaceous
- long beechfern (*Phegopteris connectilis*), other herbaceous
- American golden saxifrage (*Chrysosplenium americanum*), other herbaceous
- single delight (*Moneses uniflora*), other herbaceous
- bunchberry dogwood (*Cornus canadensis*), other herbaceous

Dominant resource concerns

- Wind erosion
- Ponding and flooding
- Seasonal high water table
- Surface water depletion
- Nutrients transported to surface water
- Pesticides transported to surface water
- Pathogens and chemicals from manure, biosolids, or compost applications transported to surface water
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Aquatic habitat for fish and other organisms

Community 1.1
Northern White Cedar Swamp

This community typically occupies level, poorly drained basins along stream flowages or the perimeter of ponds. The substrate is usually shallow peat (< 50 cm) over mineral soil; some sites are on deep peat accumulations. The characteristically alkaline conditions in this community type provide suitable habitat for a number of rare plant species. This site type is moderately to densely forested, often with little light penetrating to the forest floor. Northern white cedar is dominant (up to 95% cover), often forming a fairly uniform stand, but may be interspersed with various amounts of red maple (up to 25% cover), and black spruce (up to 40% cover). The variable shrub and

ground layers form a lush mosaic of vegetated hummocks interspersed with moist hollows. The herb layer is well developed (>30% cover), with herbs more abundant than dwarf shrubs. Small cedar trees and an array of boreal herbs grow on the fallen logs and hummocks, including yellow lady's-slipper and several rare species. Peat moss the dominant bryophyte and sphagnum blanket the hummocks, hollows, and fallen logs. (Gawler and Cutko, 2010)

Resilience management. Maine Natural Areas Program State Rank: S4 Apparently Secure – At fairly low risk of extinction or elimination due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors. Cedar swamps in northern Maine can be very extensive, running into hundreds of acres, and therefore it is more problematic to maintain examples not subject to human disturbance. In southern Maine, they are often less than 50 acres in size. Although the overall extent of this community type appears stable, there are some indications that it is difficult to regenerate cedar rather than fir through harvest practices. There has been little permanent conversion to other land uses or forest types. Some sites have been significantly altered by beaver activity. (Gawler and Cutko, 2010)

Dominant plant species

- arborvitae (*Thuja occidentalis*), tree
- red maple (*Acer rubrum*), tree
- black spruce (*Picea mariana*), tree
- red spruce (*Picea rubens*), tree
- tamarack (*Larix laricina*), tree
- white spruce (*Picea glauca*), tree
- common winterberry (*Ilex verticillata*), shrub
- speckled alder (*Alnus incana ssp. rugosa*), shrub
- threeseeded sedge (*Carex trisperma*), grass
- lesser yellow lady's slipper (*Cypripedium parviflorum*), other herbaceous

Dominant resource concerns

- Ponding and flooding
- Surface water depletion
- Ground water depletion
- Pesticides transported to surface water
- Pathogens and chemicals from manure, biosolids, or compost applications transported to surface water
- Petroleum, heavy metals, and other pollutants transported to surface water
- Elevated water temperature
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Aquatic habitat for fish and other organisms

Community 1.2
Northern White Cedar Woodland Fen

These ecological sites generally occur as part of a peatland (peat >30 cm deep) or occasionally along a peatland outlet stream where the peat substrate is shallower. Sites are in lowlands, ranging from quite acidic to circumneutral (pH 4.6-7.2), and typical of somewhat minerotrophic (fen) conditions, not raised bog conditions. These open canopy woodlands occur in a peatland setting with northern white cedar dominant. Canopy closure is 20-60%. The shrub layer may be locally dense with patches of trees and scattered shrubs. The herb layer, usually with >50% cover, is variable in composition and may be predominantly heath shrubs or herbs with a prominent component of graminoids. The bryoid layer is mostly peat mosses, but the presence of mountain fern moss is indicative of this type. (Gawler and Cutko, 2010)

Resilience management. Maine Natural Areas Program State Rank: S4 Apparently Secure – At fairly low risk of extinction or elimination due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors. These fens usually occur as part of larger peatlands, and maintaining the hydrologic integrity of the entire wetland is key. The cedars generally remain small, therefore this type is typically not a target for forest management. In some areas these fens have been

altered by beaver activity. (Gawler and Cutko, 2010)

Dominant plant species

- arborvitae (*Thuja occidentalis*), tree
- European larch (*Larix decidua*), tree
- black spruce (*Picea mariana*), tree
- red maple (*Acer rubrum*), tree
- balsam fir (*Abies balsamea*), tree
- black ash (*Fraxinus nigra*), tree
- speckled alder (*Alnus incana ssp. rugosa*), shrub
- leatherleaf (*Chamaedaphne calyculata*), shrub
- black huckleberry (*Gaylussacia baccata*), shrub
- sweetgale (*Myrica gale*), shrub
- sheep laurel (*Kalmia angustifolia*), shrub
- bog Labrador tea (*Ledum groenlandicum*), shrub
- upright sedge (*Carex stricta*), grass
- bluejoint (*Calamagrostis canadensis*), grass
- cinnamon fern (*Osmunda cinnamomea*), other herbaceous
- common snowberry (*Symphoricarpos albus*), other herbaceous
- dwarf raspberry (*Rubus arcticus ssp. acaulis*), other herbaceous
- threeleaf false lily of the valley (*Maianthemum trifolium*), other herbaceous

Dominant resource concerns

- Ponding and flooding
- Surface water depletion
- Ground water depletion
- Pesticides transported to surface water
- Pathogens and chemicals from manure, biosolids, or compost applications transported to surface water
- Petroleum, heavy metals, and other pollutants transported to surface water
- Elevated water temperature
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Aquatic habitat for fish and other organisms

Community 1.3
Cedar - Spruce Seepage Forest

These ecological sites have a substrate of shallow peat or organic material over mineral soil, generally saturated with cold groundwater. Water may emerge to form rivulets or small spring fed brooks, or it may remain under the thick layer of mosses. These forests are typically found on gentle, saturated slopes with groundwater seepage, often at the base of slopes near drainage outlets. Northern white cedar and other conifers form a moderate to dense canopy cover (70-95%), allowing only patchy light to penetrate to the forest floor. Shrubs and dwarf shrubs are typically sparse but may be more abundant in canopy gaps caused by harvesting or natural disturbance. The herb layer may be extensive, typically >50% cover, and comprised mostly of non-woody species with northern affinities. The forest floor is characterized by a rich growth of mosses. (Gawler and Cutko, 2010)

Resilience management. Maine Natural Areas Program State Rank: S4 Apparently Secure – At fairly low risk of extinction or elimination due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors. Most known occurrences of this community type in Maine have been harvested in the past, often targeting removal of spruce. Forest management generally does not result in permanent conversion of this type, although questions remain about how to most successfully regenerate cedar. (Gawler and Cutko, 2010)

Dominant plant species

- arborvitae (*Thuja occidentalis*), tree

- balsam fir (*Abies balsamea*), tree
- red spruce (*Picea rubens*), tree
- fly honeysuckle (*Lonicera ×xylosteoides*), shrub
- threeseeded sedge (*Carex trisperma*), grass
- bunchberry dogwood (*Cornus canadensis*), other herbaceous
- common snowberry (*Symphoricarpos albus*), other herbaceous
- threeleaf goldthread (*Coptis trifolia*), other herbaceous
- western oakfern (*Gymnocarpium dryopteris*), other herbaceous
- twinflower (*Linnaea borealis*), other herbaceous
- mountain woodsorrel (*Oxalis montana*), other herbaceous

Dominant resource concerns

- Ponding and flooding
- Surface water depletion
- Ground water depletion
- Pesticides transported to surface water
- Pathogens and chemicals from manure, biosolids, or compost applications transported to surface water
- Petroleum, heavy metals, and other pollutants transported to surface water
- Elevated water temperature
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Aquatic habitat for fish and other organisms

Community 1.4
Black Ash Swamp

This northern forested wetland type is characterized by a hardwood or mixed overstory and lush understory on shallow peat or muck soils. While black ash is characteristic in these small-patch communities, Black Ash Swamps often occur within or adjacent to larger expanses of Northern White Cedar Swamps or Red Maple Swamps and may be transitional between the two. Tree cover ranges from 25-80%. Common plants of forested wetlands are often dominant in the understory. Mosses and liverworts are usually abundant and may form a continuous carpet. Black Ash Swamps occupy broad basins or seepage sites on lower gentle slopes, often in association with larger areas of cedar or red maple swamp. They typically occur in rolling to low terrain in central and northern regions of the state where higher pH soils or groundwater discharge occur. Saturated soils of well decomposed organic matter (peat or muck) are typical and surface rivulets and springs are occasional. (Gawler and Cutko, 2010)

Resilience management. Maine Natural Areas Program State Rank: S4 Apparently Secure – At fairly low risk of extinction or elimination due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors. Wind is the primary form of natural disturbance in these swamps, as black ash is shallow-rooted. Although black ash does not grow as fast as other species, its ability to stump sprout may be an important reproductive strategy in response to disturbance. Black ash is fairly long lived (>250 years). Beavers have altered many black ash swamps, converting them into open or shrub-dominated wetlands. (Gawler and Cutko, 2010)

Dominant plant species

- black ash (*Fraxinus nigra*), tree
- arborvitae (*Thuja occidentalis*), tree
- red maple (*Acer rubrum*), tree
- yellow birch (*Betula alleghaniensis*), tree
- alderleaf buckthorn (*Rhamnus alnifolia*), shrub
- mountain holly (*Ilex montana*), shrub
- speckled alder (*Alnus incana ssp. rugosa*), shrub
- common winterberry (*Ilex verticillata*), shrub
- possumhaw (*Viburnum nudum*), shrub
- sensitive fern (*Onoclea sensibilis*), other herbaceous

- eastern marsh fern (*Thelypteris palustris*), other herbaceous
- heartleaf foamflower (*Tiarella cordifolia*), other herbaceous
- purple avens (*Geum rivale*), other herbaceous
- Schweinitz's ragwort (*Packera schweinitziana*), other herbaceous
- royal fern (*Osmunda regalis*), other herbaceous
- small enchanter's nightshade (*Circaea alpina*), other herbaceous
- jewelweed (*Impatiens capensis*), other herbaceous

Dominant resource concerns

- Ponding and flooding
- Surface water depletion
- Ground water depletion
- Nutrients transported to surface water
- Pesticides transported to surface water
- Pathogens and chemicals from manure, biosolids, or compost applications transported to surface water
- Petroleum, heavy metals, and other pollutants transported to surface water
- Elevated water temperature
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Aquatic habitat for fish and other organisms

State 2
Semi-natural State

Shifts in ecological site composition, functionality, and dynamics driven by natural disturbances, processes, and pressures (may have some anthropogenic influences). More research is needed to determine the extent of the Semi-natural state associated with this ecological site.

Dominant resource concerns

- Aggregate instability
- Ponding and flooding
- Seasonal high water table
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Aquatic habitat for fish and other organisms

Community 2.1
Invasiveness and Biological Introductions

Introduction of invasive species, pathogens, and/or pests resulting in shifts in ecological site composition, functionality, and dynamics. More research is needed to determine the extent of these effects on the semi-natural state associated with this ecological site.

Dominant resource concerns

- Organic matter depletion
- Aggregate instability
- Ponding and flooding
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Aquatic habitat for fish and other organisms

Community 2.2
Transitional Marsh

Community 2.3
Ponded

Pathway 2.1a
Community 2.1 to 2.2

introduction of non-native species, pests, and/or pathogens; shifts in community composition towards native species weediness

Pathway 2.1b
Community 2.1 to 2.3

introduction of non-native species, pests, and/or pathogens; shifts in community composition towards native species weediness

Pathway 2.2a
Community 2.2 to 2.3

hydrologic alteration (natural), increase in annual precipitation, snowpack, and/or significant flooding

Pathway 2.3a
Community 2.3 to 2.2

remediation of hydrologic alteration, drought, warmer annual temperatures (decadal)

State 3
Cultural State

Shifts in ecological site composition, functionality, and dynamics that are primary driven by anthropogenic disturbances and pressures (may have some associated natural influences). More research is needed to determine the extent of the cultural state associated with this ecological site.

Dominant resource concerns

- Compaction
- Aggregate instability
- Ponding and flooding
- Pesticides transported to surface water
- Pesticides transported to ground water
- Petroleum, heavy metals, and other pollutants transported to surface water
- Petroleum, heavy metals, and other pollutants transported to ground water
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Aquatic habitat for fish and other organisms

Community 3.1
Drained

Dominant resource concerns

- Organic matter depletion
- Ponding and flooding

- Surface water depletion
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Aquatic habitat for fish and other organisms

Community 3.2
Timber Production and Management

Site managed for timber production and harvesting

Dominant resource concerns

- Wind erosion
- Ponding and flooding
- Plant productivity and health
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Aquatic habitat for fish and other organisms

Pathway 3.1a
Community 3.1 to 3.2

active forest management plan, planting, timber stand improvement, overstory improvement

Transition T1A
State 1 to 2

hydrological alteration (beaver activity), increased annual precipitation or flooding events, introduction of invasive species, pests, and pathogens, wind (blow-down)

Transition T1B
State 1 to 3

hydrological alteration (anthropogenic), actively managed site for timber production, harvesting, and reproduction, seeding/planting, forest stand improvement

Restoration pathway R2A
State 2 to 1

hydrological alteration (obstruction removal or diversion), actively managed restoration, invasive species, pest, and pathogen management

Conservation practices

Obstruction Removal
Restoration and Management of Natural Ecosystems
Native Plant Community Restoration and Management
Pathogen Management
Invasive Plant Species Control
Pathogen Management
Invasive Species Pest Management
Monitoring and Evaluation

Transition T2A

State 2 to 3

hydrological alteration (anthropogenic), actively managed site for timber production, harvesting, and reproduction, seeding/planting, forest stand improvement

Restoration pathway R3A
State 3 to 1

hydrological alteration (obstruction removal to restore surface water level), native plant establishment, seeding/planting, overstory canopy removal (reduction to 50-75%)

Conservation practices

Diversion
Tree/Shrub Site Preparation
Obstruction Removal
Spoil Spreading
Tree/Shrub Establishment
Wetland Wildlife Habitat Management
Early Successional Habitat Development/Management
Wetland Restoration
Wetland Creation
Wetland Enhancement
Restoration and Management of Natural Ecosystems
Native Plant Community Restoration and Management
Restoration of Compacted Soils
Prescribed Forestry
Monitoring and Evaluation

Restoration pathway R3B
State 3 to 2

hydrological alteration (obstruction removal to restore surface water level), native plant establishment, seeding/planting, overstory canopy removal (reduction to 50-75%)

Conservation practices

Pond
Obstruction Removal
Wetland Restoration
Wetland Creation
Wetland Enhancement
Surface Flooding of Organic Soils
Restoration and Management of Natural Ecosystems
Native Plant Community Restoration and Management
Shallow water habitat
Monitoring and Evaluation

Additional community tables

Inventory data references

Future work is needed, as described in a future project plan, to validate the information presented in this provisional ecological site description. Future work includes field sampling, data collection and analysis by qualified vegetation ecologists and soil scientists. As warranted, annual reviews of the project plan can be conducted by the Ecological Site Technical Team. A final field review, peer review, quality control, and quality assurance reviews of the ESD are necessary to approve a final document.

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Approval

Nels Barrett, 9/27/2024

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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	Nels Barrett
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:**