USDA Natural Resources Conservation Service

Ecological site R231XY138AK
Boreal Sedge Loamy Flood Plain Depressions

Last updated: 2/13/2024
Accessed: 05/14/2025

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): 231X–Interior Alaska Highlands

The Interior Alaska Uplands (MLRA 231X) is in the Interior Region of Alaska and includes the extensive hills, mountains, and valleys between the Tanana River to the south and the Brooks Range to the north. These hills and mountains surround the Yukon Flats Lowlands (MLRA 232X). MLRA 231X makes up about 69,175 square miles. The hills and mountains of the area tend to be moderately steep to steep resulting in high-relief slopes. The mountains are generally rounded at lower elevations and sharp-ridged at higher elevations. Elevation ranges from about 400 feet in the west, along the boundary with the Interior Alaska Lowlands (MLRA 229X), to 6,583 feet at the summit of Mt. Harper, in the southeast. Major tributaries include large sections of the Yukon, Koyukuk, Kanuti, Charley, Coleen, and Chatanika Rivers. This area is traversed by several major roads, including the Taylor Highway in the east and the Steese, Elliott, and Dalton Highways north of Fairbanks. The area is mostly undeveloped wild land that is sparsely populated. The largest community along the road system is Fairbanks with smaller communities like Alatna, Allakaket, Chicken, Eagle, Eagle Village, Hughes, and Rampart occurring along the previously mentioned rivers and highways.

The vast majority of this MLRA was unglaciated during the Pleistocene epoch with the exceptions being the highest mountains and where glaciers extended into the area from the Brooks Range. For the most part, glacial moraines and drift are limited to the upper elevations of the highest mountains. Most of the landscape is mantled with bedrock colluvium originating from the underlying bedrock. Valley bottoms are filled with Holocene fluvial deposits and colluvium from the adjacent mountain slopes. Silty loess, which originated from unvegetated flood plains in and adjacent to this area, covers much of the surface. On hill and mountain slopes proximal to major river valleys (e.g., Tanana and Yukon Rivers), the loess is many feet thick. As elevation and distance from major river valleys increases, loess thickness decreases significantly. Bedrock is commonly exposed on the highest ridges.

This area is in the zone of discontinuous permafrost. Permafrost commonly is close to the surface in areas of the finer textured sediments throughout the MLRA. Isolated masses of ground ice occur in thick deposits of loess on terraces and the lower side slopes of hills. Solifluction lobes, frost boils, and circles and stripes are periglacial features common on mountain slopes in this area. Pingos, thermokarst pits and mounds, ice-wedge polygons, and earth hummocks are periglacial features common on terraces, lower slopes of hills and mountains, and in upland valleys in the area.

The dominant soil orders in this area are Gelisols, Inceptisols, Spodosols, and Entisols. The soils in the area have a subgelic or cryic soil temperature regime, an aquic or udic soil moisture regime, and mixed mineralogy. Gelisols are common on north facing slopes, south facing footslopes, valley bottoms, and stream terraces. Gelisols are typically shallow or moderately deep to permafrost (10 to 40 inches) and are poorly or very poorly drained. Wildfires can disturb the insulating organic material at the surface, lowering the permafrost layer, eliminating perched water tables from Gelisols, and thus changing the soil classification. Inceptisols and Spodosols commonly form on south facing hill and mountain slopes. Entisols are common on flood plains and high elevation mountain slopes. Miscellaneous (non-soil) areas make up about 2 percent of this MLRA. The most common miscellaneous areas are rock outcrop and rubble land. In many valleys placer mine tailings are common.

Short, warm summers and long, cold winters characterize the subarctic continental climate of the area. The mean annual temperature of the area ranges from 22 to 27 degrees F. The mean annual temperature of the southern half of the area is approximately 3 degrees warmer compared to the northern half (PRISM 2018). The warmest months span June through August with mean monthly temperatures ranging from 50 to 56 degrees F. The coldest months span November through February with mean monthly temperatures ranging from -5 to 3 degrees F. When compared to the high-elevation alpine and subalpine life zones, the lower elevation boreal life zone tends to be 2-3 degrees F colder during the coldest months and 1-2 degrees F warmer during the warmest months (PRISM 2018). The freeze-free period at the lower elevations averages about 60 to 100 days, and the temperature usually remains above freezing from June through mid-September.

Precipitation is limited across this area, with the average annual precipitation ranging from 12 to 19 inches. The southern half of the areas receives approximately 2.5 inches more annual precipitation then the northern half (PRISM 2018). The lower elevation boreal life zone receives approximately 2.5 inches less annual precipitation than the high-elevation alpine and subalpine life zones (PRISM 2018). Approximately 3/5th of the annual precipitation occurs during the months of June through September with thunderstorms being common. The average annual snowfall ranges from about 45 to 100 inches. The ground is consistently covered with snow from November through March.

Most of this area is forested below an elevation of about 2500 feet. Dominant tree species on slopes are white spruce and black spruce. Black spruce stands are most common on north-facing slopes, stream terraces, and other sites with poor drainage and permafrost. White spruce stands are most common on warm slopes with dry soils. At lower elevations, lightning-caused wildfires are common, often burning many thousands of acres during a single fire. Following wildfires, forbs, grasses, willow, ericaceous shrubs, paper birch, and quacking aspen communities are common until they are eventually replaced by stands of spruce. Tall willow and alder scrub is extensive on low flood plains. White spruce and balsam poplar are common on high flood plains.

With increasing elevation, the forests and woodlands give way to subalpine communities dominated by krummholz spruce, shrub birch, willow, and ericaceous shrubs. At even higher elevations, alpine communities prevail which are characterized by diverse forbs, dwarf ericaceous shrubs, and eightpetal mountain-avens. Many of these high elevation communities have a considerable amount of lichen cover and bare ground.

LRU notes

This area supports three life zones defined by the physiological limits of plant communities along an elevational gradient: boreal, subalpine, and alpine. The boreal life zone is the elevational band where forest communities dominate. Not all areas in the boreal life zone are forest communities, however, particularly in places with too wet or dry soil to support tree growth (e.g., bogs or river bluffs). Above the boreal band of elevation, subalpine and alpine vegetation dominate. The subalpine zone is typically a narrow transitional band between the boreal and the alpine life zones, and is characterized by sparse, stunted trees. In the subalpine, certain types of birch and willow shrub species grow at ≥ 1 m in height (commonly Betula glandulosa and Salix pulchra). In the alpine, trees no longer occur, and all shrubs are dwarf or lay prostrate on the ground. In this area, the boreal life zone occurs below 2500 feet elevation on average. The transition between boreal and alpine vegetation can occur within a range of elevations, and is highly dependent on slope, aspect, and shading from adjacent mountains.

Within each life zone, there are plant assemblages that are typically associated with cold slopes and warms slopes. Cold slopes and warm slopes are created by the combination of the steepness of the slope, the aspect, and shading from surrounding ridges and mountains. Warm slope positions typically occur on southeast to west facing slopes that are moderate to very steep (>10% slope) and are not shaded by the surrounding landscape. Cold slopes typically occur on northwest to east facing slopes, occur in shaded slope positions, or occur in low-lying areas that are cold air sinks. Examples of shaded positions include head slopes, low relief backslopes of hills, and the base of hills and mountains shaded by adjacent mountain peaks. Warm boreal slope soils have a cryic soil temperature regime and lack permafrost. In this area, white spruce forests are an indicator of warm boreal slopes. Cold boreal slope soils typically have a gelic soil temperature regime and commonly have permafrost. In this area, black spruce forests and woodlands are an indicator of cold boreal slopes. The boreal life zone can occur at higher elevations on warm slopes, and lower elevations on cold slopes.

Classification relationships

Landfire BPS – 7416170 – Western North American Boreal Shrub and Herbaceous Floodplain Wetland (Landfire 2009)

Ecological site concept

This boreal site occurs on depressions of flood plains with wet and deep loamy soils. Soils lack permafrost, commonly pond and flood, have a high-water table throughout the growing season, and are considered very poorly to poorly drained. The typical soil profile is a thin layer of saturated organic material over loamy alluvium. These very wet soils result in abundant wetland indicator plants and vegetation that is significantly different when compared to adjacent flood plains with drier soils.

One plant community has been documented within the reference state. This community is characterized as wet graminoid herbaceous (Viereck et al. 1992) with the dominant species being Northwest territory sedge and bluejoint. Other commonly observed species are feltleaf willow, tealeaf willow, water sedge, American mannagrass, rock sedge, water horsetail, purple marshlocks, scouringrush horsetail, and common mare's-tail.

Associated sites

F231XY196AK	**Boreal Forest Loamy Frozen Flood Plain** Occurs on the high flood plain of high-order streams in the area that support white spruce forests.
R231XY198AK	**Boreal Scrubland Loamy Flood Plain** Occurs on the low flood plain of high-order streams in the area that support shrubby communities.
R231XY130AK	**Boreal Scrubland Gravelly Floodplain** Occurs on the low flood plain of montane streams that support shrubby communities.
F231XY131AK	**Boreal Forest Gravelly Floodplain** Occurs on the high flood plain of montane streams that support forested communities.
F231XY169AK	**Boreal Woodland Peat Frozen Flats** Occurs on adjacent stream terraces that no longer flood. Soils have permafrost and support black spruce woodlands.
F231XY171AK	**Boreal Woodland Loamy Frozen Terraces** Occurs on adjacent stream terraces that no longer flood. Soils have permafrost and support black spruce woodlands.
F231XY189AK	**Boreal Forest Loamy Flood Plain** Occurs on the middle flood plain of high-order streams in the area that support balsam poplar forests.

Similar sites

R231XY137AK	**Boreal Sedge Peat Depressions** Occurs on abandoned channels on stream terraces with thick layers of saturated organic material. Site 137 has different kinds and amounts of vegetation.
XA232X01Y205	**Boreal Grass Loamy Flood Plain Depressions** Occurs on similar flood plain depressions in the Yukon Flats Lowlands area.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Carex utriculata* (2) *Calamagrostis canadensis*

Physiographic features

This boreal site most commonly occurs in depressions and/or channels of flood plains. On occasion, this site occurs

in depressions of stream terraces. Associated depressions have negligible slope and occur on all aspects. Elevation is typically below 2150 feet. In general, these depressions flood occasionally for long durations of time. Ponding occurs occasionally to frequently for long durations of time. During ponding events, water can be 4 inches above the soil surface. A water table remains at very shallow depth throughout the growing season. This site provides negligible runoff to adjacent sites.

Table 2. Representative physiographic features

Landforms	(1) Alluvial plain > Flood plain (2) Alluvial plain > Stream terrace (3) Alluvial plain > Depression (4) Alluvial plain > Channel
Runoff class	Negligible
Flooding duration	Long (7 to 30 days)
Flooding frequency	Occasional
Ponding duration	Long (7 to 30 days)
Ponding frequency	Occasional to frequent
Elevation	91–221 m
Slope	0–3%
Ponding depth	0–10 cm
Water table depth	0 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding duration	Long (7 to 30 days)
Flooding frequency	None to occasional
Ponding duration	Long (7 to 30 days) to very long (more than 30 days)
Ponding frequency	Rare to frequent
Elevation	91–655 m
Slope	0–5%
Ponding depth	0–15 cm
Water table depth	0–20 cm

Climatic features

Short, warm summers and long, cold winters characterize the subarctic continental climate associated with this boreal site. The mean annual temperature of the site ranges from 22 to 27 degrees F. The warmest months span June through August with mean normal maximum monthly temperatures ranging from 60 to 66 degrees F. The coldest months span November through February with mean normal minimum temperatures ranging from -3 to -12 degrees F. The freeze-free period for the site ranges from 80 to 120 days, and the temperature usually remains above freezing from late May through mid-September.

The area receives minimal annual precipitation with the summer months being the wettest. Average annual precipitation across the area typically ranges between 12 to 18 inches. Approximately 3/5th of the annual precipitation occurs during the months of June through September with thunderstorms common. The average annual snowfall ranges from about 45 to 100 inches. The ground is consistently covered with snow from November through March.

Table 4. Representative climatic features

Frost-free period (characteristic range)	16-78 days
Freeze-free period (characteristic range)	76-114 days
Precipitation total (characteristic range)	305-457 mm
Frost-free period (actual range)	4-87 days
Freeze-free period (actual range)	48-120 days
Precipitation total (actual range)	229-508 mm
Frost-free period (average)	53 days
Freeze-free period (average)	90 days
Precipitation total (average)	381 mm

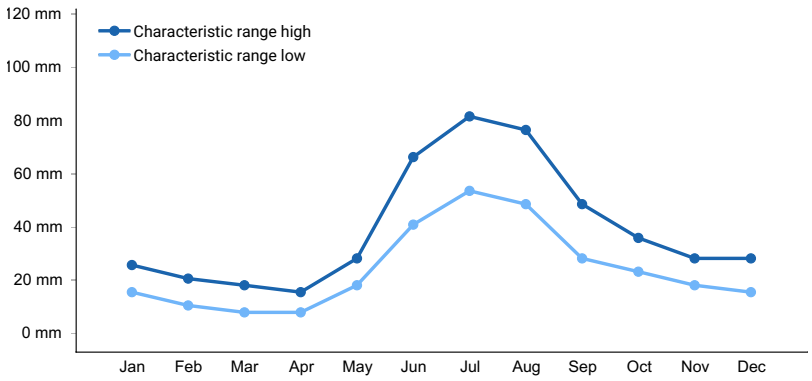

Figure 1. Monthly precipitation range

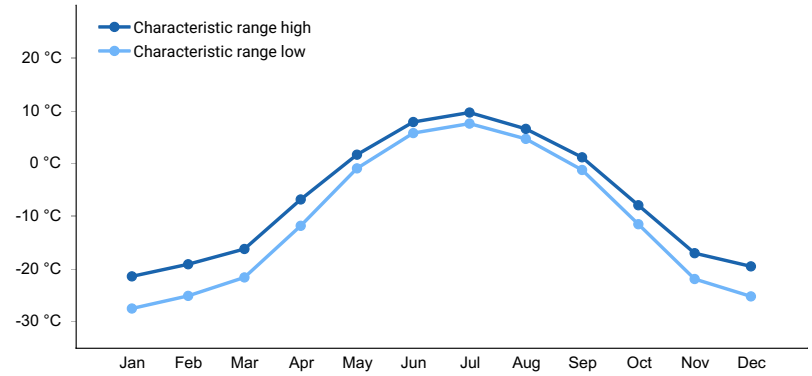

Figure 2. Monthly minimum temperature range

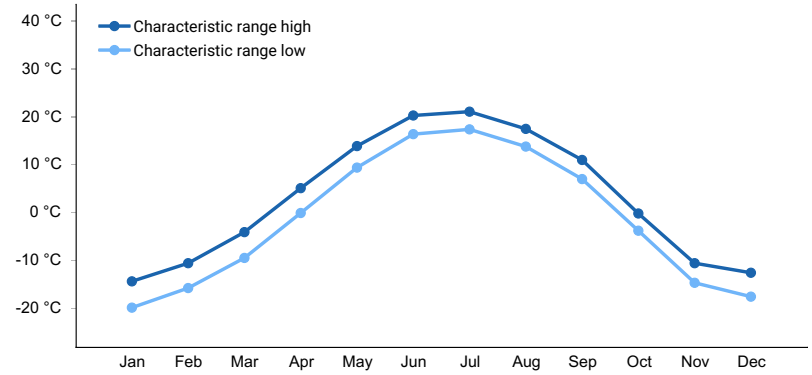

Figure 3. Monthly maximum temperature range

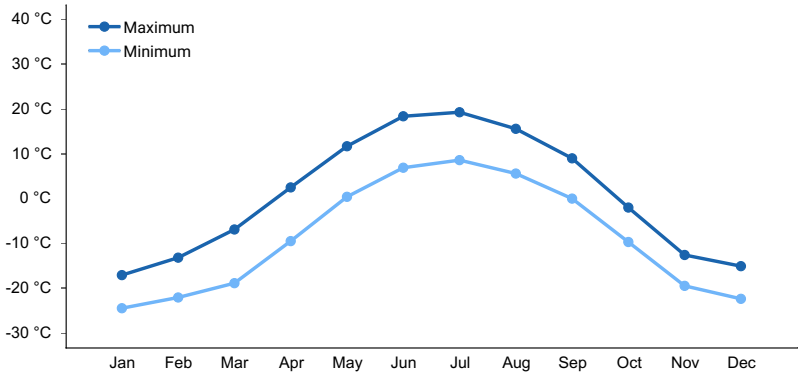

Figure 4. Monthly average minimum and maximum temperature

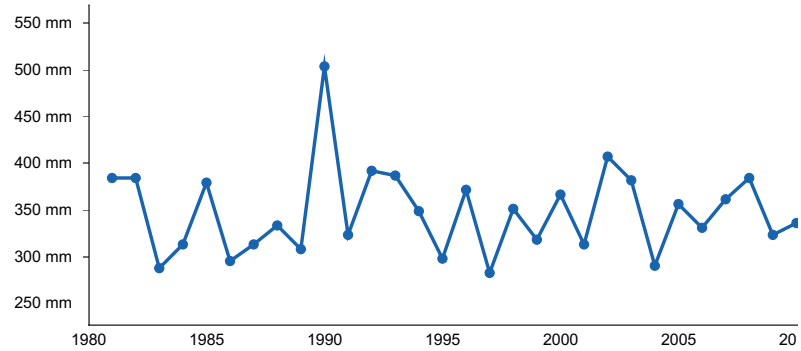

Figure 5. Annual precipitation pattern

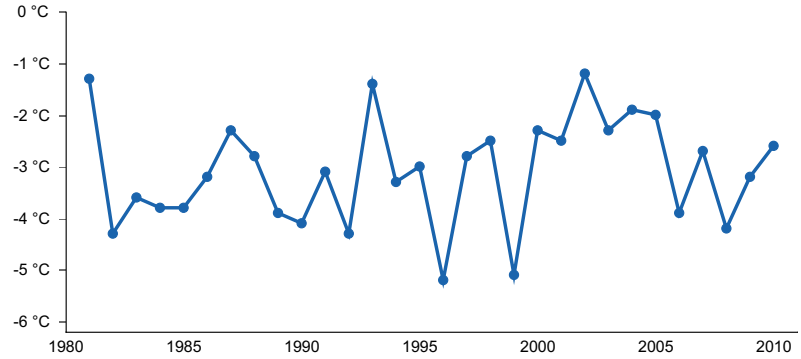

Figure 6. Annual average temperature pattern

Climate stations used

- (1) EAGLE AP [USW00026422], Tok, AK
- (2) CHICKEN [USC00501684], Tok, AK
- (3) MILE 42 STEESE [USC00505880], Fairbanks, AK
- (4) BETTLES AP [USW00026533], Bettles Field, AK
- (5) CIRCLE HOT SPRINGS [USC00501987], Central, AK
- (6) FT KNOX MINE [USC00503160], Fairbanks, AK
- (7) GILMORE CREEK [USC00503275], Fairbanks, AK
- (8) FOX 2SE [USC00503181], Fairbanks, AK
- (9) ESTER DOME [USC00502868], Fairbanks, AK
- (10) ESTER 5NE [USC00502871], Fairbanks, AK
- (11) COLLEGE 5 NW [USC00502112], Fairbanks, AK
- (12) COLLEGE OBSY [USC00502107], Fairbanks, AK
- (13) KEYSTONE RIDGE [USC00504621], Fairbanks, AK

Influencing water features

This site is classified as a Riverine wetland under the Hydrogeomorphic (HGM) classification system (Smith et al.

1995; USDA-NRCS 2008). In the associated flood plain depressions, overbank flow from the channel and subsurface hydraulic connections between the stream and adjacent wetland are the main sources of water (Smith et al. 1995).

Depth to the water table may decrease following summer storm events or spring snowmelt and increase during extended dry periods.

Soil features

Soils formed in loamy alluvium and do not have permafrost. Soil surface rock fragments are typically absent. These are mineral soils commonly capped with 2 to 6 inches of organic material. The mineral soil below the organic material is often silt loam derived from alluvium, which lack rock fragments and have high water holding capacity. Below the surface mineral layer are stratified bands of silt loam, loamy sand, and sand. These are very deep soils without restrictive layers. The pH of the soil profile typically ranges from neutral to slightly alkaline. The soils are wet for long portions of the growing season and are considered very poorly to poorly drained.

Figure 7. A typical soil profile associated with this site.

Table 5. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Silt loam
Family particle size	(1) Coarse-loamy
Drainage class	Very poorly drained to poorly drained
Permeability class	Moderately rapid
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	16.51–20.07 cm
Calcium carbonate equivalent (25.4-101.6cm)	0%
Clay content (0-50.8cm)	0–6%
Electrical conductivity (25.4-101.6cm)	0–5 mmhos/cm
Sodium adsorption ratio (25.4-101.6cm)	0

Soil reaction (1:1 water) (25.4-101.6cm)	6.6–7.8
Subsurface fragment volume <=3" (0-152.4cm)	0%
Subsurface fragment volume >3" (0-152.4cm)	0%

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	9.91–42.67 cm
Calcium carbonate equivalent (25.4-101.6cm)	Not specified
Clay content (0-50.8cm)	Not specified
Electrical conductivity (25.4-101.6cm)	Not specified
Sodium adsorption ratio (25.4-101.6cm)	Not specified
Soil reaction (1:1 water) (25.4-101.6cm)	5.5–7.8
Subsurface fragment volume <=3" (0-152.4cm)	0–3%
Subsurface fragment volume >3" (0-152.4cm)	Not specified

Ecological dynamics

These flood plain depressions have one documented plant community. During field work, it was noted these depressions commonly have at least two separate plant communities (NRCS personal observation). The outer half or shallower portions of the depression pond for shorter durations of time and tend to support sedge and grass dominant communities (community 1.1). The center or deeper portions of the depressions tend to pond for longer durations of time and support different plant communities (at times water horsetail and common mare’s tail dominant herbaceous meadows). The center of these depressions were not sampled. For this site, additional plots will help clarify additional plant communities in the reference state.

State and transition model

Ecosystem states

1. Reference State

State 1 submodel, plant communities

1.1. Northwest Territory sedge - bluejoint / water horsetail - purple marshlocks

State 1
Reference State

Figure 8. Sedge meadow on a flood plain depression in the area.

The reference plant community is wet graminoid herbaceous (Viereck et al. 1992). Associated soils pond and have a persistent high water table. The reference state has one documented plant community.

Dominant plant species

- Northwest Territory sedge (*Carex utriculata*), grass
- bluejoint (*Calamagrostis canadensis*), grass
- water horsetail (*Equisetum fluviatile*), other herbaceous
- purple marshlocks (*Comarum palustre*), other herbaceous

Community 1.1
Northwest Territory sedge - bluejoint / water horsetail - purple marshlocks

Figure 9. A typical plant community associated with community 1.1.

Reference community 1.1 is characterized as wet graminoid herbaceous (Viereck et al. 1992) with the dominant species being Northwest territory sedge, bluejoint, and water sedge. Other commonly observed species are feltleaf willow, tealeaf willow, American mannagrass, rock sedge, water horsetail, purple marshlocks, scouringrush

horsetail, and common mare's-tail. The soil surface is primarily covered with herbaceous litter. Water was commonly ponded over the herbaceous litter (as much as 100 percent of the plot). The vegetative strata that characterize this community are tall graminoids (greater than 2 feet in height) and medium graminoids (between 4 inches and 2 feet).

Dominant plant species

- feltleaf willow (*Salix alaxensis*), shrub
- tealeaf willow (*Salix pulchra*), shrub
- Northwest Territory sedge (*Carex utriculata*), grass
- bluejoint (*Calamagrostis canadensis*), grass
- water sedge (*Carex aquatilis*), grass
- American mannagrass (*Glyceria grandis*), grass
- rock sedge (*Carex saxatilis*), grass
- purple marshlocks (*Comarum palustre*), other herbaceous
- water horsetail (*Equisetum fluviatile*), other herbaceous
- scouringrush horsetail (*Equisetum hyemale*), other herbaceous
- common mare's-tail (*Hippuris vulgaris*), other herbaceous

Additional community tables

Table 7. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
Northwest Territory sedge	CAUT	*Carex utriculata*	Native	0.6–0.9	0–90
bluejoint	CACA4	*Calamagrostis canadensis*	Native	0.6–1.2	0–75
water sedge	CAAQ	*Carex aquatilis*	Native	0.6–0.9	0–65
rock sedge	CASA10	*Carex saxatilis*	Native	0.6–0.9	0–45
American mannagrass	GLGR	*Glyceria grandis*	Native	0.6–1.2	0–25
shortawn foxtail	ALAE	*Alopecurus aequalis*	Native	0.6–1.2	0–5
Forb/Herb					
water horsetail	EQFL	*Equisetum fluviatile*	Native	0.1–0.6	0–45
scouringrush horsetail	EQHY	*Equisetum hyemale*	Native	0.1–0.6	0–25
purple marshlocks	COPA28	*Comarum palustre*	Native	0.1–0.6	0–5
common mare's-tail	HIVU2	*Hippuris vulgaris*	Native	0–0.1	0–1
Shrub/Subshrub					
feltleaf willow	SAAL	*Salix alaxensis*	Native	0.9–3	0–8
tealeaf willow	SAPU15	*Salix pulchra*	Native	0.9–1.5	0–2

Animal community

n/a

Hydrological functions

n/a

Recreational uses

n/a

Wood products

n/a

Other products

n/a

Other information

n/a

Inventory data references

Tier 2 sampling plots used to develop the reference state. Plot numbers as recorded in NASIS with associated community phase.

Community 1.1

09NP02204, 09TC02803, 09TC04101, 10NP01603, 10NP03402, 11BB03703, 2015AK290504, 2015AK290506, 2015AK290531, 2016AK290702

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Approval

Kirt Walstad, 2/13/2024

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	05/14/2025
Approved by	Kirt Walstad
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):**

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

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

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
