Ecological site F236XY139AK
Boreal Woodland Loamy Rises

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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): 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 describes woodlands surrounding gallery forests. Gallery forests are non-flood plain forests that develop along river corridors. These forests do not spread out onto neighboring non-treed landforms, such as surround tundra. This siteIt is on linear to convex plain talfs and rises. Site elevation is between 30 and 500 feet above sea level. Slopes are nearly level to gentle (0 – 8 percent). Soil factors and a fire regime shape the vegetation on this landform. Soils are Spodosols with naturally low fertility. Low-severity burns are typical for this ecological site, with an estimated fire return interval of around 100 years, based on tree age.

The reference state supports three communities. The reference plant community is characterized as a mixed woodland (Viereck et al., 1992). The overstory is comprised of white spruce and paper birch with an open understory of ericaceous shrubs, grasses, mosses, and lichens. Post-fire communities are dominated first by fast growing herbaceous species and later shrubs.

There are two alternate states on this site. One is the result of selective thinning and harvesting of trees. The

second state results from complete removal of vegetation, often by bulldozer or plow.

Associated sites

R236XY130AK	**Subarctic Scrub Scrub Tundra Loamy Plains and Hills** Both sites are on plains. R236XY130AK is on wetter soils that experience cryoturbation. These soils support a low scrubland of ericaceous shrubs and do not support trees.
R236XY132AK	**Subarctic Dwarf Scrub Dry Loamy Slopes** Both sites are on plains. R236XY132AK is found on glaciated plains underlain with gravelly till or drift. These soils support a dwarf scrubland community. The soils in this site developed on eolian deposits and support a woodland.

Similar sites

F236XY157AK	**Boreal Woodland Moist Loamy Plains** Both sites support woodlands on loamy soils. Vegetation in F236XY157AK is hydrologically influenced and supports different communities in the reference state and different reference plant communities.

Table 1. Dominant plant species

Tree	(1) *Picea glauca* (2) *Betula papyrifera*
Shrub	(1) *Empetrum nigrum* (2) *Vaccinium vitis-idaea*
Herbaceous	(1) *Calamagrostis canadensis*

Physiographic features

This site is on linear to convex plain talfs and rises. Elevation generally ranges from 30 to 500 feet above sea level. Slopes are usually nearly level to gentle (0 – 8 percent). This site is found at all aspects. Flooding and ponding do not occur and there is no water table.

Table 2. Representative physiographic features

Hillslope profile	(1) Backslope
Geomorphic position, flats	(1) Rise (2) Talf
Landforms	(1) Plains > Plain (2) Plains > Hill (3) Plains > Rise
Runoff class	Negligible to medium
Flooding frequency	None
Ponding frequency	None
Elevation	30–500 ft
Slope	0–8%
Water table depth	60 in
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Negligible to high
Flooding frequency	None
Ponding frequency	None

Elevation	0–1,560 ft
Slope	0–70%
Water table depth	60 in

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)	21-34 in
Frost-free period (actual range)	75-100 days
Freeze-free period (actual range)	65-90 days
Precipitation total (actual range)	15-41 in
Frost-free period (average)	90 days
Freeze-free period (average)	75 days
Precipitation total (average)	29 in

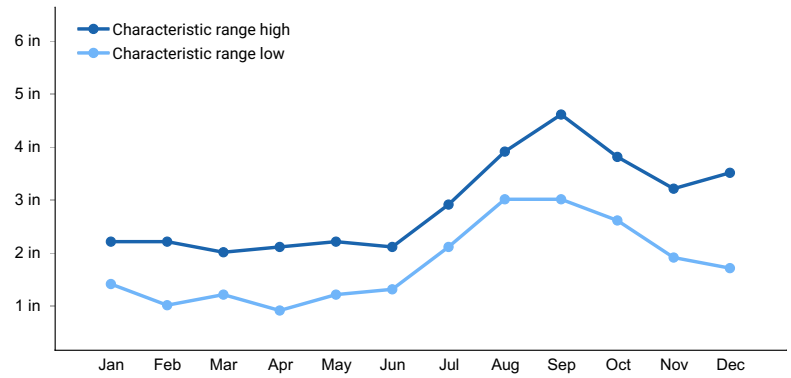


Figure 1. Monthly precipitation range

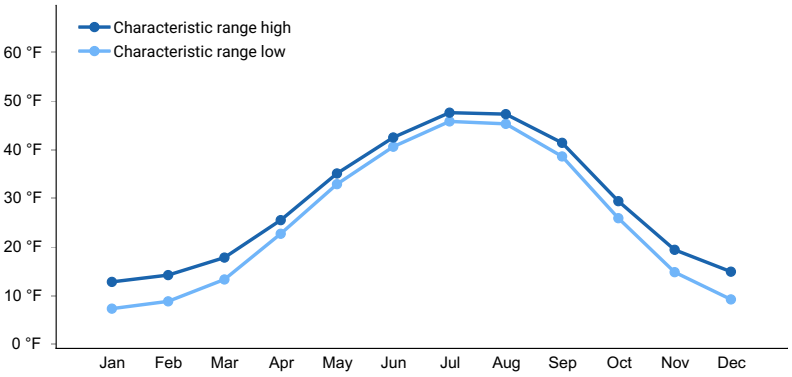


Figure 2. Monthly minimum temperature range

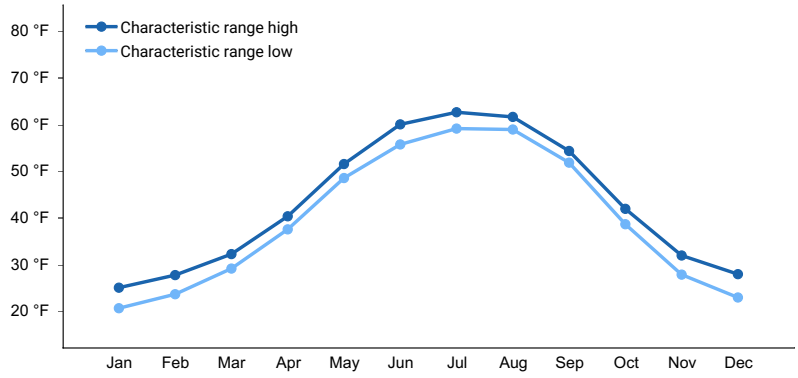


Figure 3. Monthly maximum temperature range

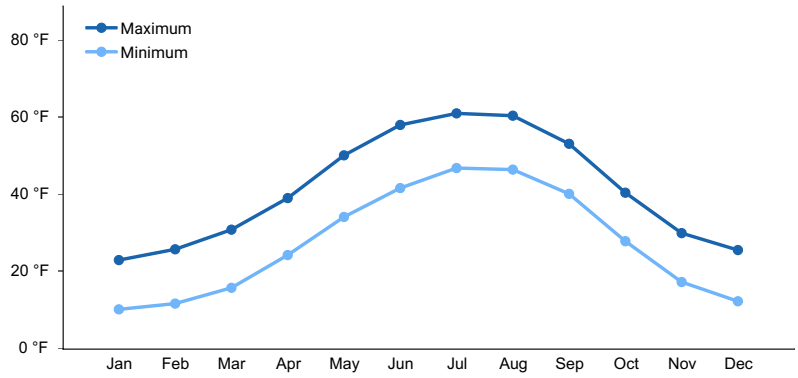


Figure 4. Monthly average minimum and maximum temperature

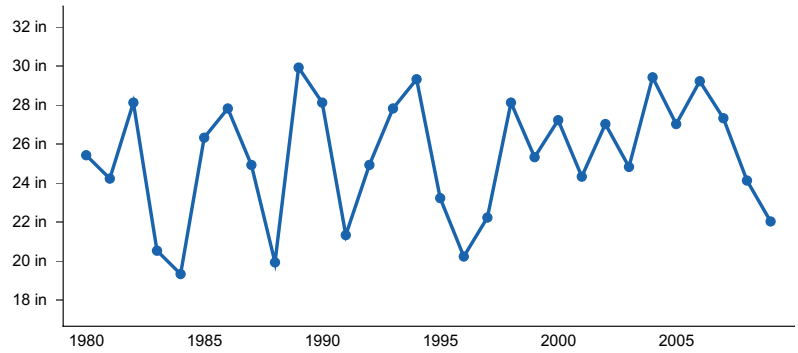


Figure 5. Annual precipitation pattern

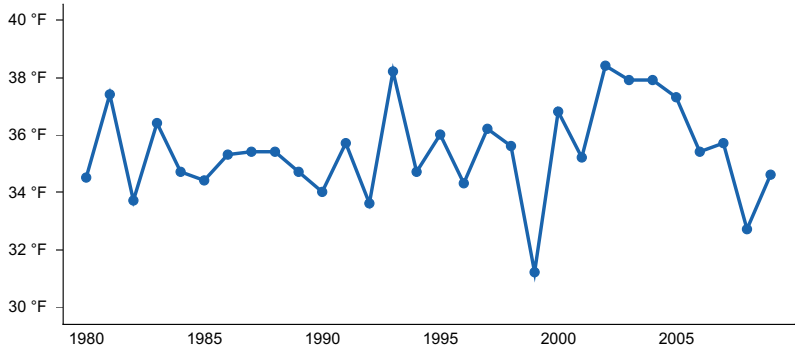


Figure 6. Annual average temperature pattern

Influencing water features

Due to its landscape position, this site is not influenced by wetland or riparian water features. Precipitation is the main source of water.

Soil features

Soils are very deep and well drained. They support a cryic temperature regime and an udic moisture regime. Parent material is mossy or herbaceous organic material over eolian deposits.

Soil acidity and fertility affect vegetation. Spodosols are acidic soil with low fertility (Soil Survey Staff, 2013). However, the presence of volcanic ash, as indicated by andic soil properties between 3 and 9 inches, likely increases soil fertility. Volcanic ash likely alleviates some of the influential pressure of the ultra to moderately acidic soil and allows a wider range of plant species to grow on this site.

Correlated soil components in MLRA 236: D36-Boreal forest loamy eolian slopes, Ekwok, E36-Boreal forest-silty slopes

Table 5. Representative soil features

Parent material	(1) Eolian deposits
Surface texture	(1) Highly organic silt loam
Drainage class	Well drained
Permeability class	Moderate
Soil depth	60 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-10in)	2.2–2.6 in
Soil reaction (1:1 water) (0-10in)	3.3–5.9
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	Well drained
Permeability class	Moderate
Soil depth	60 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-10in)	1.9–2.6 in
Soil reaction (1:1 water) (0-10in)	3.3–6
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This site describes woodlands surrounding gallery forests along and near rivers such as the Nushagak River. It is on plain talfs and rises. Local site factors including soil characteristics and a fire regime shape three communities in the reference state. The reference plant community is a mixed birch and white spruce forest.

Fire is the major disturbance on this site. Fire affects myriad biotic and abiotic characteristics, including soil factors (Liljedahl et al., 2007; Hinzman et al., 2006), and the richness and diversity of vegetation (Racine et al., 1987; Boucher, 2003). Fires in cooler and moister habitats tend to result in low-severity burns; those in warmer and drier habitats generally produce high-severity burns. Low-severity burns are typical for this ecological site. The relatively robust population of lichens and mosses in the early fire community phase suggests that while the overstory canopy may be removed, the understory may experience a patchy burn that avoids burning all areas. Fire cycles tend to be longer in Western and Southwest Alaska than in the Interior (Viereck and Schandelmeier, 1980; Trigg 1971). The mean age of white spruce in the reference plant community is 80 to 100 years, suggesting a current fire cycle of about a century.

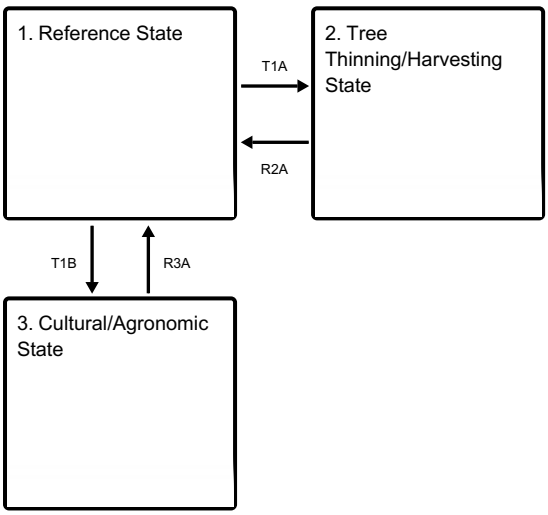
Windthrow occurs in the reference plant community. It does not result in a unique community. However, it may keep the forest canopy open and promote plant diversity in the understory. Willows are browsed by moose. Caribou browse willow and lichens. This does not appear to affect the ecological processes of the site.

There are two alternate states on this site. The first state is the result of selective thinning and harvesting of trees. This occurs most frequently around villages and towns. The second state results from complete removal of vegetation, often by bulldozer or plow. Bulldozing not only removes vegetation but alters the soil and seedbank. This state is also most frequently found around inhabited areas.

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

Ecosystem states

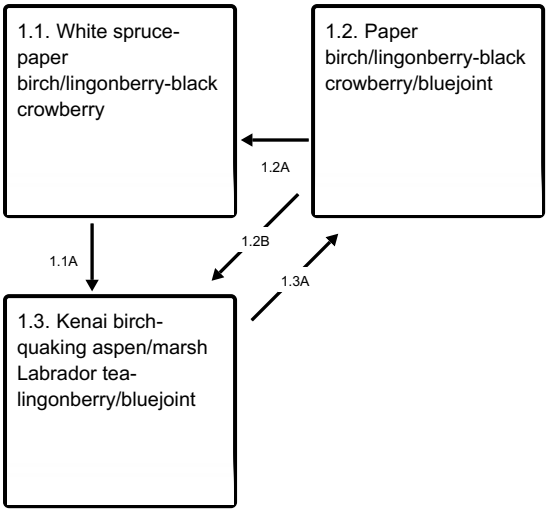


T1A - Tree thinning/harvesting.

T1B - Cultural/agonomic change.

R3A - Active replanting.

State 1 submodel, plant communities



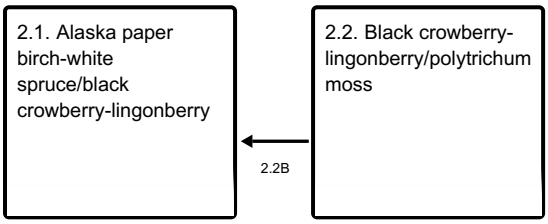
1.1A - Fire.

1.2A - Time and growth without disruptive fire.

1.2B - Fire.

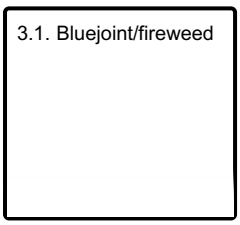
1.3A - Natural succession: Time and growth without disruptive fire.

State 2 submodel, plant communities



2.2B - Time and growth without harvesting.

State 3 submodel, plant communities



State 1
Reference State

Figure 7. Aerial view of the mixed forest reference plant community in foreground.

The reference state supports three community phases, which are distinguished by the developed structure and dominance of the vegetation and by their ecological function and stability. The reference community phase is an open mixed forest (Viereck et al., 1992). The presence of each community is dictated temporally by a fire disturbance regime. This report provides baseline inventory data on the vegetation. Future data collection is needed to provide further information about existing plant communities and the disturbance regimes that result in transitions from one community to another. Common and scientific names are from the USDA PLANTS database. Community phases are characterized by the Alaska Vegetation Classification System (Viereck et al., 1992).

Community 1.1
White spruce-paper birch/lingonberry-black crowberry

Figure 8. Typical area of community 1.1.

Community Phase 1.1 Canopy Cover Table

Vegetation data is aggregated across modal sample plots for this community phase and 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	140*	15^
T	Paper birch	*Betula papyrifera*	BEPA	72	15^
S	Lingonberry	*Vaccinium vitis-idaea*	VAVI	97	15
S	Black crowberry	*Empetrum nigrum*	EMNI	93	25
S	Bog blueberry	*Vaccinium uliginosum*	VAUL	83	15
S	Marsh Labrador tea	*Ledum palustre* ssp. *decumbens*	LEPAD	81	20
S	Dwarf birch	*Betula nana*	BENA	69	15
G	Bluejoint grass	*Calamagrostis canadensis*	CACA4	57	5
M	Feathermosses	Includes 3 genera		25, 47, 47#	25, 15, 15

* Trees may be present in multiple strata within one plot; therefore, it is possible for species of this plant 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.

This dataset includes data from 35 sample plots. The sample 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

Figure 9. Frequency and canopy cover of plants in community 1.1.

The reference plant community is characterized by an open mixed forest that has an understory of dominantly shrubs and mosses. Trees are in all four height strata (regenerative trees less than 15 feet high to tall trees more than 40 feet high). Typically, this community consists of an overstory of white spruce (*Picea glauca*) and paper birch (*Betula papyrifera*) and an understory of low and dwarf shrubs such as lingonberry (*Vaccinium vitis-idaea*), black crowberry (*Empetrum nigrum*), bog blueberry (*Vaccinium uliginosum*), dwarf birch (*Betula nana*), and marsh Labrador tea (*Ledum palustre* ssp. decumbens) and feathermosses. Other species may include Kenai birch (*Betula papyrifera* var. kenaica), dwarf birch (*Betula nana*), bluejoint (*Calamagrostis canadensis*), sedges (Carex spp.), fireweed (*Chamerion angustifolium*), and horsetails (Equisetum spp.). Lichens, particularly reindeer lichens (Cladina spp.) and cup lichens (Cladonia spp.), and mosses, mainly feathermosses, are common in the ground cover. Other ground cover typically includes herbaceous litter and woody litter.

Dominant plant species

- white spruce (*Picea glauca*), tree
- paper birch (*Betula papyrifera*), tree
- lingonberry (*Vaccinium vitis-idaea*), shrub
- black crowberry (*Empetrum nigrum*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- dwarf birch (*Betula nana*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- splendid feather moss (*Hylocomium splendens*), other herbaceous
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous
- knights plume moss (*Ptilium crista-castrensis*), other herbaceous

Community 1.2
Paper birch/lingonberry-black crowberry/bluejoint

Figure 10. Typical area of community 1.2.

Community Phase 1.2 Canopy Cover Table

Vegetation data is aggregated across modal sample plots for this community phase and 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	Paper birch	*Betula papyrifera*	BEPA	111*	25^
S	Lingonberry	*Vaccinium vitis-idaea*	VAVI	97	10
S	Black crowberry	*Empetrum nigrum*	EMNI	86	20
S	Marsh Labrador tea	*Ledum palustre* ssp. *decumbens*	LEPAD	78	20
S	Bog blueberry	*Vaccinium uliginosum*	VAUL	72	15
G	Bluejoint grass	*Calamagrostis canadensis*	CACA4	81	9
F	Fireweed	*Chamerion angustifolium*	CHAN9	53	4
M	Feathermosses	Includes 3 genera		33, 33 56#	25, 15, 15

* Trees may be present in multiple strata within one plot; therefore, it is possible for species of this plant 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.

This dataset includes data from 15 sample plots. The sample 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

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 11. Frequency and canopy cover of plants in community 1.2.

The late fire community phase is characterized by an open broadleaf forest. A low density of white spruce, Kenai birch, or quaking aspen (*Populus tremuloides*) creates an open forest in some areas. Typically, this community has an overstory of paper birch and an understory of lingonberry, black crowberry, marsh Labrador tea, bog blueberry, and bluejoint. The understory is dense in some areas. Other species extant in this community include spirea (*Spiraea stevenii*), dwarf birch, willows (Salix spp.), sedges (Carex spp.), fireweed, field horsetail (*Equisetum arvense*), and woodland horsetail (*Equisetum sylvaticum*). Lichens and mosses are common in the ground cover. Other ground cover commonly includes herbaceous litter and woody litter. Some areas are bare soil.

Dominant plant species

- paper birch (*Betula papyrifera*), tree
- lingonberry (*Vaccinium vitis-idaea*), shrub
- black crowberry (*Empetrum nigrum*), shrub
- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub

- bog blueberry (*Vaccinium uliginosum*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- fireweed (*Chamerion angustifolium*), other herbaceous
- splendid feather moss (*Hylocomium splendens*), other herbaceous
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous
- knights plume moss (*Ptilium crista-castrensis*), other herbaceous

Community 1.3
Kenai birch-quaking aspen/marsh Labrador tea-lingonberry/bluejoint

Figure 12. Typical area of community 1.3.

Community Phase 1.3 Canopy Cover Table

Vegetation data is aggregated across modal sample plots for this community phase and 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	Kenai birch	*Betula papyrifera* var. *kenaica*	BEPAK	125*	35^
T	Quaking aspen	*Populus tremuloides*	POTR5	100	25^
S	Marsh Labrador tea	*Ledum palustre* ssp. *decumbens*	LEPAD	100	25
S	Black crowberry	*Empetrum nigrum*	EMNI	100	15
S	Lingonberry	*Vaccinium vitis-idaea*	VAVI	100	20
S	Bog blueberry	*Vaccinium uliginosum*	VAUL	75	15
G	Bluejoint grass	*Calamagrostis canadensis*	CACA4	100	1
F	Fireweed	*Chamerion angustifolium*	CHAN9	75	Trace
M	Feathermosses	Includes 3 genera		50, 75, 75#	50, 15, 3

* Trees may be present in multiple strata within one plot; therefore, it is possible for species of this plant 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.

This dataset includes data from 15 sample plots. The sample 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

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 13. Frequency and canopy cover of plants in community 1.3.

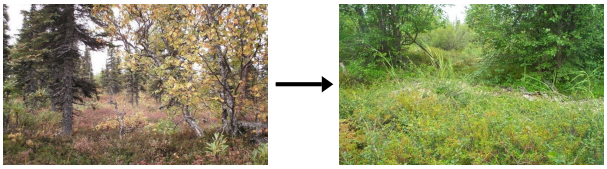
The early fire community phase is characterized by an open broadleaf forest that has an understory of shrubs. Typically, this community consists of an overstory of quaking aspen and Kenai birch and an understory of marsh Labrador tea, lingonberry, black crowberry, and bog blueberry. Other species extant in this community include bluejoint, Bigelow’s sedge (*Carex bigelowii*), horsetails, and willows. Lichens and mosses are common in the

ground cover. Other ground cover includes herbaceous litter and woody litter. Some areas are bare soil.

Dominant plant species

- Kenai birch (*Betula papyrifera var. kenaica*), tree
- quaking aspen (*Populus tremuloides*), tree
- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- black crowberry (*Empetrum nigrum*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- fireweed (*Chamerion angustifolium*), other herbaceous
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous
- splendid feather moss (*Hylocomium splendens*), other herbaceous
- knights plume moss (*Ptilium crista-castrensis*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.3



White spruce-paper birch/lingonberry-black crowberry

Kenai birch-quaking aspen/marsh Labrador tea-lingonberry/bluejoint

Fire. A low-intensity fire may damage trees and taller shrubs, but pockets of low vegetation may remain. The decreased competition for light and space allows fast-growing tree species to colonize (such as quaking aspen [*Populus tremuloides*], which is highly competitive in burned sites [DeByle et al., 1987]) and allows for propagation of the pockets of low and dwarf shrubs that remain. Based on the soil data and age of in situ trees, a low-intensity fire is hypothesized to occur once every 100 years.

Pathway 1.2A
Community 1.2 to 1.1

Paper birch/lingonberry-black crowberry/bluejoint

White spruce-paper birch/lingonberry-black crowberry

Time and growth without disruptive fire. Over time after a fire, white spruce (*Picea glauca*) will colonize the deciduous woodland and become the dominant tree species. As the coniferous cover increases and the deciduous cover decreases, the total canopy cover generally increases only slightly and the established understory remains relatively stable. The time required for this transition is unknown. It likely depends on various factors, including the distance to a seed source and growth rate of trees.

Pathway 1.2B
Community 1.2 to 1.3

Paper birch/lingonberry-black crowberry/bluejoint

Kenai birch-quaking aspen/marsh Labrador tea-lingonberry/bluejoint

Fire. A low-intensity, fast-burning fire may remove trees and taller shrubs, but pockets of low vegetation may remain. The decreased competition for light and space allows fast-growing tree species to colonize (such as quaking aspen [*Populus tremuloides*], which is highly competitive in burned areas [DeByle et al., 1987]) and allows for propagation of the pockets of low and dwarf shrubs that remain. It currently is unknown how often this community is subject to a fire.

Pathway 1.3A
Community 1.3 to 1.2

Kenai birch-quaking aspen/marsh Labrador tea-lingonberry/bluejoint

Paper birch/lingonberry-black crowberry/bluejoint

Natural succession: Time and growth without disruptive fire. As burned areas recover, other deciduous trees may colonize and eventually outshade quaking aspen (*Populus tremuloides*). The total canopy cover does not appear to fluctuate greatly, which allows the established understory to remain relatively stable. The richness of species may increase as new niches are established. The period needed for this transition is unknown. It likely depends on a variety of factors, including the distance to a seed source and growth rate of trees.

State 2
Tree Thinning/Harvesting State

This alternate state results from the thinning or harvesting of trees. This disturbance commonly occurs in or around villages and camps and generally includes collection of woody material for use in construction and as firewood. Removal of trees commonly opens the overstory and reduces competition for light in the understory. This may alter the abundance of species, but the richness of the community typically remains. Field observations suggest that these areas commonly are reharvested; thus, the alternate state is maintained perpetually. No documentation exists for a transition of this alternate state back to the reference state; however, it is hypothesized that the cessation of thinning and harvesting may allow the community to return to the reference state eventually.

Community 2.1
Alaska paper birch-white spruce/black crowberry-lingonberry

Figure 14. Typical area of community 2.1.

Community Phase 2.1 Canopy Cover Table

Vegetation data is aggregated across modal sample plots for this community phase and 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	Alaska paper birch	*Betula neoalaskana*	BENE4	200*	30^
T	White spruce	*Picea glauca*	PIGL	200*	8^
S	Lingonberry	*Vaccinium vitis-idaea*	VAVI	100	40
S	Black crowberry	*Empetrum nigrum*	EMNI	100	35
S	Bog blueberry	*Vaccinium uliginosum*	VAUL	100	7
G	Bluejoint grass	*Calamagrostis canadensis*	CACA4	100	2

* Trees may be present in multiple strata within one plot; therefore, it is possible for species of this plant 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.

This dataset includes data from 15 sample plots. The sample 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

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 15. Frequency and canopy cover of plants in community 2.1.

The late community of the alternate state is characterized by an open mixed forest that has an understory of dense, low and dwarf shrubs. Typically, this community supports Alaska paper birch (*Betula neoalaskana*) and white spruce in the overstory and black crowberry, lingonberry, and bog blueberry in the understory and open areas. Other species may include bluejoint, marsh Labrador tea, spirea, fireweed, and woodland horsetail. Mosses are a major component in the ground cover, and lichens are a minor component. Other ground cover commonly includes herbaceous litter and woody litter.

Dominant plant species

- resin birch (*Betula neoalaskana*), tree
- white spruce (*Picea glauca*), tree
- lingonberry (*Vaccinium vitis-idaea*), shrub
- black crowberry (*Empetrum nigrum*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- bluejoint (*Calamagrostis canadensis*), grass

Community 2.2
Black crowberry-lingonberry/polytrichum moss

Figure 16. Typical area of community 2.2.

Community Phase 2.2 Canopy Cover Table

Vegetation data is aggregated across modal sample plots for this community phase and 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)
S	Black crowberry	*Empetrum nigrum*	EMNI	100	25
S	Lingonberry	*Vaccinium vitis-idaea*	VAVI	100	25
S	Marsh Labrador tea	*Ledum palustre* ssp. *decumbens*	LEPAD	100	20
S	Dwarf birch	*Betula nana*	BENA	100	20
S	Bog blueberry	*Vaccinium uliginosum*	VAUL	100	20
S	Barclay's willow	*Salix barclayi*	SABA3	75	2
M	Polytrichum moss	*Polytrichum spp.*	POLYT5	75	40

This dataset includes data from 15 sample plots. The sample 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

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 17. Frequency and canopy cover of plants in community 2.2.

The early community phase of this alternate state occurs immediately following anthropogenic disturbance. It is characterized as a closed low scrubland (Viereck et al., 1992) that consists of low and dwarf shrubs. Typically, the community consists of black crowberry, lingonberry, marsh Labrador tea, and bog blueberry. Other extant species include Barclay's willow (*Salix barclayi*), bluejoint, Altai fescue (*Festuca altaica*), and fireweed. Individual trees, including white spruce, Alaska paper birch, quaking aspen, and paper birch, may be present. A mat of mosses, typically polytrichum mosses (Polytrichum spp.) and one or more feathermosses, is common. The ground cover may also include lichens, herbaceous litter, and woody litter. Some areas are bare soil.

Dominant plant species

- black crowberry (*Empetrum nigrum*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- dwarf birch (*Betula nana*), shrub

- bog blueberry (*Vaccinium uliginosum*), shrub
- Barclay's willow (*Salix barclayi*), shrub
- polytrichum moss (*Polytrichum*), other herbaceous

Pathway 2.2B
Community 2.2 to 2.1

Black crowberry-lingonberry/polytrichum moss

Alaska paper birch-white spruce/black crowberry-lingonberry

Time and growth without harvesting. As harvesting activities slow or cease, trees may colonize and form a canopy. The period needed for this transition is unknown. It likely depends on the distance to a seed source and cessation of anthropogenic activities.

State 3
Cultural/Agronomic State

This alternate state results from the anthropogenic clearing of all trees and shrubs from a prescribed area. This commonly involves disturbances, including compaction or removal of the soil. This state commonly is within the boundaries of villages, and it may include areas cleared for lawns or agricultural uses. Clearing of the vegetation in any of the reference state community phases will result in a transition to community phase 3.1. Areas of this alternate state commonly are mowed to prevent colonization of shrubs and keep graminoids and forbs below a maximum height. Taller shrubs and trees may colonize if these areas are abandoned, but this has not been observed in situ.

Community 3.1
Bluejoint/fireweed

Figure 18. Typical area of community 3.1.

Community Phase 3.1 Canopy Cover Table

Vegetation data is aggregated across modal sample plots for this community phase and 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)
S	Tealeaf willow	*Salix pulchra*	SAPU15	100	4
G	Bluejoint grass	*Calamagrostis canadensis*	CACA4	100	85
F	Fireweed	*Chamerion angustifolium*	CHAN9	100	6

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

This dataset includes data from 2 sample plots. The sample 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

Figure 19. Frequency and canopy cover of plants in community 3.1.

This alternate state community phase is characterized as a mesic graminoid herbaceous meadow (Viereck et al., 1992). Typically, this community is grassland that consists of bluejoint and sporadic fireweed, tealeaf willow (*Salix pulchra*), and paper birch. Other species may include seacoast angelica (*Angelica lucida*), arctic starflower (*Trientalis europaea*), and horsetails. Mosses generally are a minor component in the ground cover, and lichens are rare. Other ground cover commonly includes herbaceous litter and woody litter.

Dominant plant species

- tealeaf willow (*Salix pulchra*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- fireweed (*Chamerion angustifolium*), other herbaceous

Transition T1A
State 1 to 2

Anthropogenic thinning and harvesting of trees near and in villages and towns results in this transition. The threshold between the plant community remaining in the reference phase and transitioning to the alternate state depends solely on the extent of thinning and harvesting of trees.

Transition T1B
State 1 to 3

Clearing of all vegetation from the reference state will result in community phase 3.1. Bulldozed soils are compacted or removed during removal of the naturally occurring vegetation. This anthropogenic disturbance is drastic. No threshold allows the plant community to remain in the reference state.

Restoration pathway R2A
State 2 to 1

No apparent active restoration activity will transition alternate state 2 to the reference state. Although situ data are not available, it is hypothesized that state 2 will passively return to the reference state if thinning and harvesting activities are ceased. The period required depends on various anthropogenic and natural factors, including the extent of the original thinning or harvesting, cessation of anthropogenic disturbance, and lack of a natural fire disturbance.

Restoration pathway R3A
State 3 to 1

The cultural/agronomic alternate state may be restored to the reference state by ceasing mowing and planting trees and understory species. A passive transition of this alternate state to the reference state has not been observed in situ. If anthropogenic activity is ceased, the state to which these mowed areas may transition naturally is unknown. Thus, it is impossible to hypothesize whether the state can or will transition to the reference state naturally.

Additional community tables

Inventory data references

Modal points for Community 1.1
07SS01902
07AO03103
08AO09108
08SS13704
09AO12603

Modal points for Community 1.2
07MM05001
07AO02902
07DM00604
08AO08702
08SS13001
10SS06806

Modal points for Community 1.3
07DM01004
10SS08506
Modal points for Community 2.1
09SS04204
09SS04402
09SS04504

Modal points for Community 2.2
08SS13603
09SS03501
09SS03502

Modal points for Community 3.1
08LL06303
08LL10102

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Contributors

Phil Barber
Michael Margo
Kendra Moseley
Sue Tester
Stephanie Schmit
Jamin Johanson
Steff Shoemaker

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	04/29/2024
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):**

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

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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

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

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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

17. **Perennial plant reproductive capability:**