Ecological site XA232X02Y210
Boreal Forest Loamy Frozen Plains Warm

Last updated: 5/18/2020
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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 the uplands LRU.

Classification relationships

Yukon Flats Lowlands MLRA.

Ecological site concept

This ecological site occurs on warmer slope positions (i.e. South facing slopes) in the marginal uplands region of the Yukon Flats Lowlands MLRA. Associated soils have very deep loess deposition and are well drained. The reference state supports multiple community phases related to a fire regime. The reference plant community is characterized as an open needleleaf forest (25 to 60 percent cover; Viereck et al. 1992) primarily composed of mature white spruce (Picea glauca). Commonly observed understory species include prickly rose (Rosa acicularis), twinflower (Linnaea borealis), russet buffaloberry (Shepherdia canadensis), lingonberry (Vaccinium vitis-idaea), Siberian alder (Alnus viridis ssp. fruticosa), sidebells wintergreen (Orthilia secunda), false toadflax (Geocaulon lividum), and splendid feathermoss (Hylocomium splendens).

Associated sites

XA232X02Y217	**Boreal Woodland Loamy Frozen Plain Wet** This ecological site occurs where water accumulates on the slopes (i.e. lower third of slopes and swales) of the marginal uplands region of the Yukon Flats Lowlands MLRA. The marginal uplands are characterized by broad and extensive plains. Associated soils have very deep loess deposition, are prone to ponding, and are 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 (Picea mariana).
XA232X02Y203	**Boreal Scrub Loamy Frozen Drainages** This ecological site occurs in drainageways of the marginal uplands region of the Yukon Flats Lowlands MLRA. The marginal uplands are characterized by broad and extensive 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 is characterized as closed tall scrub (Viereck et al. 1992). Black spruce commonly occurs but cover is generally low.
XA232X01Y201	**Boreal Woodland Peat Frozen Terraces** This ecological site occurs in organic rich bogs in the lowlands and marginal uplands regions of 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 generally has permafrost at moderate depth (20 to 40 inches). This ecological site has an alternative state related to thermokarst.
XA232X02Y227	**Boreal Forest Loamy Frozen Plains Cold** This ecological site occurs on colder slope positions (i.e. North facing slopes) in the marginal uplands region of the Yukon Flats Lowlands MLRA. 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.
XA232X02Y211	**Boreal Loamy Escarpments** This ecological site is associated with steep and erosive slopes in the marginal uplands region of the Yukon Flats Lowlands MLRA. During field work, these escarpments were not sampled and this ecological site is currently a provisional concept.

Similar sites

XA232X01Y204	**Boreal Forest Loamy Flood Plain High** XA232X01Y204 is associated with the lowlands LRU, is on flood plains, and has plant community phases related to a flood regime. Unique species occur on floodplain that do not typically occur on loess covered plains.
XA232X01Y221	**Boreal Forest Loamy Terraces** XA232X01Y221 occurs on stream terraces and gravelly fan remnants. Reference state communities are similar but XA232X01Y221 appears to have less productive stands of trees.

Table 1. Dominant plant species

Tree	(1) *Picea glauca*

Shrub	(1) *Rosa acicularis* (2) *Linnaea borealis*
Herbaceous	(1) *Hylocomium splendens*

Legacy ID

F232XY210AK

Physiographic features

This ecological site and its associated communities occur on rises of plains in the marginal uplands LRU of the Yukon Flats Lowlands MLRA. The marginal uplands are characterized by broad and extensive plains. Due to weathering, these plains are often highly dissected and often resemble hill complexes. In areas where plains are highly dissected, slopes can be steep. This ecological site is associated with areas within the marginal uplands that have very deep accumulations of loess (greater than 60 inches).

Four ecological sites were observed on slopes of these loess covered plains. This ecological site is associated with rises on warmer slopes (e.g. south facing or steeper slopes). Ecological site XA232X01Y227 occurs on rises of colder slopes (e.g. north facing or less steep slopes). Ecological site XA232X01Y217 occurs in positions where water accumulates on the slopes (e.g. lower third of slopes, swales, or dips). Ecological site XA232X01Y211 is associated with steep and erosive escarpments on slopes. These differences in site characteristics lead to dramatically different assemblages of vegetation and resulted in unique ecological site concepts.

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

Table 2. Representative physiographic features

Geomorphic position, flats	(1) Rise
Hillslope profile	(1) Summit (2) Backslope (3) Shoulder
Landforms	(1) Plains > Plain (2) Plains > Hillslope
Flooding frequency	None
Ponding frequency	None
Elevation	140 – 450 m
Slope	0 – 40 %
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

Soil features

Correlated soil components for the Soil Survey of Yukon-Charley Rivers National Preserve Area Alaska (AK684): Boreal forest gravelly escarpments, frozen.

Correlated soil components for the Yukon Flats Areas, Alaska soil survey (AK685): Typic Haplocryepts; Folistic Haplorthels.

After fire, permafrost can thaw in the soil profile. For this ecological site, this transition marks a change in soil components from Folistic Haplorthels to Typic Haplocryepts.

Figure 6. Typical soil profile associated with Folistic Haplorthels soil component. After fire, these soils often thaw resulting in Oxyaquic Haplocryept.

Table 4. Representative soil features

Parent material	(1) Organic material (2) Loess
Family particle size	(1) Coarse-silty

Drainage class	Well 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 the plant succession and alter dynamic soil properties (e.g., presence or thickness of permafrost). For this ecological site to progress from the pioneering fire stage to the reference plant community 1.1, data suggest that 100 years or more must elapse without another fire event.

When comparing all major land resource areas of Interior Alaska, land in the Yukon Flats Lowlands MLRA burns most frequently (Begét et al. 2006). Within this MLRA, fire is considered a natural and common event that typically is 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 perimeter of the fires totaled about 4.1 million acres (AICC 2016). Fire-related disturbances are highly patchy and can leave undisturbed areas within the burn perimeter. Ten of the fire events were attributed to human activities (affecting a total of 2,864 acres), but the majority 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 Interior Alaska 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 areas of cooler and moister habitat tend to result in low-severity burns, and those in areas of warmer and drier habitat tend to result in high-severity burns. As a result of field observations and because the associated soils are warm and well drained, the typical fire scenario for this ecological site is considered to result in a high-severity burn.

Large portions of the organic mat are consumed during a high-severity fire event, commonly exposing pockets of mineral soil. The loss of this organic mat, which insulates the mineral soil, and the decrease in site albedo tends to cause overall soil temperatures to increase (Hinzman et al. 2006). In areas that have permafrost before a fire event, the increase in soil temperatures leads to a decrease in the depth to the permafrost or loss of permafrost in the soil profile (Hinzman et al. 2006). For this ecological site, permafrost was typically not observed in the soil profiles after recent fire events and a soil component was developed for this change in dynamic soil properties (Oxyaquic Haplocryepts soils). Data from fieldwork indicate that permafrost aggradation in the soil profile typically does not occur until community 1.2 and that permafrost is commonly associated with community 1.1. Fire events also destroy a majority of the vascular and nonvascular biomass above ground.

Field data suggest that each of the forested community phases will burn and that fire events will cause a transition to the pioneering stage of fire succession. This stage (community 1.4) 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 seed or spores that colonize exposed mineral soil (e.g., resin birch [Betula neoalaskana] and Ceratodon moss [Ceratodon purpureus]). The pioneering stage of fire succession is primarily composed of tree seedlings, forbs, grasses, and weedy bryophytes. Willow (Salix spp.) and deciduous tree seedlings continue to colonize and grow on recently burned sites until they become dominant in the overstory, which marks the transition to the early stage of fire succession (observed but not documented in the field). In the absence of fire, tree species continue to become more dominant in the stand. The later stages of succession have an overstory that is dominantly deciduous trees (community 1.3), a mix of broadleaf and needleleaf trees (community 1.2), or needleleaf trees (community 1.1).

The time elapsed since the most recent fire event plays a large role in determining the community phase observed in the field. Using data from the burn perimeter (AICC 2016) and tree age, the pioneering and early fire stages are thought to persist for about 10 to 30 years postfire. After approximately 30 years, an open forest with some combination of birch and white spruce will persist until the next fire event. Field data suggest that broadleaf trees (primarily resin birch) are dominant in the canopy first. During this phase of broadleaf tree dominance, white spruce colonize and mature in the understory. Eventually, white spruce gains dominance in the overstory and begins to replace the shade-intolerant broadleaf tree species. Late-fire community 1.2 has a mixture of immature and mature white spruce, while the reference community 1.1 has a stand composed primarily of mature white spruce. The average age of white spruce in the reference state is 106 years; therefore, it takes more than a century to progress from the pioneering stage to the reference community phase.

Other Observations

Animal use (browsing and grazing) of this ecological site primarily consists of moose browse on willow and tree regeneration in 1.3 and 1.4. The severity of moose browse is considered slight for all communities. A browse severity rating of slight on willow and tree regeneration is defined as a majority of individuals having no signs of browsing.

No alternative states for this ecological site were documented.

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 (%)

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							
white spruce	PIGL	*Picea glauca*	Native	14.6-28	40-69	12.2-36.8	–

Table 7. Community 1.2 plant community composition

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

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							
white spruce	PIGL	*Picea glauca*	Native	5.8-38.7	30-63	7.1-46.5	–

Table 9. Community 1.3 plant community composition

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

Table 10. Community 1.3 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height M	Canopy Cover (%)	Diameter Cm	Basal Area (square M/hectare)
Tree							
resin birch	bene4	*Betula neoalaskana*	Native	–	45-95	–	–
white spruce	pigl	*Picea glauca*	Native	12.2-15.2	15-20	9.9-10.7	–

Table 11. Community 1.4 plant community composition

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

Table 12. Representative site productivity

Common Name	Symbol	Site Index Low	Site Index High	CMAI Low	CMAI High	Age Of CMAI	Site Index Curve Code	Site Index Curve Basis	Citation
white spruce	*PIGL*	49	91	–	–	–	–	–	

Inventory data references

NASIS User Site ID / Modal Datasets 12SN00703 F232XY290AK community 1.1 2015AK290801 F232XY290AK community 1.1 2015AK290802 F232XY290AK community 1.1 2015AK290803 F232XY290AK community 1.2 2015AK290850 F232XY290AK community 1.2 2015AK290860 F232XY290AK community 1.2 2017AK290541 F232XY290AK community 1.2 2017AK290909 F232XY290AK community 1.2 08TC01901 F232XY290AK community 1.3 12SN00701 F232XY290AK community 1.3 2015AK290868 F232XY290AK community 1.4 2017AK290545 F232XY290AK community 1.4 2017AK290912 F232XY290AK community 1.4

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Contributors

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Approval

Michael Margo, 5/18/2020

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	05/11/2020
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:

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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:**
