USDA Natural Resources Conservation Service

Ecological site XA232X01Y219
Boreal Forest Loamy Terraces Moist

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 lowlands LRU.

Classification relationships

Yukon Flats Lowlands MLRA.

Ecological site concept

This ecological site is associated with somewhat poorly to moderately well drained soils on the tread of stream terraces throughout the Yukon Flats Lowlands MLRA. While soils do not pond, a water table commonly occurs at moderate to deep depths in the soil profile (20 to 60 inches). The associated drainage class causes trees to be less productive as compared to forested stands over drier soils (i.e., XA232X01Y221). The reference state supports multiple plant communities related to a fire regime.

Reference plant community 1.1 is characterized as an open needleleaf forest (25 to 60 percent cover; Viereck et al. 1992) composed primarily of mature white spruce (Picea glauca). Commonly observed understory species include grayleaf willow (Salix glauca), prickly rose (Rosa acicularis), red fruit bearberry (Arctostaphylos rubra), lingonberry (Vaccinium vitis-idaea), twinflower (Linnaea borealis), false toadflax (Geocaulon lividum), dwarf scouringrush (Equisetum scirpoides), and stairstep moss (Hylocomium splendens).

Associated sites

XA232X01Y229	**Boreal Scrub Loamy Terrace Swales** This ecological site is associated with swales on stream terraces in lowlands region of the Yukon Flats Lowlands MLRA. Associated soils are considered very poorly drained. The reference plant community is characterized as open tall scrub (Viereck et al. 1992) and the dominant shrubs are willow (Salix spp.) and shrub birch (Betula glandulosa).
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 (Salix spp.).
XA232X01Y206	**Boreal Scrub Loamy Frozen Flood Plain Depressions** This ecological site is associated with depressions on flood plains in the Yukon Flats Lowlands MLRA. The reference state plant communities are associated with soils that both pond and flood. Ponding occurs frequently (greater than 50 times in 100 years) for long durations of time (between 7 and 30 days). Flooding occurs occasionally (5 to 50 times in 100 years) for brief durations of time (between 2 and 7 days). The reference plant community is characterized as mesic graminoid herbaceous (Viereck et al. 1992) and is primarily composed of bluejoint (Calamagrostis canadensis).
XA232X01Y207	**Boreal Herbaceous Peat Flood Plain Depressions** This ecological site is associated with high pH floating mats that occur most commonly in flood plain depressions in the Yukon Flats Lowlands MLRA. The reference state has soils that both pond and flood. The reference plant community is characterized as wet forb herbaceous (Viereck et al. 1992) and is composed of various obligate wetland species.
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).
XA232X01Y212	**Boreal Sedge Peat Terrace Depressions** This ecological site is associated with drainageways on stream terraces in the lowlands region of the Yukon Flats Lowlands MLRA. Associated drainageways are subaqueous, which means the water table remains above the soil surface for the entire growing season. The reference plant community phase is characterized as subarctic lowland sedge wet meadow (Viereck et al. 1992) and is composed primarily of water sedge (Carex aquatilis).
XA232X01Y222	**Boreal Graminoid Loamy Terrace Depressions** This ecological site is associated with closed depressions of stream terraces that support a reference state with multiple graminoid-dominant community phases. These depressions are considered closed because they are not associated with a flood regime and have limited, if any, groundwater flow or recharge. The presumed hydrological inputs for this ecological site are primarily thaw of the annual active soil layer and/or permafrost, snowmelt runoff, and precipitation. This hydrologic regime results in the development of sodic soil properties.

XA232X01Y223	**Boreal Scrub Loamy Frozen Terrace Depressions** This shrubby ecological site occurs in the transitional area between the forested tread of a stream terrace and the graminoid-dominant communities associated with closed, terrace depressions (ecological site R232XY222AK). This site typically occurs between the outer third and lip of these closed depressions. The reference plant community for ecological site is characterized as an open tall scrubland (Viereck et al. 1992) and those shrubs are primarily an assortment of willow (Salix spp.).
XA232X01Y204	**Boreal Forest Loamy Flood Plain High** This ecological site occurs on the high flood plain of major tributaries in the Yukon Flats Lowlands MLRA. Flooding occurs occasionally (5 to 50 times in 100 years) for brief durations of time (between 2 and 7 days). The reference plant community is characterized as an open needleleaf forest (25 to 60 percent cover) primarily composed of mature white spruce (Picea glauca).
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.
XA232X01Y218	**Boreal Woodland Loamy Frozen Terraces** This ecological site is associated with wet soils on the tread of stream terraces in Yukon Flats Lowlands MLRA. Soils generally have permafrost at moderate depth (20 to 40 inches) and pond occasionally for long durations of time. The reference plant community is characterized as a needleleaf woodland (10 to 25 percent cover; Viereck et al. 1992) composed of black spruce (Picea mariana) and white spruce (Picea glauca).
XA232X01Y221	**Boreal Forest Loamy Terraces** This ecological site is associated with moderately well to well drained soils on the tread of stream terraces in the Yukon Flats Lowlands MLRA. Flooding frequency ranges from rare to none. The reference plant community is characterized as an open needleleaf forest (25 to 60 percent cover) primarily composed of mature white spruce (Picea glauca).
XA232X01Y224	**Boreal Woodland Sandy Terrace Rises** This ecological site is associated with vegetated dunes on treads of stream terraces in the lowlands region of the Yukon Flats Lowlands MLRA. The reference plant community is characterized as a needleleaf woodland (10 to 25 percent cover; Viereck et al. 1992) composed primarily of mature white spruce (Picea glauca).
XA232X01Y262	**Boreal Woodland Gravelly Terraces** This ecological site is associated with wet soils on the tread of gravelly stream terraces in the lowlands region of the Yukon Flats Lowlands MLRA. Gravelly horizons range from very shallow to shallow depths (0 to 20 inches) and soils lack permafrost at depth. The pH of soil horizons commonly range from neutral to moderately alkaline, which leads to diverse species assemblages. The reference plant community phase is characterized as a needleleaf woodland (10 to 25 percent cover; Viereck et al. 1992) composed primarily of black spruce (Picea mariana) and white spruce (Picea glauca).
XA232X01Y205	**Boreal Grass Loamy Flood Plain Depressions** This ecological site is associated with depressions on flood plains in the Yukon Flats Lowlands MLRA. The reference state plant communities are associated with soils that both pond and flood. Ponding occurs occasionally (5 to 50 times in 100 years) for brief durations of time (between 2 and 7 days). Flooding occurs occasionally for brief durations of time. The reference plant community is characterized as open tall scrub (Viereck et al. 1992) and is primarily composed of willow (Salix spp.).

Similar sites

XA232X01Y221	**Boreal Forest Loamy Terraces** XA232X01Y221 is in similar landform positions as XA232X01Y219 (treads of stream terraces), but site XA232X01Y219 is associated with wetter soils. As compared to XA232X01Y219, white spruce trees associated with XA232X01Y221 tend to grow larger and have a higher site index value.
XA232X02Y210	**Boreal Forest Loamy Frozen Plains Warm** XA232X02Y210 is associated with well drained soils but occurs in the marginal uplands LRU. As compared to XA232X01Y219, white spruce trees associated with site XA232X02Y210 tend to grow larger and have a higher site index value.

XA232X01Y218	**Boreal Woodland Loamy Frozen Terraces** Soils associated with XA232X01Y218 tend to pond and have a water table at very shallow to shallow depths for much of the growing season (0 to 20 inches). As a result, ecological site XA232X01Y219 has much more productive stands of trees.
XA232X01Y204	**Boreal Forest Loamy Flood Plain High** XA232X01Y204 is on flood plains and has plant community phases related to a flood regime. As compared to XA232X01Y219, white spruce trees associated with site XA232X01Y204 tend to grow larger and have a higher site index value.

Table 1. Dominant plant species

Tree	(1) *Picea glauca*
Shrub	(1) *Arctostaphylos rubra* (2) *Vaccinium vitis-idaea*
Herbaceous	(1) *Hylocomium splendens*

Legacy ID

F232XY219AK

Physiographic features

This ecological site and its associated plant communities are throughout the Yukon Flats Lowlands MLRA. Given the large spatial extent, the site is associated with a wide array of soil components. The differences in site characteristics among soils of different ages (young and old) and on different landforms are discussed in this section. All of the soil components, however, support similar kinds and amounts of vegetation.

This ecological site and its associated plant communities commonly occur on young and old terraces. The Yukon Flats Lowlands MLRA is composed of broad and numerous terrace levels. Individual terrace levels commonly span several miles in all directions, but one level to the next can be separated by less than 25 feet in elevation. These terrace levels can be broadly segregated by age. Young terraces are generally proximal to active stream channels and have a recent or current association with a flood regime (rare flooding, 1 to 5 times in 100 years). While capped with organic material, soils on young terraces are primarily composed of alluvium (Nuntragut soils). Flight or satellite reconnaissance of young terraces results in observance of readily identifiable stream landforms, which in the Yukon Flats Lowlands MLRA commonly include meander scrolls, abandoned channels, and oxbow lakes. Old terraces are generally distal from active stream channels and are disconnected from a flood regime. Soils on old terraces are generally composed of eolian deposits and/or loess underlain by alluvium (Tajittro soils). The depositional surface material commonly is thick enough to mask stream landforms like abandoned linear channels. From the air, the depressions appear to be circular to amorphous in shape.

Soils associated with rivers that are currently or have previously been glacially fed have different characteristics than those associated with nonglacial rivers. For instance, glacial rivers that flow out of the southern foothills of the Brooks Range have created large gravelly stream terraces north of the Yukon River (e.g., Sheenjek River). The soils on these terraces tend to have a sandy and gravelly substrata (Canvasback soils). These coarse textured soils are unfavorable for permafrost aggradation in the profile. Nonglacial rivers that flow out of the Yukon-Tanana Plateau (e.g., Beaver Creek) have formed numerous terrace levels south of the Yukon River. The soils on these terrace levels have a loamy substrata that is generally favorable for permafrost aggradation (Nuntragut and Tajittro soils).

During the soil survey, many unique soil types were identified because of the differences in the age of the terraces and in the landforms. Each soil type originally had a correspondingly unique ecological site. After more fieldwork and data analysis, it was determined that these wide-ranging soils all appear to support plant communities that respond similarly to fire and have similar kinds and amounts of vegetation in the reference state. As a result, the soil components were all correlated into one ecological site.

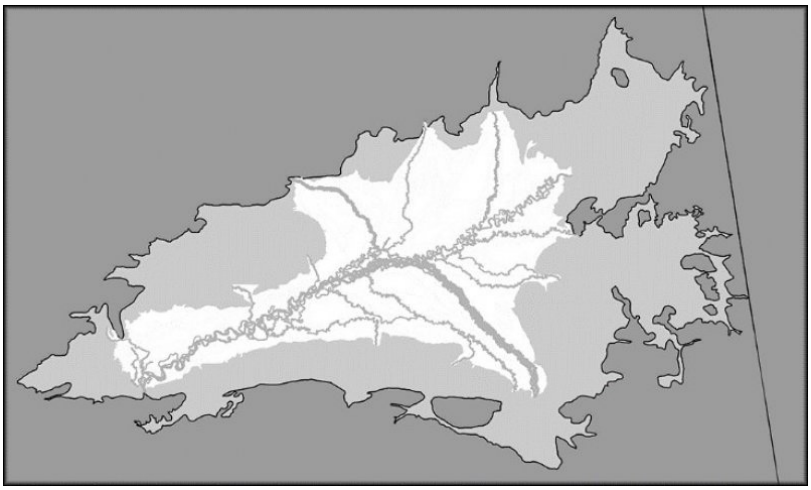


Figure 1. Lowlands region (white) and marginal uplands region (light gray) of the Yukon Flats Lowlands MLRA.

Table 2. Representative physiographic features

Geomorphic position, terraces	(1) Tread
Landforms	(1) Alluvial plain > Stream terrace (2) Alluvial plain > Stream terrace
Flooding frequency	None to rare
Ponding frequency	None
Elevation	91–305 m
Slope	0–3%
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).

All of the tabular data below was calculated from the PRISM dataset (1971-2000) and is specific to the Lowlands LRU in the Yukon Flats Lowlands MLRA.

Table 3. Representative climatic features

Frost-free period (characteristic range)	45-97 days
Freeze-free period (characteristic range)	70-120 days
Precipitation total (characteristic range)	203-330 mm
Frost-free period (average)	75 days
Freeze-free period (average)	
Precipitation total (average)	254 mm

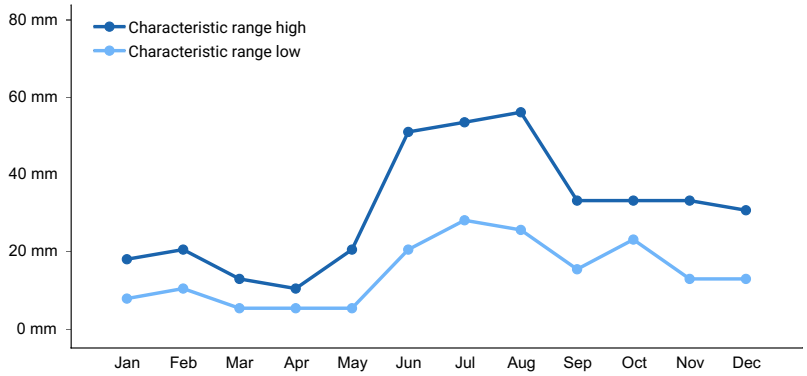


Figure 2. Monthly precipitation range

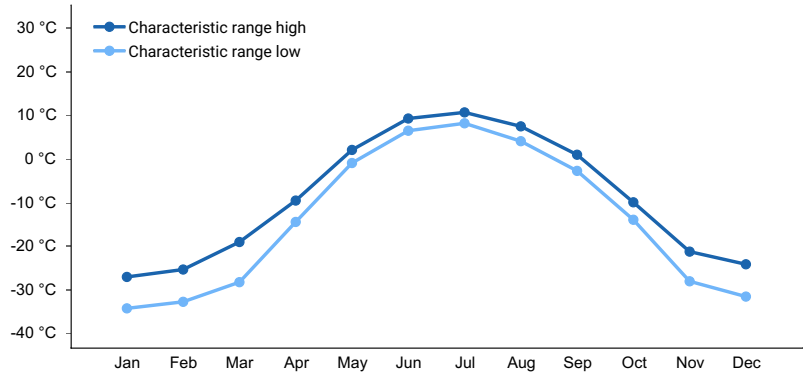


Figure 3. Monthly minimum temperature range

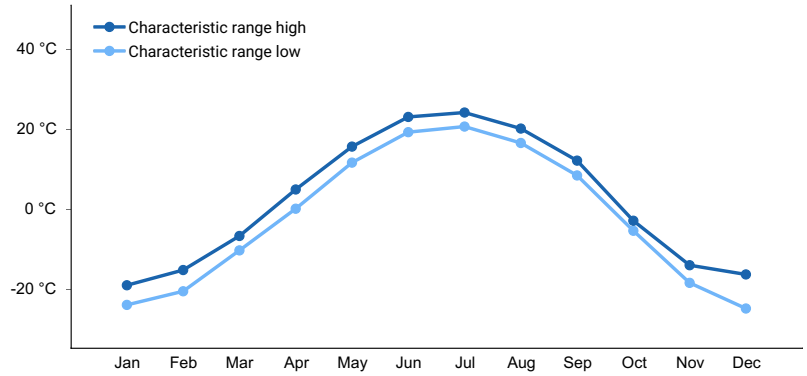


Figure 4. Monthly maximum temperature range

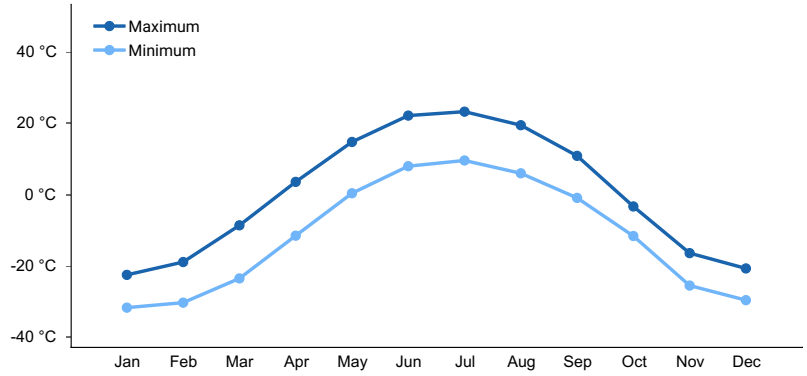


Figure 5. Monthly average minimum and maximum temperature

Influencing water features

During the spring and early growing season (May and June), a perched water table typically is over the seasonal frost in the soil profile, resulting in wet soils at a shallow depth (10 to 20 inches). As the seasonal frost melts, the water drains from these soils. During the rest of the growing season, a water table is commonly at moderate to

deep depths (20 to 60 inches) in the soil profile. The typical depth to the water table was determined through field observation and by the presence of redoximorphic features that are common throughout the soil profile.

White spruce are more productive when growing in well-drained soils in this MLRA. The water table associated with this ecological site decreases white spruce productivity and increases the presence of wetland indicator species.

Soil features

Correlated soil components for the Yukon Flats Areas, Alaska soil survey (AK685): Canvasback; Nuntragut; Tajittro.

Figure 6.

Figure 7.

Table 4. Representative soil features

Parent material	(1) Organic material (2) Alluvium
Family particle size	(1) Coarse-loamy over sandy or sandy-skeletal (2) Coarse-loamy (3) Coarse-silty
Drainage class	Somewhat poorly drained to moderately 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 the 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, data suggest that 100 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 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 cold and wet, 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 that was present before the fire event typically remains in the soil profile. While field observations support that each community phase is associated with permafrost (in Nuntragut and Tajittro soils), fire was thought to increase active layer depth causing the permafrost to occur deeper in the soil profile.

Field data suggest that each of the forested communities 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 seeds or spores that colonize the exposed mineral soil (e.g., quaking aspen [*Populus tremuloides*] 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 tree seedlings continue to colonize and grow in recently burned areas until they become dominant in the overstory, which marks the transition to the early stage of fire succession (community 1.3). 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 a mix of regenerating broadleaf and needleleaf trees (community 1.2) or is primarily 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 a combination of burn perimeter (AICC 2016) and tree age data, the pioneering fire stage is thought to persist for up to 10 years postfire and the early fire community phase persists about 10 to 30 years postfire. After approximately 30 years, an open forest with some combination of deciduous trees and white spruce will persist until the next fire event. During this timeframe, white spruce matures and eventually replaces the shade-intolerant broadleaf tree species. The average age of white spruce in reference community 1.1 is 113 years; therefore, it takes more than a century to progress from the pioneering stage to the reference community 1.1.

Given the high frequency of fire and its associated footprint, much of the land in the Yukon Flats Lowlands MLRA has burned too recently to support the reference plant community phase. GIS data and flight reconnaissance have shown that large swaths of mature white spruce forests are uncommon throughout the MLRA. Mixed and open broadleaf forests have the greatest spatial representation in the Yukon Flats Lowlands MLRA.

Flooding

This ecological site is associated with young terraces that rarely flood (Nuntragut soils) and old terraces that no longer flood (Tajittro soils). Historical flood markers in Fort Yukon and aerial observations conducted by U.S. Fish and Wildlife Service staff (personal communication) have shown that flooding occurs on the young terraces that support this ecological site.

While conducting fieldwork, little if any evidence of flood-related disturbance was observed. Thus, no flood-related

community phases were developed for this ecological site. A flood event in areas associated with this ecological site likely has limited energy, depositing alluvium on the soil surface but causing minimal alterations to overall composition of the plant community.

Other Observations

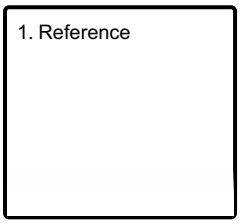
For this ecological site, the time of season that a burn occurs is likely a critical factor in determining the severity of a fire event. Associated soils are wet before and during the early portion of the growing season and eventually drain as the growing season progresses. If a fire event occurs later when soils are drier, then areas associated with this ecological site are expected to experience a high-severity burn. Future research may result in determining unique and currently unknown plant communities that result from high-severity burns.

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

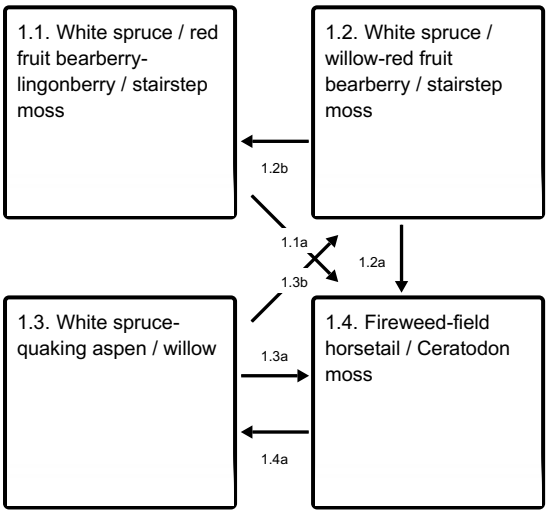
No alternative states for this ecological site were documented.

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 1
Reference

Figure 8. Aerial image of a stream terrace in the Yukon Flats Lowlands MLRA. This ecological site occurs on terraces in this MLRA.

The reference state has four associated plant communities. These communities are grouped by the structure and dominance of the vegetation (e.g., coniferous trees, deciduous trees, shrubs, and forbs) and their ecological function and stability. Plant communities in the reference state appear to be largely controlled by the influences of fire. This report provides baseline vegetation inventory data for the ecological site. More data collection is needed to provide further information about existing plant communities and the disturbance regimes that would result in transitions from one community to another. The common and scientific plant names are from the USDA PLANTS database. All plant communities in this report are characterized using the Alaska Vegetation Classification (Viereck et al. 1992).

Community 1.1
White spruce / red fruit bearberry-lingonberry / stairstep moss

Figure 9. Typical community associated with community 1.1.

Community Phase 1.1 Canopy Cover Table

Vegetation data is aggregated from all sample plots for this community phase. The data is provided as frequency (percent) and mean canopy cover (percent) of the most dominant and ecologically relevant species. Canopy cover is represented as a mean with the range in parentheses.

Plant group	Common name	Scientific name	USDA plant code	Frequency (percent)	Mean canopy cover (percent)
T	white spruce	*Picea glauca*	PIGL	100	35 (1-65)
T	black spruce	*Picea mariana*	PIMA	19	3 (0-40)
S	red fruit bearberry	*Arctostaphylos rubra*	ARRU	96	10 (0-30)
S	grayleaf willow	*Salix glauca*	SAGL	78	5 (0-20)
S	prickly rose	*Rosa acicularis*	ROAC	74	3 (0-15)
S	lingonberry	*Vaccinium vitis-idaea*	VAVI	63	10 (0-55)
S	twinflower	*Linnaea borealis*	LIBO3	63	2 (0-15)
S	russet buffaloberry	*Shepherdia canadensis*	SHCA	59	1 (0-10)
S	shrubby cinquefoil	*Dasiphora fruticosa*	DAFR3	52	1 (0-5)
S	littletree willow	*Salix arbusculoides*	SAAR3	37	2 (0-10)
G	reedgrass	*Calamagrostis spp.*	CALAM	48	2 (0-25)
F	false toadflax	*Geocaulon lividum*	GELI2	78	5 (0-30)
F	dwarf scouringrush	*Equisetum scirpoides*	EQSC	70	6 (0-50)
F	field horsetail	*Equisetum arvense*	EQAR	48	1 (0-8)
B	stairstep moss	*Hylocomium splendens*	HYSP70	89	30 (0-90)
B	Tomentypnum moss	*Tomentypnum nitens*	TONI70	22	3 (0-40)
L	felt lichen	*Peltigera aphthosa*	PEAP60	48	1 (0-10)
L	greygreen reindeer lichen	*Cladina rangiferina*	CLRA60	44	3 (0-40)

This dataset includes data from 27 sample plots. The plots are distributed across the survey area and are independent of one another.

Values for tall, medium, regenerative, and stunted tree strata are used to calculate mean canopy cover and range values. Regenerative trees are not considered part of the overstory canopy.

Plant functional group classifications—T = trees, S = shrubs, G = graminoids, F = forbs, B = bryophytes, L = lichens

Figure 10. Canopy cover table for community 1.1.

Reference plant community 1.1 is characterized as an open needleleaf forest (Viereck et al. 1992) composed primarily of mature white spruce. The majority of the white spruce trees are similar in age, and the tree cover is split between the tall tree stratum (greater than 40 feet in height) and medium tree stratum (15 to 40 feet in height). Gaps occur in the tree canopy, but they are limited in size and extent and are likely the result of occasional windthrow. Occasional live deciduous trees, primarily quaking aspen, are in the tree canopy, but most have been replaced by white spruce. The soil surface is covered primarily with bryophytes. Commonly observed understory species include grayleaf willow, prickly rose, red fruit bearberry, lingonberry, twinflower, false toadflax, dwarf scouringrush, and stairstep moss. The understory vegetative strata that characterize this community are bryophytes and dwarf shrubs (less than 8 inches in height). White spruce trees were sampled for diameter at breast height (dbh), height, and age at dbh (68 trees, 1 without age data). The basal area of the stand and the site index were determined for each sample plot. The mean dbh is 6.1 inches (ranging from 2.0 to 13.5 inches), the mean height is 40 feet (ranging from 14 to 76 feet), and the mean age is 113 years (ranging from 50 to 173 years). The mean basal area of the stands is 94 (ranging from 40 to 205), and the mean site index is 38 (ranging from 16 to 58) (Farr 1967).

Dominant plant species

- white spruce (*Picea glauca*), tree
- black spruce (*Picea mariana*), tree
- red fruit bearberry (*Arctostaphylos rubra*), shrub
- grayleaf willow (*Salix glauca*), shrub
- prickly rose (*Rosa acicularis*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- twinflower (*Linnaea borealis*), shrub
- russet buffaloberry (*Shepherdia canadensis*), shrub
- shrubby cinquefoil (*Dasiphora fruticosa*), shrub
- littletree willow (*Salix arbusculoides*), shrub
- reedgrass (*Calamagrostis*), grass
- false toadflax (*Geocaulon lividum*), other herbaceous
- dwarf scouringrush (*Equisetum scirpoides*), other herbaceous
- field horsetail (*Equisetum arvense*), other herbaceous

- splendid feather moss (*Hylocomium splendens*), other herbaceous
- tomentypnum moss (*Tomentypnum nitens*), other herbaceous
- felt lichen (*Peltigera aphthosa*), other herbaceous
- greygreen reindeer lichen (*Cladina rangiferina*), other herbaceous

Community 1.2
White spruce / willow-red fruit bearberry / stairstep moss

Figure 11. Typical plant community associated with community 1.2.

Community Phase 1.2 Canopy Cover Table

Vegetation data is aggregated from all sample plots for this community phase. The data is provided as frequency (percent) and mean canopy cover (percent) of the most dominant and ecologically relevant species. Canopy cover is represented as a mean with the range in parentheses.

Plant group	Common name	Scientific name	USDA plant code	Frequency (percent)	Mean canopy cover (percent)
T	white spruce	*Picea glauca*	PIGL	100	40 (2-65)
T	quaking aspen	*Populus tremuloides*	POTR5	24	2 (0-20)
T	black spruce	*Picea mariana*	PIMA	18	4 (0-35)
S	red fruit bearberry	*Arctostaphylos rubra*	ARRU	82	2 (0-5)
S	russet buffaloberry	*Shepherdia canadensis*	SHCA	82	2 (0-10)
S	prickly rose	*Rosa acicularis*	ROAC	76	8 (0-35)
S	grayleaf willow	*Salix glauca*	SAGL	71	3 (0-25)
S	littletree willow	*Salix arbusculoides*	SAAR3	71	4 (0-30)
S	twinflower	*Linnaea borealis*	LIBO3	65	7 (0-35)
S	lingonberry	*Vaccinium vitis-idaea*	VAVI	59	1 (0-10)
L	felt lichen	*Peltigera spp.*	PELTI2	94	3 (0-10)
L	cup lichen	*Cladonia spp.*	CLADO3	59	2 (0-10)
L	reindeer lichen	*Cladina spp.*	CLADI3	53	1 (0-15)
F	wintergreen	*Pyrola spp.*	PYROL	59	1 (0-10)
F	false toadflax	*Geocaulon lividum*	GELI2	41	6 (0-30)
F	dwarf scouringrush	*Equisetum scirpoides*	EQSC	41	10 (0-45)
B	stairstep moss	*Hylocomium splendens*	HYSP70	65	3 (0-10)

This dataset includes data from 17 sample plots. The plots are distributed across the survey area and are independent of one another.

Values for tall, medium, regenerative, and stunted tree strata are used to calculate mean canopy cover and range values. Regenerative trees are not considered part of the overstory canopy.

Plant functional group classifications—T = trees, S = shrubs, G = graminoids, F = forbs, B = bryophytes, L = lichens

Canopy cover data is rounded, except trace (0.1 percent) cover. Data ranging from 1 to 9 percent cover is rounded to the nearest integer. Data ranging from 10 to 100 percent cover is rounded to the nearest factor of 5.

Figure 12. Canopy cover table for community 1.2.

Community 1.2 is in the late stage of fire-induced secondary succession for this ecological site (fig. 4). It is characterized as an open needleleaf forest (Viereck et al. 1992) that is composed of immature and mature white spruce. Quaking aspen has minimal canopy cover, and the common standing and fallen dead deciduous trees indicate that white spruce is becoming dominant in the canopy. Tree cover is split between the regenerating tree stratum (less than 15 feet in height) and medium tree stratum (15 to 40 feet in height). The soil surface is covered with a mixture of herbaceous litter, woody debris, and bryophytes. Commonly observed understory species include

grayleaf willow, littletree willow (*Salix arbusculoides*), russet buffaloberry (*Shepherdia canadensis*), prickly rose, red fruit bearberry, lingonberry, twinflower, false toadflax, and stairstep moss. The understory vegetative strata that characterize this community are bryophytes and dwarf shrubs (less than 8 inches in height). White spruce trees were sampled for diameter at breast height (dbh), height, and age at dbh (42 trees). The basal area of the stand and the site index were determined for each sample plot. The mean dbh is 4.8 inches (ranging from 1.5 to 9.4 inches), the mean height is 28 feet (ranging from 6 to 47 feet), and the mean age is 52 years (ranging from 14 to 79 years). The mean basal area of the stands is 57 (ranging from 18 to 120), and the mean site index is 43 (ranging from 14 to 79) (Farr 1967).

Dominant plant species

- white spruce (*Picea glauca*), tree
- quaking aspen (*Populus tremuloides*), tree
- black spruce (*Picea mariana*), tree
- red fruit bearberry (*Arctostaphylos rubra*), shrub
- russet buffaloberry (*Shepherdia canadensis*), shrub
- prickly rose (*Rosa acicularis*), shrub
- grayleaf willow (*Salix glauca*), shrub
- littletree willow (*Salix arbusculoides*), shrub
- twinflower (*Linnaea borealis*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- dwarf scouringrush (*Equisetum scirpoides*), other herbaceous
- false toadflax (*Geocaulon lividum*), other herbaceous
- wintergreen (*Pyrola*), other herbaceous
- felt lichen (*Peltigera*), other herbaceous
- cup lichen (*Cladonia*), other herbaceous
- reindeer lichen (*Cladina*), other herbaceous
- splendid feather moss (*Hylocomium splendens*), other herbaceous

Community 1.3
White spruce-quaking aspen / willow

Figure 13. Typical plant community associated with community 1.3.

Community Phase 1.3 Canopy Cover Table

Vegetation data is aggregated from all sample plots for this community phase. The data is provided as frequency (percent) and mean canopy cover (percent) of the most dominant and ecologically relevant species. Canopy cover is represented as a mean with the range in parentheses.

Plant group	Common name	Scientific name	USDA plant code	Frequency (percent)	Mean canopy cover (percent)
T	white spruce	*Picea glauca*	PIGL	100	20 (15-25)
T	quaking aspen	*Populus tremuloides*	POTR5	67	2 (0-4)
S	Bebb willow	*Salix bebbiana*	SABE2	100	30 (15-45)
S	russet buffaloberry	*Shepherdia canadensis*	SHCA	100	6 (3-7)
S	prickly rose	*Rosa acicularis*	ROAC	67	3 (0-7)
S	littletree willow	*Salix arbusculoides*	SAAR3	67	3 (0-5)
G	Pumpelly's brome	*Bromus inermis ssp. pumpellianus*	BRINP5	33	8 (0-25)
G	wideleaf polargrass	*Arctagrostis latifolia*	ARLA2	33	4 (0-10)
G	Altai fescue	*Festuca altaica*	FEAL	33	2 (0-5)
F	fireweed	*Chamerion angustifolium*	CHAN9	100	1 (0.1-1)
F	marsh grass of Parnassus	*Parnassia palustris*	PAPA8	67	1 (0-2)
F	horsetail	*Equisetum spp.*	EQUIS	67	0.1 (0-1)
F	tall bluebells	*Mertensia paniculata*	MEPA	67	0.1 (0-0.1)
F	great burnet	*Sanguisorba officinalis*	SAOF3	67	0.1 (0-0.1)
L	felt lichen	*Peltigera aphthosa*	PEAP60	67	1 (0-3)

This dataset includes data from three sample plots. The plots are distributed across the survey area and are independent of one another.

Plant functional group classifications—T = trees, S = shrubs, G = graminoids, F = forbs, B = bryophytes, L = lichens

Values for tall, medium, regenerative, and stunted tree strata are used to calculate mean canopy cover and range values. Regenerative trees are not considered part of the overstory canopy.

Canopy cover data is rounded, except trace (0.1 percent) cover. Data ranging from 1 to 9 percent cover is rounded to the nearest integer. Data ranging from 10 to 100 percent cover is rounded to the nearest factor of 5.

Figure 14. Canopy cover table for community 1.3.

Community 1.3 is in the early stage of fire-induced secondary succession for this ecological site. It is characterized as open tall scrub (Viereck et al. 1992). The overstory canopy is primarily composed of willow and regenerating tree species, commonly quaking aspen and white spruce. Tree cover occurs primarily in the regenerative tree stratum (less than 15 feet in height). The soil surface is covered with a mixture of herbaceous litter, woody debris, and bryophytes. Commonly observed understory species include an assortment of willow (dominantly *S. bebbiana* and *S. arbusculoides*), russet buffaloberry, prickly rose, and an assortment of weedy bryophytes. The understory vegetative strata that characterize this community are low shrubs (8 to 36 inches in height), medium shrubs (3 to 10 feet in height), and tall shrubs (greater than 10 feet in height). White spruce trees were sampled for diameter at breast height (dbh), height, and age at dbh (8 trees). The basal area of the stand was determined for each sample plot. The mean dbh is 3.7 inches (ranging from 0.9 to 6.2 inches), the mean height is 23 feet (ranging from 7 to 38 feet), and the mean age is 25 years (ranging from 6 to 40 years). The mean basal area of the stands is 10 (ranging from 3 to 23).

Dominant plant species

- white spruce (*Picea glauca*), tree
- quaking aspen (*Populus tremuloides*), tree
- Bebb willow (*Salix bebbiana*), shrub
- russet buffaloberry (*Shepherdia canadensis*), shrub
- prickly rose (*Rosa acicularis*), shrub
- littletree willow (*Salix arbusculoides*), shrub
- Pumpelly's brome (*Bromus inermis ssp. pumpellianus var. pumpellianus*), grass
- wideleaf polargrass (*Arctagrostis latifolia*), grass
- Altai fescue (*Festuca altaica*), grass
- marsh grass of Parnassus (*Parnassia palustris*), other herbaceous
- horsetail (*Equisetum*), other herbaceous
- tall bluebells (*Mertensia paniculata*), other herbaceous
- great burnet (*Sanguisorba officinalis*), other herbaceous
- felt lichen (*Peltigera aphthosa*), other herbaceous

Community 1.4
Fireweed-field horsetail / Ceratodon moss

Figure 15. Typical plant community associated with community 1.4.

Community Phase 1.4 Canopy Cover Table

Vegetation data is aggregated from all sample plots for this community phase. The data is provided as frequency (percent) and mean canopy cover (percent) of the most dominant and ecologically relevant species. Canopy cover is represented as a mean with the range in parentheses.

Plant group	Common name	Scientific name	USDA plant code	Frequency (percent)	Mean canopy cover (percent)
T	quaking aspen	*Populus tremuloides*	POTR5	100	6 (2-10)
S	willow	*Salix spp.*	SALIX	100	3 (0.1-5)
F	fireweed	*Chamerion angustifolium*	CHAN9	100	35 (2-85)
F	field horsetail	*Equisetum arvense*	EQAR	67	20 (0-65)
B	*Ceratodon* moss	*Ceratodon purpureus*	CEPU12	67	20 (0-30)
B	*Marchantia* liverwort	*Marchantia polymorpha*	MAPO16	33	2 (0-5)
L	felt lichen	*Peltigera spp.*	PELTI2	33	10 (0-30)

This dataset includes data from three sample plots. The plots are distributed across the survey area and are independent of one another.

Plant functional group classifications—T = trees, S = shrubs, G = graminoids, F = forbs, B = bryophytes, L = lichens

Values for tall, medium, regenerative, and stunted tree strata are used to calculate mean canopy cover and range values. Regenerative trees are not considered part of the overstory canopy.

Canopy cover data is rounded, except trace (0.1 percent) cover. Data ranging from 1 to 9 percent cover is rounded to the nearest integer. Data ranging from 10 to 100 percent cover is rounded to the nearest factor of 5.

Community pathway 1.4A
Time without fire. For more information, refer to the "Disturbance Dynamics" section.

Figure 16. Canopy cover table or community 1.4.

Community 1.4 is in the pioneering stage of fire-induced secondary succession for this ecological site. It is characterized as mesic forb herbaceous (Viereck et al. 1992). Deciduous tree seedlings, primarily quaking aspen, are common. The tree cover is in the regenerative tree stratum (less than 15 feet in height). Although there are small areas of exposed bare soil, the soil surface is covered primarily with a mixture of bryophytes, woody debris, and herbaceous litter. Commonly observed understory species include an assortment of willow, fireweed (*Chamerion angustifolium*), field horsetail (*Equisetum arvense*), and Ceratodon moss (*Ceratodon purpureus*). The understory vegetative strata that characterize this community are medium forbs (4 to 24 inches in height) and bryophytes.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree

- willow (*Salix*), shrub
- fireweed (*Chamerion angustifolium*), other herbaceous
- ceratodon moss (*Ceratodon purpureus*), other herbaceous
- (*Marchantia polymorpha*), other herbaceous
- felt lichen (*Peltigera*), other herbaceous

Pathway 1.1a
Community 1.1 to 1.4

White spruce / red fruit bearberry-lingonberry / stairstep moss

Fireweed-field horsetail / Ceratodon moss

Fire.

Pathway 1.2b
Community 1.2 to 1.1

White spruce / willow-red fruit bearberry / stairstep moss

White spruce / red fruit bearberry-lingonberry / stairstep moss

Time without fire.

Pathway 1.2a
Community 1.2 to 1.4

White spruce / willow-red fruit bearberry / stairstep moss

Fireweed-field horsetail / Ceratodon moss

Fire.

Pathway 1.3b
Community 1.3 to 1.2

White spruce-quaking aspen / willow

White spruce / willow-red fruit bearberry / stairstep moss

Time without fire.

Pathway 1.3a
Community 1.3 to 1.4

White spruce-quaking aspen / willow

Fireweed-field horsetail / Ceratodon moss

Fire.

Pathway 1.4a
Community 1.4 to 1.3

Fireweed-field horsetail / Ceratodon moss

White spruce-quaking aspen / willow

Time without fire.

Additional community tables

Table 5. 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	4.3–23.2	1–65	5.1–34.3	–
black spruce	PIMA	*Picea mariana*	Native	–	0–40	–	–

Table 6. 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	1.8–14.3	2–65	3.8–23.9	–
black spruce	PIMA	*Picea mariana*	Native	–	0–35	–	–
quaking aspen	POTR5	*Populus tremuloides*	Native	–	0–20	–	–

Table 7. Community 1.3 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	2.1–11.6	15–25	2.3–15.7	–
quaking aspen	POTR5	*Populus tremuloides*	Native	–	0–4	–	–

Table 8. 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*	16	58	–	–	–	–	–	

Inventory data references

NASIS User Site ID / Modal Datasets
10BL01603 community 1.1
11SN03301 community 1.1
11BB05403 community 1.1
11BB05604 community 1.1
12NR02103 community 1.1
12NR02202 community 1.1
12NR01602 community 1.1
12NR01603 community 1.1
12NR01704 community 1.1
12BB00501 community 1.1
11BB05201 community 1.1
11BB05206 community 1.1
12BB00202 community 1.1
10BB01103 community 1.1
10BB01404 community 1.1
10BB00902 community 1.1
13BA01305 community 1.1
13NR01103 community 1.1
13NR02101 community 1.1
14AK2903010 community 1.1
14NR00501 community 1.1
14NR00902 community 1.1
14AK2903113 community 1.1
14AK2903078 community 1.1
2015AK290998 community 1.1
2015AK290619 community 1.1
S2015AK290007 community 1.1
10BB01002 community 1.2
10BB01204 community 1.2
10BL02501 community 1.2
11TD08906 community 1.2
11TD09501 community 1.2
11TD09504 community 1.2
12NR02201 community 1.2
12NR02702 community 1.2
12NR03003 community 1.2
13BA01703 community 1.2
13NR01201 community 1.2
13NR01202 community 1.2
14NR02102 community 1.2
2015AK290412 community 1.2
2015AK290413 community 1.2
2015AK290420 community 1.2
2015AK290465 community 1.2
11TD08803 community 1.3
12SN00502 community 1.3
13BA01602 community 1.3
10BL01303 community 1.4
12NR01303 community 1.4
13NR01203 community 1.4

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Contributors

Blaine T. Spellman

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	Michael Margo
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):**

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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:**

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17. **Perennial plant reproductive capability:**
