USDA Natural Resources Conservation Service

Ecological site F236XY171AK
Subarctic Woodland Loamy Slopes

Last updated: 2/13/2024
Accessed: 05/17/2024

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.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 236X–Bristol Bay-Northern Alaska Peninsula Lowlands

The Bristol Bay-Northern Alaska Peninsula Lowland Major Land Resource Area (MLRA 236) is located in Western Alaska. This MLRA covers approximately 19,500 square miles and is defined by an expanse of nearly level to rolling lowlands, uplands and low to moderate hills bordered by long, mountain footslopes. Major rivers include the Egegik, Mulchatna, Naknek, Nushagak, and Wood River. MLRA 236 is in the zone of discontinuous permafrost. It is primarily in areas with finer textured soils on terraces, rolling uplands and footslopes. This MLRA was glaciated during the early to middle Pleistocene. Moraine and glaciofluvial deposits cover around sixty percent of the MLRA. Alluvium and coastal deposits make up a large portion of the remaining area (Kautz et al., 2012; USDA, 2006).

Climate patterns across this MLRA shift as one moves away from the coast. A maritime climate is prominent along the coast, while continental weather, commonly associated with Interior Alaska, is more influential inland. Across the MLRA, summers are general short and warm while winters are long and cold. Mean annual precipitation is 13 to 50 inches, with increased precipitation at higher elevations and areas away from the coast. Mean annual temperatures is between 30 and 36 degrees F (USDA, 2006).

The Bristol Bay-Northern Alaska Peninsula MLRA is principally undeveloped wilderness. Federally managed land includes parts of the Katmai and Aniakchak National Parks, and the Alaska Peninsula, Becharof, Togiak and Alaska Maritime National Wildlife Refuges. The MLRA is sparsely populated. Principal communities include Dillingham,

Naknek, and King Salmon. Commercial fishing in Bristol Bay and the Bering Sea comprises a major part of economic activity in the MLRA. Other land uses include subsistence activities (fishing, hunting, and gathering) and sport hunting and fishing (USDA, 2006).

Ecological site concept

This boreal ecological site is on sloped plain talfs. Site elevation ranges from 10 to 190 feet above sea level. Slopes are nearly level to gentle (0 – 8 percent). Soil hydrology and local slope gradient shape the vegetation on this landform. Soils are typically poorly drained with a histic epipedon and aquic conditions throughout. These conditions limit where a forest may develop in this site. A woodland typically only develops in the drier areas of this landform, commonly where slope gradient is highest. The effects of soil wetness are decreased here due to increased run off and drainage. Level slopes generally support wetter soil, which exclude trees and support hydrophytic shrubs and graminoids.

The reference state supports three communities. The reference plant community is characterized as a mixed woodland (Viereck et al., 1992). It is composed of a white spruce and birch overstory with ericaceous shrubs and moss in the understory. Other communities on this site are limited by wetter soils. Communities on this site are relatively stable, as a marked change in site hydrology is typically required to elicit a vegetative response or community shift.

Associated sites

R236XY124AK	**Subarctic Tall Scrub Loamy Convex Hillslopes** R236XY124 describes a scrubland on convex plain slopes. It is associated with well drained soils with no water table.
F236XY115AK	**Boreal Forest Loamy Moist Slopes** F236XY115AK describes a forested plain on well drained soils. It is found on similar landforms as this site, but differences in soil, and particularly soil wetness, prevent a forest from developing on areas described by F236XY171AK.
R236XY127AK	**Subarctic Sedge Peat Plain Depressions** F236XY127AK is found in concave dips in plains. Soil is organic and very poorly drained and does not support the trees found in R236XY171AK.

Similar sites

R236XY140AK	**Subarctic Tussock Tundra Wet Loamy Plains** R236XY140AK is associated with a soil similar to that of F236XY171AK. R236XY140AK is found in upstream areas of the Nushagak River, where local climate excludes the presence of trees.

Table 1. Dominant plant species

Tree	(1) *Picea glauca* (2) *Betula papyrifera*
Shrub	(1) *Empetrum nigrum* (2) *Betula nana*
Herbaceous	(1) *Carex*

Physiographic features

This site is on linear slopes of plain talfs. Elevation ranges from 10 to 190 feet above sea level. Slopes are nearly level to gentle (0 – 8 percent). Flooding does not occur. Ponding a a frequent and long event, particularly on the shallowest slopes. This site is found at all aspects.

Table 2. Representative physiographic features

Geomorphic position, flats	(1) Talf
Landforms	(1) Plains > Plain

Runoff class	Low to medium
Flooding frequency	None
Ponding duration	Long (7 to 30 days)
Ponding frequency	Frequent
Elevation	3–58 m
Slope	0–8%
Water table depth	0 cm
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Low to high
Flooding frequency	None
Ponding duration	Long (7 to 30 days)
Ponding frequency	Frequent
Elevation	0–107 m
Slope	0–11%
Water table depth	0 cm

Climatic features

The climate of this site reflects that of the MLRA, which is described as maritime polar (EPA, 2013). Temperatures are moderated by the nearby Bristol Bay and norther Pacific bodies of water. Annual precipitation ranges from 21 – 34 inches with approximately 40 percent occurring during the June-September growing season (PRISM, 2018).

Table 4. Representative climatic features

Frost-free period (characteristic range)	75-100 days
Freeze-free period (characteristic range)	65-90 days
Precipitation total (characteristic range)	533-864 mm
Frost-free period (actual range)	75-100 days
Freeze-free period (actual range)	65-90 days
Precipitation total (actual range)	381-1,041 mm
Frost-free period (average)	90 days
Freeze-free period (average)	75 days
Precipitation total (average)	737 mm

Influencing water features

Due to its landscape position, this site is not influenced by wetland or riparian water features. Precipitation and snow melt are the main sources of water.

Soil features

Soils are young and weakly developed Inceptisols (Soil Survey Staff, 2013). Soils are very deep and poorly drained. They support a cryic temperature regime and an aquic moisture regime. Parent material is herbaceous organic material over coarse-silty loess.

Soil hydrology affects the extant vegetation. This organic soil is wet, with a histic epipedon and aquic conditions throughout the soil profile. A water table is present at the soil surface at the beginning on the growing season (May and June). These conditions limit where a forest may develop in this site. A woodland typically only develops in the drier areas of this landform. Other soil factors, including extreme to strong acidity (pH 4.3 to 5.2) in the top ten inches of soil, may affect vegetation as well.

Correlated soil components in MLRA 236: Nushagak

Table 5. Representative soil features

Parent material	(1) Loess
Surface texture	(1) Mucky peat
Drainage class	Poorly drained
Permeability class	Slow to moderate
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	17.53–33.53 cm
Soil reaction (1:1 water) (0-25.4cm)	4.3–5.2
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Table 6. Representative soil features (actual values)

Drainage class	Poorly drained
Permeability class	Slow to moderate
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	17.53–33.53 cm
Soil reaction (1:1 water) (0-25.4cm)	4.3–5.2
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This site is on linear slopes of plain talfs. Local site factors, including soil hydrology and site topography and slope support three vegetative communities in the reference state. The reference plant community is a mixed birch and white spruce woodland.

Spatial patterns in site slope and hydrology shape three communities in the reference state. Trees, and the reference plant community, are most common in areas with the greatest slope gradient. The effects of soil wetness are decreased here due to increased run off and drainage. Level slopes generally support wetter soil, which exclude trees and support hydrophytic shrubs and graminoids. Additionally, the presence of trees indicates the likelihood of

a nearby forested site. Increased propagule pressure and ecotonal edge effects increase the likelihood of a woodland developing on this soil.

Ponding is the major disturbance. This disturbance is unlikely to cause a shift in communities within the reference state in the short term. A natural shift between communities is unlikely at the human management timescale. Changes in hydrologic inputs, such as an increase or decrease in precipitation due to climate change, may cause a shift in community. Likewise, improved drainage in the scrubland communities is likely to increase the chances of a woodland developing.

The information in this Ecological Dynamics section, including the state-and-transition model (STM), was developed based on current field data, professional experience, and a review of the scientific literature. As a result, all possible scenarios or plant species may not be included. Key indicator plant species, disturbances, and ecological processes are described to inform land management decisions.

State and transition model

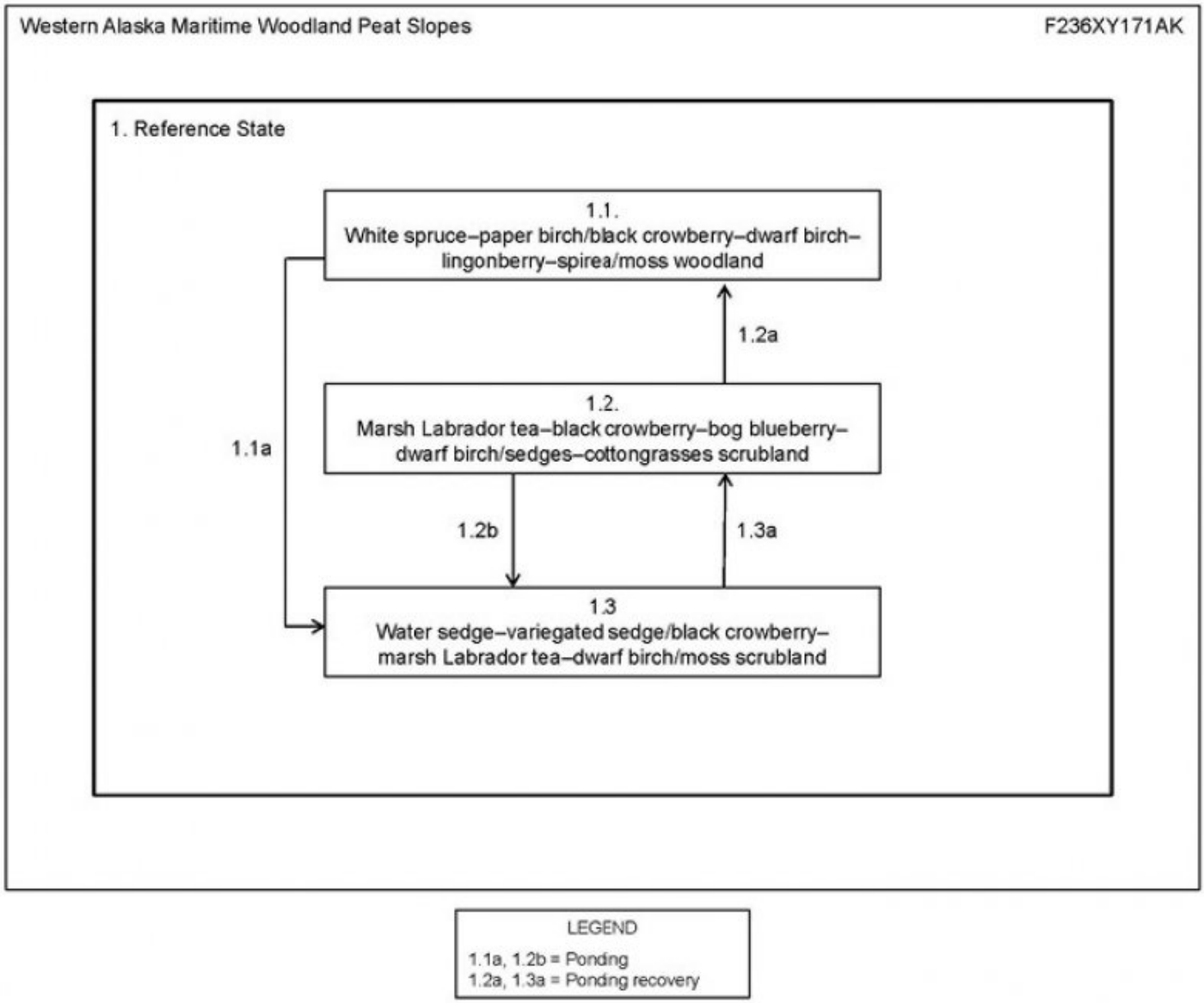

Figure 8. State-and-transition model.

State 1
Reference State

The reference state supports three community phases, which are grouped by the structure and dominance of the vegetation (e.g., trees, shrubs, and graminoids) and by their ecological function and stability. The presence of these

community phases is dictated temporally by the ponding regime. The reference community phase is characterized by mixed woodland that has a dense understory of shrubs. No alternate states have been observed

Community 1.1
White spruce-paper birch/black crowberry-dwarf birch-lingonberry-spirea/moss woodland

Figure 9. Typical area of community 1.1.

Community Phase Canopy Cover

(Vegetation data in the table are provided as constancy (percent) and average canopy cover (percent) of the most dominant and ecologically relevant species for this community phase.)

Plant group	Common name	Scientific name	USDA plant code	Constancy (percent)	Average canopy cover (percent)
T	White spruce	*Picea glauca*	PIGL	183*	15*
T	Paper birch	*Betula papyrifera*	BEPA	100	25*
S	Beauverd spirea	*Spiraea stevenii*	SPST3	100	3
S	Black crowberry	*Empetrum nigrum*	EMNI	83	40
S	Dwarf birch	*Betula nana*	BENA	83	20
S	Bog blueberry	*Vaccinium uliginosum*	VAUL	83	10
S	Lingonberry	*Vaccinium vitis-idaea*	VAVI	83	6
M	Feathermosses~	Includes 3 genera		33, 50, 83	15, 3, 10
M	Sphagnum moss#	*Sphagnum spp.*	SPHAG2	100	50

* Trees may be present in multiple strata within one plot; therefore, it is possible for species of this group to have a constancy value of more than 100 percent.

^ Tall, medium, and stunted individuals are counted as canopy trees. Regenerative individuals are not included.

~ Feathermosses are represented by three species—*Hylocomium splendens*, *Pleurozium schreberi*, and *Ptilium crista-castrensis*, respectively.

Sphagnum mosses are identified to the genus level.

Figure 10. Canopy cover and constancy of species in community 1.1.

The reference community phase is characterized by mixed deciduous and coniferous woodland that has dense shrubs in the understory. Typically, the community consists of a mixed overstory of white spruce (*Picea glauca*) and paper birch (*Betula papyrifera*) in the medium stratum and an understory of black crowberry (*Empetrum nigrum*), dwarf birch (*Betula nana*), bog blueberry (*Vaccinium uliginosum*), and spirea (*Spiraea stevenii*). Other species may include various willows (Salix spp.), lingonberry (*Vaccinium vitis-idaea*), sedges (Carex spp.), bluejoint grass (*Calamagrostis canadensis*), and horsetails (Equisetum spp.). Mosses are common in the ground cover (about 75 percent total mean cover), and they commonly include sphagnum mosses (Sphagnum spp.), splendid feathermoss (*Hylocomium splendens*), and knight's plume moss (*Ptilium crista-castrensis*). A low density of lichen is common (about 2 percent total mean cover). Other ground cover commonly includes herbaceous litter (about 35 percent total mean cover), woody litter (about 2 percent) and water (about 2 percent).

Community 1.2
Marsh Labrador tea-black crowberry-bog blueberry-dwarf birch/sedge-cottongrasses scrubland

Figure 11. Typical area of community 1.2.

Community Phase Canopy Cover

(Vegetation data in the table are provided as constancy (percent) and average canopy cover (percent) of the most dominant and ecologically relevant species for this community phase.)

Plant group	Common name	Scientific name	USDA plant code	Constancy (percent)	Average canopy cover (percent)
S	Marsh Labrador tea	*Ledum palustre* ssp. *decumbens*	LEPAD	100	20
S	Black crowberry	*Empetrum nigrum*	EMNI	100	15
S	Dwarf birch	*Betula nana*	BENA	100	10
S	Bog blueberry	*Vaccinium uliginosum*	VAUL	100	8
S	Cloudberry	*Rubus chamaemorus*	RUCH	72	8
S	Bog rosemary	*Andromeda polifolia*	ANPO	61	1
G	Variegated sedge	*Carex stylosa*	CAST10	67	7
M	Sphagnum moss	*Sphagnum spp.*	SPHAG2#	78	40

Sphagnum mosses are identified at the genus level.

Figure 12. Canopy cover and constancy of species in community 1.2.

The late ponding community phase is characterized by scrubland consisting of facultative and facultative wetland shrubs with similar types of graminoids scattered throughout. Typically, the community consists of dense shrubs such as marsh Labrador tea (*Ledum palustre* ssp. decumbens), black crowberry (*Empetrum nigrum*), bog blueberry (*Vaccinium uliginosum*), and dwarf birch (*Betula nana*) and hydrophilic graminoids such as variegated sedge (*Carex stylosa*) and water sedge (*Carex aquatilis*). Other species may include cloudberry (*Rubus chamaemorus*), bog rosemary (*Andromeda polifolia*), white cottongrass (*Eriophorum scheuchzeri*), tussock cottongrass (*Eriophorum vaginatum*), horsetails (Equisetum spp.), and arctic sweet coltsfoot (*Petasites frigidus*). Regenerating and stunted trees may be present. Mosses, commonly including sphagnum mosses (Sphagnum spp.) and feathermosses, make up much of the ground cover (about 50 percent total mean cover). The ground cover commonly includes lichen (about 35 percent cover) and herbaceous litter (about 30 percent).

Community 1.3
Water sedge-variegated sedge/black crowberry-marsh Labrador tea-dwarf birch/moss scrubland

Figure 13. Typical area of community 1.3.

Community Phase Canopy Cover

(Vegetation data in the table are provided as constancy (percent) and average canopy cover (percent) of the most dominant and ecologically relevant species for this community phase.)

Plant group	Common name	Scientific name	USDA plant code	Constancy (percent)	Average canopy cover (percent)
S	Black crowberry	*Empetrum nigrum*	EMNI	100	15
S	Marsh Labrador tea	*Ledum palustre* ssp. *decumbens*	LEPAD	100	10
S	Dwarf birch	*Betula nana*	BENA	100	8
G	Water sedge	*Carex aquatilis*	CAAQ	64	10
G	Variegated sedge	*Carex stylosa*	CAST10	55	8
G	Manyflower sedge	*Carex pluriflora*	CAPL6	55	3
G	Tussock cottongrass	*Eriophorum vaginatum*	ERVA4	55	1
M	Sphagnum mosses	*Sphagnum spp.*	SPHAG2#	100	50

Sphagnum mosses are identified at the genus level.

Figure 14. Canopy cover and constancy of species in community 1.3.

The early ponding community phase is characterized by open scrubland consisting of water-tolerant shrubs and obligate wetland graminoids. Typical species are black crowberry (*Empetrum nigrum*), marsh Labrador tea (*Ledum palustre* ssp. decumbens), and dwarf birch (*Betula nana*). Water sedge (*Carex aquatilis*) and variegated sedge (*Carex stylosa*) are scattered throughout. Other species may include bog blueberry (*Vaccinium uliginosum*), bog rosemary (*Andromeda polifolia*), manyflower sedge (*Carex pluriflora*), and tussock cottongrass (*Eriophorum vaginatum*). Reproducing white spruce (*Picea glauca*) may be present, particularly in ecotonal areas between this ecological site and forested sites. The ground cover is dominantly moss (about 70 percent total mean cover), commonly including sphagnum mosses (Sphagnum spp.) and Schreber's big red stem moss (*Pleurozium schreberi*). Other ground cover typically includes lichens (about 15 percent cover) and herbaceous litter (about 30 percent).

Pathway 1.1a
Community 1.1 to 1.3

White spruce-paper birch/black crowberry-dwarf birch-lingonberry-spirea/moss woodland

Water sedge-variegated sedge/black crowberry-marsh Labrador tea-dwarf birch/moss scrubland

Increased hydrologic pressure - Changes in hydrologic inputs, such as an increase in precipitation or increase upstream run-off due to fire, may cause a vegetative shift to a more hydrophytic community. A natural shift between communities is unlikely at the human management timescale. Many of the plants in the reference community phase are facultative or obligate wetland species, which suggests they may inherently survive periods of ponding. Frequent, long periods of ponding in April through October have been noted in situ. Multiple consecutive years of

frequent, long periods of ponding is hypothesized to be necessary to cause a transition from the reference community phase to the early ponding phase (community 1.3).

Pathway 1.2a
Community 1.2 to 1.1

Marsh Labrador tea-black crowberry-bog blueberry-dwarf birch/sedge-cottongrasses scrubland

White spruce-paper birch/black crowberry-dwarf birch-lingonberry-spirea/moss woodland

Decreased hydrologic pressure - Changes in hydrologic inputs, such as a decrease in precipitation due to climate change, may cause a shift in community. Likewise, improved drainage in this community is likely to increase the chances of a woodland developing. Populations of hydrophilic graminoids may decrease. This provides space for existing populations of shrubs to expand and facilitates colonization of new species of shrubs and trees. The period needed for this transition currently is unknown; however, nearly 100 years is needed for white spruce trees in the early community phase to reach the age of those in the reference community phase.

Pathway 1.2b
Community 1.2 to 1.3

Marsh Labrador tea-black crowberry-bog blueberry-dwarf birch/sedge-cottongrasses scrubland

Water sedge-variegated sedge/black crowberry-marsh Labrador tea-dwarf birch/moss scrubland

Increased hydrologic pressure - Changes in hydrologic inputs, such as an increase in precipitation due to climate change, may cause a vegetative shift to a more hydrophytic community. Increased water input drowns shrub species that are less water tolerant . This decreases the competition for space and light and allows competitive hydrophilic graminoids to colonize and spread. Long periods of ponding likely are needed to initiate this transition because many of the plants in community phase 1.2 are facultative or facultative wetland species that may survive brief periods of ponding.

Pathway 1.3a
Community 1.3 to 1.2

Water sedge-variegated sedge/black crowberry-marsh Labrador tea-dwarf birch/moss scrubland

Marsh Labrador tea-black crowberry-bog blueberry-dwarf birch/sedge-cottongrasses scrubland

Decreased hydrologic pressure - Changes in hydrologic inputs, such as a decrease in precipitation due to climate change, may cause a shift in community. Likewise, improved drainage in this community is likely to increase the chances of less hydrophytic shrubs colonizing. Over time, plant species that are less hydrophilic, are more competitive, and have a slower rate of reproduction may colonize the early ponding community phase. Populations of extant shrubs and graminoids may increase. The period needed for this transition currently is unknown. It likely depends on various factors, such as the rate of drying of the soil and distance to a seed source of colonizing plants.

Additional community tables

Inventory data references

Modal points for Community 1.1
07SS11603
08LL11002
08SS15903

Modal points for community 1.2
07AO01606
07SS05602
07SS10503
07SS10705
07SS07804
10SS00804

Modal points for community 1.3
07SS06604
08SS16309
10SS01601
10SS02403
10SS02603

References

Viereck, L.A., C. T. Dyrness, A. R. Batten, and K. J. Wenzlick. 1992. The Alaska vegetation classification. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station General Technical Report PNW-GTR-286..

Other references

Kautz, D.R., P. Taber, and S. Nield, editors. 2012. Land Resource Regions and Major Land Resource Areas of Alaska. United States Department of Agriculture, Natural Resources Conservation Service (USDA–NRCS).

PRISM Climate Group. (PRISM) Oregon State University. https://prism.oregonstate.edu. Date created October 2018. Accessed 3 Mar 2023.

Scenarios Network for Alaska and Arctic Planning (SNAP). Historical Monthly Temperature – 1km, 1901-2009. http://ckan.snap.uaf.edu/dataset/. Accessed 20 Mar 2023.

Scenarios Network for Alaska and Arctic Planning (SNAP). Historical monthly and derived precipitation products downscaled from CRU TS data via the delta methods – 2km, 1901-2009. http://ckan.snap.uaf.edu/dataset/. Accessed 20 Mar 2023.

Soil Survey Staff. 2013. Simplified Guide to Soil Taxonomy. USDA-Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE.

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

US Environmental Protection Agency (EPA). Level III Ecoregions of the Conterminous United States. UP ESP Office of Research and Development. Corvallis, OR. http://edg.epa.gov/. Created 16 Apr 2013. Accessed 20 Mar 2023.

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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	05/17/2024
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):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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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:**