

Ecological site XA232X01Y201

Boreal Woodland Peat Frozen Terraces

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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): 232X–Yukon Flats Lowlands

The Yukon Flats Lowlands MLRA is an expansive basin characterized by numerous levels of flood plains and terraces that are separated by minimal breaks in elevation. This MLRA is in Interior Alaska and is adjacent to the middle reaches of the Yukon River. Numerous tributaries of the Yukon River are within the Yukon Flats Lowlands MLRA. The largest are Beaver Creek, Birch Creek, Black River, Chandalar River, Christian River, Dall River, Hadweenzic River, Hodzana River, Porcupine River, and Sheenjek River. The MLRA has two distinct regions—lowlands and marginal uplands. The lowlands have minimal local relief and are approximately 9,000 square miles in size (Williams 1962). Landforms associated with the lowlands are flood plains and stream terraces. The marginal uplands consist of rolling and dissected plains that are a transitional area between the lowlands and adjacent mountain systems. The marginal uplands are approximately 4,700 square miles in size (Williams 1962). This MLRA is bounded by the Yukon-Tanana Plateau to the south, Hodzana Highlands to the west, Porcupine Plateau to the east, and southern foothills of the Brooks Range to the north (Williams 1962). These surrounding hills and mountains partially isolate the Yukon Flats Lowlands MLRA from weather systems affecting other MLRAs of Interior Alaska. As a result, temperatures are generally warmer in summer and colder in winter than is characteristic in other areas at comparable latitude. There is a moisture and temperature gradient in which the lowlands region tends to be drier and colder and the surrounding marginal uplands region tends to be moister and warmer (PRISM Climate Group 2006). The Yukon Flats Lowlands MLRA is mostly undeveloped lands that are sparsely populated and not accessible by a road system. A number of villages, including Beaver, Birch Creek, Chalkyitsik, Circle, Fort Yukon, Stevens Village, and Venetie, are adjacent to the Yukon River or one of its major tributaries. The largest village is Fort Yukon, which according to the 2010 U.S. Census has 583 residents that are dominantly Gwich'in Alaska Natives.

LRU notes

Alaska has no officially recognized LRU. However, there appear to be two distinct LRU in the Yukon Flats Lowlands MLRA. These LRU are thought to have differing climatic regimes, landforms, and soil types (STATSGO and Jorgensen and Meidinger 2015). The two LRU were previously discussed in the MLRA notes section above and are termed the lowlands LRU and the marginal uplands LRU. This ecological site is associated with both the lowlands and marginal uplands LRU.

Classification relationships

Yukon Flats Lowlands MLRA.

Ecological site concept

This ecological site is associated with organic-rich bogs in the Yukon Flats Lowlands MLRA. The cumulative thickness of organic material often exceeds 50 inches in the soil profile. Reference state soils are poorly drained and organic material is considered ultra to extremely acidic. The soils associated with the reference plant community 1.1 generally have permafrost at moderate depth (20 to 40 inches). The reference state supports multiple plant communities related to a fire regime. This ecological site has an alternative state related to thermokarst. Reference plant community 1.1 is characterized as a needleleaf woodland (10 to 25 percent cover; Viereck et al. 1992) composed of mature black spruce (*Picea mariana*). Tree cover primarily occurs in the stunted tree stratum (less than 15 feet in height). Commonly observed understory species include lingonberry (*Vaccinium vitis-idaea*), marsh Labrador tea (*Ledum palustre* ssp. *decumbens*), cottongrass (*Eriophorum* spp.), cloudberry (*Rubus chamaemorus*), greygreen reindeer lichen (*Cladina rangiferina*), star reindeer lichen (*Cladina stellaris*), and Sphagnum moss (*Sphagnum* spp.).

Associated sites

XA232X02Y217	Boreal Woodland Loamy Frozen Plain Wet This ecological site occurs in the marginal uplands region of the Yukon Flats Lowlands MLRA. The marginal uplands are characterized by broad and extensive plains. This ecological site occurs where water accumulates on the slopes of these plains (e.g. lower third of slopes or in swales). Associated soils have very deep loess deposition and range from poorly to very poorly drained. The reference plant community is characterized as needleleaf woodland (10 to 25 percent cover; Viereck et al. 1992) primarily composed of black spruce (<i>Picea mariana</i>).
XA232X02Y227	Boreal Forest Loamy Frozen Plains Cold This ecological site occurs in the marginal uplands region of the Yukon Flats Lowlands MLRA. The marginal uplands are characterized by broad and extensive plains. This ecological site occurs on colder slopes of these plains. Associated soils have very deep loess deposition and range from poorly to somewhat poorly drained. The reference plant community is characterized as an open needleleaf forest (25 to 60 percent cover; Viereck et al. 1992) primarily composed of black spruce.
XA232X01Y209	Boreal Tussock Loamy Frozen Terraces This ecological site occurs on stream terraces in the lowlands region of the Yukon Flats Lowlands MLRA. Soils commonly have permafrost at moderate depth (20 to 40 inches) and pond frequently for very long durations. The reference plant community is characterized as open low mixed shrub-sedge tussock bog (Viereck et al. 1992).
XA232X01Y280	Boreal Scrub Loamy Flood Plain Wet This ecological site occurs on the flood plain and adjacent terraces of minor, low-gradient tributaries in the lowlands region of the Yukon Flats Lowlands MLRA. The reference plant community is associated with soils that both pond and flood. The reference plant community phase is characterized as closed tall scrub (greater than 75 percent shrub cover; Viereck et al. 1992) primarily composed of a mixture of willow (<i>Salix</i> spp.).
XA232X02Y210	Boreal Forest Loamy Frozen Plains Warm This ecological site occurs in the marginal uplands region of the Yukon Flats Lowlands MLRA. The marginal uplands are characterized by broad and extensive plains. This ecological site occurs on warm slopes of these plains. Associated soils have very deep loess deposition and are well drained. The reference plant community phase is characterized as an open needleleaf forest (25 to 60 percent cover; Viereck et al. 1992) primarily composed of mature white spruce (<i>Picea glauca</i>).
XA232X02Y203	Boreal Scrub Loamy Frozen Drainages This ecological site occurs in the marginal uplands region of the Yukon Flats Lowlands MLRA. The marginal uplands are characterized by broad and extensive plains. This ecological site occurs in drainageways on these plains. Associated soils flood occasionally (5 to 50 times in 100 years) for long durations of time (between 7 and 30 days). Soils range from poorly to very poorly drained. The reference plant community phase is characterized as closed tall scrub (Viereck et al. 1992). Black spruce commonly occurs but cover is generally low.

Similar sites

XA232X01Y207	Boreal Herbaceous Peat Flood Plain Depressions The thermokarst alternative state for ecological site XA232X01Y201 and the reference state for XA232X01Y207 both are associated with soils that have thick organic mats that are considered very poorly drained. Soils associated with XA232X01Y201 are acidic, while soils associated with XA232X01Y207 are neutral to basic. The difference in pH results in different plant communities.
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XA232X02Y217	Boreal Woodland Loamy Frozen Plain Wet Both ecological sites XA232X02Y217 and XA232X01Y201 have wet soils, have ice-rich permafrost in the soil profile, and are associated with low-severity fire regimes. When compared to ecological site XA232X02Y217, soils associated with XA232X01Y201 have comparatively more organic matter and have more acidic soil profiles. While the reference plant communities share similar overstories, XA232X01Y201 has comparably greater Sphagnum moss and reindeer lichen cover and soils are much more prone to thermokarst events.
XA232X01Y218	Boreal Woodland Loamy Frozen Terraces Both ecological sites XA232X01Y201 and XA232X01Y218 have wet soils, have ice-rich permafrost in the soil profile, and are associated with low-severity fire regimes. When compared to ecological site XA232X01Y201, soils associated with XA232X01Y218 have comparatively less organic matter and have less acidic soil profiles. While the reference plant communities share similar overstories, XA232X01Y201 has comparably greater Sphagnum moss and reindeer lichen cover and soils are much more prone to thermokarst events.
XA232X01Y209	Boreal Tussock Loamy Frozen Terraces Both ecological sites XA232X01Y201 and XA232X01Y209 have wet soils, have ice-rich permafrost in the soil profile, and are associated with low-severity fire regimes. When compared to ecological site XA232X01Y201, soils associated with XA232X01Y209 have comparatively less organic matter and have less acidic soil profiles. When compared to XA232X01Y201, this ecological site has less forest cover, Sphagnum moss and reindeer lichen cover, and soils are much less prone to thermokarst events.
XA232X01Y262	Boreal Woodland Gravelly Terraces Both ecological sites XA232X01Y201 and XA232X01Y262 have wet soils and are associated with low-severity fire regimes. When compared to ecological site XA232X01Y201, soils associated with XA232X01Y262 have comparatively less organic matter, have less acidic soil profiles, and lack permafrost. While the reference plant communities share similar overstories,XA232X01Y201 has comparably greater Sphagnum moss and reindeer lichen cover and soils are much more prone to thermokarst events.

Table 1. Dominant plant species

Tree	(1) <i>Picea mariana</i>
Shrub	(1) <i>Ledum palustre ssp. decumbens</i>
Herbaceous	(1) <i>Sphagnum</i>

Legacy ID

F232XY201AK

Physiographic features

This ecological site and its associated plant communities are associated with organic-rich bogs in the Yukon Flats Lowlands MLRA. These bogs occur in both the lowlands and marginal upland regions of this MLRA. Within the lowland region, bogs have a limited extent primarily occurring North of Stevens Village and in areas adjacent to Circle. Within these bogs, thermokarst depressions are prevalent.

Figure 1. Lowlands (white) and marginal uplands (light gray) LRU of the Yukon Flats Lowlands MLRA.

Table 2. Representative physiographic features

Geomorphic position, flats	(1) Talf
Geomorphic position, terraces	(1) Tread
Landforms	(1) Plains > Bog (2) Alluvial plain > Bog
Flooding frequency	None
Ponding duration	Long (7 to 30 days)
Ponding frequency	Occasional
Elevation	90 – 310 m
Slope	0 %
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

Short, warm summers and long, very cold winters characterize the subarctic continental climate of the area. The surrounding hills and mountains of this MLRA partially isolate it from weather systems affecting other interior lowlands. As a result, temperatures are generally warmer in summer and colder in winter than is characteristic in other areas of comparable latitude. The average annual temperature ranges from about 20 to 25 degrees F (-7 to -4 degrees C). The freeze-free period averages 70 to 120 days. The temperature usually remains above freezing from early June through late August. The average annual precipitation ranges from about 6 inches (150 millimeters) in the central basin to 15 inches (380 millimeters) along the boundary with the surrounding highlands. The maximum precipitation occurs in late summer, mainly as a result of thunderstorms. The average annual snowfall is about 45 to 55 inches (115 to 140 centimeters) (USDA, NRCS 2006).

The tabular data in this report is specific to the marginal uplands LRU in the Yukon Flats Lowlands MLRA. All tabular data was calculated from the PRISM dataset (1971-2000).

Table 3 Representative climatic features

Frost-free period (characteristic range)	50-100 days
Freeze-free period (characteristic range)	70-120 days
Precipitation total (characteristic range)	230-560 mm
Frost-free period (average)	80 days

Freeze-free period (average)	
Precipitation total (average)	280 mm

Influencing water features

Reference state soils are associated with permafrost and are considered poorly drained (Sussaymin soils). During the spring and early growing season (May and June), these soils have a perched water table over the seasonal frost in the soil profile resulting in wet soils at very shallow depth (less than 10 inches). During this time frame, ponding of water over the soil surface occurs occasionally (between 5 and 50 times in 100 years) for long durations of time (between 7 and 30 days). As the seasonal frost melts, the water drains from these soils. During long portions of the growing season, a water table is commonly at shallow depths (10 to 20 inches) in the soil profile.

Thermokarst state soils lack permafrost and are considered very poorly drained (Hydric Cryofibrists). Ponding of water over the soil surface occurs continuously during the growing season. Ponding duration and the typical depth to the water table was determined through field observations.

Due to the depth and persistence of this water table, wetland indicator plants are commonly observed in both the reference and thermokarst states.

Soil features

Correlated soil components from Soil Survey of Yukon-Charley Rivers National Preserve (AK684): D32-Boreal taiga organic plains, frozen.

Correlated soil components from Yukon Flats Areas, Alaska soil survey (AK685): Hydric Cryofibrists, dysic; Sussaymin.

Sussaymin and D32-Boreal taiga organic plains, frozen soils are associated with the reference state. Hydric Cryofibrists, dysic soils are associated with the alternative state related to thermokarst.

Figure 6. Typical soil profile associated with Sussaymin soil component.

Figure 7. The Sussaymin soil component is prone to thawing and thermokarst.

Table 4. Representative soil features

Parent material	(1) Mossy organic material
Surface texture	(1) Mucky peat (2) Muck
Drainage class	Very poorly drained to poorly drained

Ecological dynamics

Fire

In the Yukon Flats Lowlands MLRA, fire is a common and natural event that has a significant control on the vegetation dynamics across the landscape. A typical fire event in areas associated with this ecological site will reset plant succession and alter dynamic soil properties (e.g., presence or thickness of permafrost). For this ecological site to progress from the early fire stage to the reference plant community, data suggest that 70 years or more must elapse without another fire event.

When comparing all MLRAs of Interior Alaska, land in the Yukon Flats Lowlands MLRA burns most frequently (Begét et al. 2006). Within the Yukon Flats Lowlands MLRA, fire is considered to be a natural and common event that typically goes unmanaged. Fire suppression

generally occurs adjacent to villages or on allotments with known structures, both of which have a relatively limited acre footprint. From 2000 to 2015, 132 known fire events occurred on land in the Yukon Flats Lowlands MLRA and the burn perimeters of the fires totaled about 4.1 million acres (AICC 2016). Fire-related disturbances are highly patchy and can leave large undisturbed areas within the burn perimeters. Ten fires were attributed to human activities (affecting a total of 2,864 acres), but the majority of the fires were caused by lightning strikes (AICC 2016).

The fire regime within Interior Alaska follows two basic scenarios—low-severity burns and high-severity burns. It should be noted, however, that the fire regime in this area is generally thought to be much more complex (Johnstone et al. 2008). Burn severity refers to the proportion of the vegetative canopy and organic material consumed in a fire event (Chapin et al. 2006). Fires in cool and moist habitat tend to result in low-severity burns, while fires in warm and dry habitat tend to result in high-severity burns. From field observations and because the associated soils are cooler and poorly drained, the typical fire scenario for this ecological site is considered to result in a low-severity burn.

While a low-severity fire can consume the bulk of above ground vegetation, minimal proportions of the organic mat are removed. Organic matter continues to insulate these cold soils and permafrost remains in the soil profile. While field observations support that each reference state plant community is associated with permafrost, fire was thought to increase active layer depth causing the permafrost to occur deeper in the soil profile. For this ecological site, fire also results in thermokarst.

In areas prone to low-severity fire events, the pre-fire vegetative community generally reestablishes quickly and there is minimal long-term alteration to community composition (Johnstone et al. 2010; Bernhardt et al. 2011). When minimal proportions of the organic mat are consumed, many species regenerate asexually using below ground root tissues. Species known to regenerate after low-severity fire events include various graminoids (e.g. *Carex* spp. and *Eriophorum* spp.), forbs (e.g. *Equisetum* sp.), and shrubs (e.g. *Ledum groenlandicum*, *Vaccinium uliginosum*, *Salix* sp.) (Johnstone et al. 2010). Black spruce is the Interior Alaska tree species best adapted to a low-severity fire regime. Black spruce have semi-serotinous cones and a low-severity fire often results in a flush of black spruce seedlings at the burned location.

Field data suggest that each of the woodland community phase burn and that fire events will cause a transition to the early stage of fire succession. This stage (plant community 1.3) is a mix of species that either regenerate in place (e.g., subterranean root crowns for willow and rhizomes for graminoids) and/or from wind-dispersed seeds or spores (e.g., resin birch [*Betula neoalaskana*] and *Polytrichum* moss [*Polytrichum* spp.]). The early stage of fire succession is primarily composed of tree seedlings, ericaceous shrubs, willow, and graminoids. In the absence of fire, tree seedlings continue to colonize and grow in recently burned areas until they become dominant in the overstory. The later stages of succession have an overstory that is a mix of immature broadleaf and needleleaf trees (community 1.2) or is primarily a mixed age needleleaf stand (reference community 1.1).

Other Observations

Animal use (browsing and grazing) was not typically observed in community phases related to this ecological site.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 6. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height M	Canopy Cover (%)	Diameter Cm	Basal Area (square M/hectare)
Tree							
black spruce	PIMA	<i>Picea mariana</i>	Native	0.9-5.8	15-35	2-8.1	—

Table 7. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 1.2 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height M	Canopy Cover (%)	Diameter Cm	Basal Area (square M/hectare)
Tree							
black spruce	PIMA	<i>Picea mariana</i>	Native	1.8-7.6	5-25	3.3-11.4	—
resin birch	BENE4	<i>Betula neoalaskana</i>	Native	—	0-1	—	—

Table 9. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 10. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Inventory data references

NASIS User Site ID / Modal Datasets 12NR02803 Plant Community 1.1 2015AK290643 Plant Community 1.1 2015AK290658 Plant Community 1.1 2015AK290612 Plant Community 1.1 2015AK290614 Plant Community 1.1 S2015AK290004 Plant Community 1.1 2015AK290608 Plant Community 1.2 2015AK290616 Plant Community 1.2 2015AK290640 Plant Community 1.3 2015AK290609 Plant Community 2.1 2015AK290610 Plant Community 2.1 2015AK290615 Plant Community 2.1 2015AK290617 Plant Community 2.1 2015AK290642 Plant Community 2.1

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Contributors

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Approval

Michael Margo, 5/11/2020

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	05/07/2020
Approved by	
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:
