

Ecological site R246XY005AK

Arctic Ice-Wedge Polygon Complex

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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): 246X–Arctic Coastal Plain

The Arctic Coastal Plain MLRA (MLRA 246X) consists of level to gently rolling plains along the coast of the Arctic Ocean. This area makes up 22,235 square miles. It is mostly remote, sparsely populated wildland. Numerous rivers, mostly originating in the Brooks Range, drain to the Arctic Ocean. The largest being the Canning, Colville, Jago, Kongakut, Kuk, Utukok, and Sagavanirktok Rivers. Narrow, nearly level flood plains and stream terraces parallel the many rivers. The area is dotted by thousands of small and medium-size lakes and interconnecting wetlands. Many of the lakes are elongated thaw lakes, which are consistently oriented from north to northwest. Small sand dunes occur along the coastline, rivers, and plains. Elevation ranges from sea level to about 655 feet. Permanent settlements include Point Lay, Wainwright, Utqiagvik, Nuigsut, and Kaktovik. The Prudhoe Bay oil fields and the northern terminus of the Trans-Alaska Pipeline are in the central part of the MLRA. The Dalton Highway and the Trans-Alaska Pipeline bisect the area west of the Sagavanirktok River, terminating at Deadhorse. The community of Deadhorse provides much of the industrial infrastructure and many of the residential facilities associated with the oil fields and pipeline. Parts of the National Petroleum Reserve and Arctic National Wildlife Refuge are in this MLRA. Geology and Soils This area was never glaciated (NRCS 2022). The bedrock geology consists of Cretaceous and Tertiary stratified sedimentary rocks and uplifted continental deposits. The modern landscape is mantled with Quaternary deposits of alluvial, eolian, or glaciofluvial origin. This MLRA is in the zone of continuous permafrost. Areas without permafrost in the soil profile are limited to tidal flats, large sand dunes, and soils directly adjacent to large rivers. Thick layers of permafrost occur in both fine textured and coarse textured deposits across the area. Depth to the base of the permafrost layer ranges between 500 and 2000 feet. Periglacial features, such as beaded drainages, patterned ground (ice-wedge polygons, thaw gullies, pingos, and frost boils) occur throughout the MLRA. The dominant soil order in this MLRA is Gelisols. Most have an aquic soil moisture regime. The Gelisols are shallow or moderately deep to permafrost, occur on fine and coarse textured sediments, and are generally poorly drained or very poorly drained. Common Gelisol suborders are Histels, Orthels, and Turbels. The Histels have a glacial layer and/or thick accumulations of surface organic material and are associated with ice-wedge troughs of polygons, vegetated lake basins, swales, and low-gradient drainageways. The Orthels and Turbels have comparably thinner surface organic material and occur on flood plains, stream terraces, plains, and the centers of low- and high-center polygons. Miscellaneous (non-soil) areas make up about 20 percent of this MLRA. The most common are water, riverwash, and beaches. Climate The average annual precipitation in this area is 4 to 8 inches. Brief, cool summers and long, very cold winters characterize the arctic climate. The average annual snowfall is about 20 to 40 inches. The average annual temperature ranges from 11 to 14 degrees Fahrenheit. The average freeze-free period is between 43 and 76 days but freezing temperatures can occur in any month. Vegetation The wet soils prevalent across this MLRA support extensive swaths of tussock tundra and wet sedge meadow tundra (Viereck et al. 1992). The drier sites and low uplands support dwarf scrub dominated by various ericaceous shrubs and dwarf willow. On shallow, rocky soils and exposed sites, lichens and scattered herbs dominate the ground layer. Flood plains support a mixture of low willow scrub and scattered herbs. Fire is not common in this MLRA (AICC 2022).

LRU notes

The bulk of the MLRA is associated with the Circumpolar Arctic Vegetation Mapping (CAVM) subzone D with a small portion of the Northern most lands falling into subzone C (CAVM 2022). Arctic subzone D is associated with vegetation that have herbaceous and dwarf shrub communities that are commonly 4 to 15 inches tall, while subzone C has an herbaceous and dwarf shrub layer that are typically less than 6 inches tall (CAVM 2022). At this time, these differences in community structure are recognized with large differences in annual production expected; but unique ecological sites for each CAVM bioclimate subzone were not developed.

Classification relationships

Landfire BPS – 17060 - Alaska Arctic Polygonal Ground Wet Sedge Tundra (Landfire 2009) Landfire BPS – 17080 – Alaska Arctic Polygonal Ground Shrub-Tussock Tundra (Landfire 2009)

Ecological site concept

-Associated with low- and high-center ice-wedge polygons on stream terraces, drainageways, and relict lakebeds. The reference state is a complex of three ecological sites related to microtopography in low-center polygons: low-center, rim, and trough. An alternate thermokarst state indicates how this complex changes with ice-wedge degradation. -Soils formed in organic material over eolian deposits and/or alluvium that are often cryoturbated. -The low-center and trough of low-center polygons pond, while the rims do not. A water table occurs at very shallow to shallow depths and these soils are considered very poorly to poorly drained. -Soils are considered very deep but have permafrost at shallow to moderate depths. - The reference plant community for troughs and the low-centers is wet sedge meadow tundra (Viereck et al. 1992) with tall cottongrass, various sedges, and various moss as dominant plants. The reference plant community for rims is mixed shrub-sedge tussock tundra (Viereck et al. 1992) with dwarf birch, lingonberry, Bigelow's sedge, tussock cottongrass, splendid feathermoss, and turgid Aulacomnium moss as dominant plants.

Associated sites

R246XY002AK	Arctic Sedge Loamy Frozen Terraces Occurs on stream terraces without ice-wedge polygons with sedge-willow tundra.
R246XY004AK	Arctic Shrub Sandy Flood Plains Occurs on flood plains that support willow thickets.
R246XY009AK	Arctic High-Center Polygon Complex Occurs on plains with tussock tundra and high-center polygons.
R246XY012AK	Arctic Dwarf Scrub Sandy Coastal Plain Occurs upslope on inland dunes with dwarf scrub vegetation.
R246XY014AK	Arctic Sedge Peat Frozen Depressions Occurs on depressions without prominent ice-wedge polygons. This ecological site also represents younger drained lakebeds.

Similar sites

R246XY050AK	Arctic Sedge Loamy Tidal Marsh Occurs in tidal marsh and estuaries with halophytic wet sedge communities.
R246XY009AK	Arctic High-Center Polygon Complex Ecological site complex 005 and 009 model soils and vegetation associated with ice-wedge polygons. Ecological site complex 009 describes landforms with only high-center polygons, which differs from this ecological site complex.
R246XY014AK	Arctic Sedge Peat Frozen Depressions Ecological site complex 14 models the soil and vegetation in freshwater depressions without ice-wedge polygons. While both ecological sites share similar plant communities, degradation of ice-wedges cause unique state transitions and disturbance pathways.

Figure 1. The flood plain, dunes, and younger surfaces of stream terraces are not associated with this Arctic Ice-Wedge Polygon Complex.

Figure 2. More recently drained lakes without ice-wedge polygons are associated with ecological site 014.

Table 3. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Betula nana</i> (2) <i>Vaccinium vitis-idaea</i>
Herbaceous	(1) <i>Carex aquatilis</i> (2) <i>Eriophorum vaginatum</i>

Physiographic features

- Associated with landforms that have a mosaic of low-center and high-center ice-wedge polygons. In the National Petroleum Reserve, common landforms include relict lakebeds, low-gradient drainageways, and stream terraces. The low-center polygons have three microtopographic positions being the ice-wedge trough, adjacent rim, and low-center of the polygon. Low-center polygons belong to the reference state. The high-center polygons have two microtopographic positions being the ice wedge trough and the interior or domed center. High-center polygons belong to the thermokarst state.
- Slopes are nearly level. Given the low relief, aspect is not relevant for this ecological site concept.
- Elevation occurs between 10 and 330 feet.
- Soils do not flood.

Reference State

- Low-center ice-wedge polygon.
- Ice-wedge troughs are generally less than 3 feet wide. Soils pond frequently for very long durations and are covered with 2 to 6 inches of ponded water throughout much of the growing season.
- Adjacent rims commonly exceed 2 feet in height and three feet in width. Soils do not pond.
- The low-center of these polygon commonly range in diameter from 30 to 100 feet. Soils pond frequently for very long durations and are covered with 2 to 6 inches of water for much of the growing season.

Thermokarst State

- High-center ice-wedge polygon.
- Ice-wedge troughs are greater than 3 feet wide and have 12 to 24 inches or more ponded water.
- Substantial relief exists between the troughs and domed center of polygons (ie between 3 and 10 or more feet).
- The interior or domed centers of polygons do not pond. As relief increases, permafrost thaws to deeper depths and soils have improved drainage. During the growing season, a water table ranges between very shallow and shallow depth.

Figure 1. An old, relict lakebed with ice-wedge polygons.

Table 4. Representative physiographic features

Landforms	(1) River valley > Stream terrace (2) Alluvial plain > Depression (3) Coastal plain > Drainageway (4) Coastal plain > Lakebed (relict) (5) Coastal plain > Patterned ground > Ice wedge polygon (6) Coastal plain > Patterned ground > Low-center polygon (7) Coastal plain > Patterned ground > High-center polygon
Runoff class	Negligible
Flooding frequency	None
Ponding duration	Very long (more than 30 days)
Ponding frequency	None to frequent
Elevation	0 – 100 m
Slope	0 %
Ponding depth	20 cm
Water table depth	0 – 30 cm
Aspect	Aspect is not a significant factor

Table 5. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding frequency	Not specified
Ponding duration	Not specified
Ponding frequency	Not specified
Elevation	0 – 250 m

Slope	0 %
Ponding depth	60 cm
Water table depth	0 – 80 cm

Climatic features

Very short, cool summers and long, very cold winters characterize the arctic climate associated with this ecological site. Given its far North latitude, this Arctic Coastal Plains MLRA experiences long-periods of continuous light in the summer (85 days in Utqiagvik) and continuous darkness in the winter (65 days in Utqiagvik). Mean annual temperature for the Arctic Coastal Plains MLRA typically ranges from 11 to 14 degrees Fahrenheit. The warmest months span June through August with mean normal temperatures ranging from 40 to 47 degrees Fahrenheit (PRISM 2008). The coldest months span December through March with mean normal temperatures ranging from -19 to -9 degrees Fahrenheit (PRISM 2008). This MLRA is arid with mean annual precipitation ranging from 4 to 8 inches. Approximately half of the annual precipitation occurs during the months of July through September. The average annual snowfall ranges from 20 to 40 inches (USDA 2022). The ground is consistently covered with snow from October through May March.

Table 6 Representative climatic features

Frost-free period (characteristic range)	10-30 days
Freeze-free period (characteristic range)	40-80 days
Precipitation total (characteristic range)	100-200 mm
Frost-free period (actual range)	0-50 days
Freeze-free period (actual range)	20-90 days
Precipitation total (actual range)	80-230 mm
Frost-free period (average)	20 days
Freeze-free period (average)	60 days
Precipitation total (average)	150 mm

- (1) BARROW POST ROGERS AP [USW00027502], Barrow, AK
- (2) KUPARUK [USC00505136], Prudhoe Bay, AK
- (3) PRUDHOE BAY [USC00507780], Prudhoe Bay, AK

Influencing water features

Depressional wetlands occur in topographic depressions. Dominant water sources are precipitation, ground water discharge, and both interflow and overland flow from adjacent uplands.

Wetland description

This ecological site is classified as a depressional wetland under the Hydrogeomorphic (HGM) classification system (Smith et al. 1995; USDA-NRCS 2008).

Soil features

- Soils formed in organic material over eolian deposits and/or alluvium that are often cryoturbated.
- Rock fragments do not occur on the soil surface or in the soil profile.
- Mineral soils are capped with thick layers of saturated organic material that varies with cryoturbation and polygon microtopographic position. The surface mineral horizon textures are fine sandy loam and highly organic silt loam.
- The ice-wedge troughs have glacial horizons that are often pure ice. During field work in the National Petroleum Reserve, these troughs were cored and the ice-wedges extend to depths beyond 60 inches.
- While soils are considered very deep, permafrost is a restriction that occurs at shallow and moderate depth.
- The pH of the soil profile ranges from very strongly acidic to slightly acidic.

Reference State

- Low-center ice-wedge polygon
- The ice-wedge troughs and low-center of polygons are considered very poorly drained.
- Adjacent rims are considered poorly drained.

Thermokarst State

- High-center ice-wedge polygon
- The interior or domed centers of polygons are commonly capped with 15 to 40 or more inches of organic material that is primarily mucky peat and muck. In relict lakebeds, domed centers are commonly Typic Folistels. The troughs in the thermokarst state are capped with 15 or more inches of organic material that is primarily peat and mucky peat.
- Permafrost in domed centers thaws and goes deeper in the soil profile resulting in soils that are considered poorly and somewhat poorly drained.

This Arctic Ice-Wedge Polygon ecological site complex is correlated to seven major soil components: Bansheecreek, Inigok, Nuiqsut, Pingok, E46-Arctic tussock-silty frozen terraces, E46-Arctic sedge-loamy frozen low-center polygons, and E46-Arctic scrub-organic frozen polygon rims. All soils classified as Gelisols. Bansheecreek occurs on the domes of high-center polygons and is classified in the great group Folistels; Inigok occurs on the rims of low-center polygons and is classified as Histoturbels; Nuiqsut occurs in the center of low-center polygons and is classified as Hemistels; Pingok occurs in ice-wedge troughs and is classified in the great group Glacistels.

Figure 8. Frost crack intersection in arctic soils (in Kerfoot 1972).

Figure 9. Ice-wedges extend to depths beyond 60 inches.

Figure 10. Photo of a Pingok soil sampled in the trough of ice-wedge polygons in the National Petroleum Reserve-Beaufort Coastal Plain soil survey.

Figure 11. Photo of a Nuiqsut soil sampled in the center of a low-center ice-wedge polygon in the National Petroleum Reserve-Beaufort Coastal Plain soil survey.

Figure 12. Photo of a Nuiqsut soil sampled in the rim of a low-center ice-wedge polygon in the National Petroleum Reserve-Beaufort Coastal Plain soil survey.

Figure 13. Photo of a Bansheecreek soil sampled on the dome of a high-center ice-wedge polygon in the National Petroleum Reserve-Beaufort Coastal Plain soil survey.

Table 7. Representative soil features

Parent material	(1) Organic material (2) Eolian deposits (3) Alluvium
Surface texture	(1) Peat (2) Permanently frozen

Family particle size	(1) Coarse-loamy (2) Sandy
Drainage class	Very poorly drained to poorly drained
Permeability class	Moderately rapid to very rapid
Depth to restrictive layer	50 – 80 cm
Soil depth	150 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	12.19 – 25.91 cm
Calcium carbonate equivalent (25.4-101.6cm)	Not specified
Clay content (0-50.8cm)	0 – 10 %
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)	4.5 – 6.2
Subsurface fragment volume <=3" (0-152.4cm)	Not specified

Subsurface fragment volume >3" (0-152.4cm)	Not specified
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Table 8. Representative soil features (actual values)

Drainage class	Very poorly drained to somewhat poorly drained
Permeability class	Not specified
Depth to restrictive layer	20 – 80 cm
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	Not specified
Calcium carbonate equivalent (25.4-101.6cm)	0 %
Clay content (0-50.8cm)	Not specified
Electrical conductivity (25.4-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (25.4-101.6cm)	0
Soil reaction (1:1 water) (25.4-101.6cm)	4.2 – 7.8

Subsurface fragment volume <=3" (0-152.4cm)	0 – 10 %
Subsurface fragment volume >3" (0-152.4cm)	0 %

Ecological dynamics

Ecological Site Complex

The plant communities in the reference and thermokarst state represent the distinct microtopographic positions of low-center and high-center ice-wedge polygon. Each microtopographic position represents a unique ecological site that was combined into a complex. The soils and vegetation are linked together through the formation and deterioration of the ice-wedges, which create vegetation shifts across a landform. The significant shifts in vegetation occur in a patchwork and is best illustrated with an ecological site complex.

Ice-wedge polygons genesis and transitions

The soils in the arctic reach extremely cold temperatures resulting in thermal contraction and ground cracking. During the winters of 1949 and 1950 in Utqiagvik, soil temperatures ranged between -13 to 5 degrees Fahrenheit, which would cause a 65-foot block of soil to contract ~0.75 inches (Black 1952). Soil contraction at extremely cold temperature results in incredible stress that is relieved through cracking of the soil profile. At first, the ground cracks in a random pattern (Kerfoot 1972). In subsequent winters, secondary cracks typically occur at orthogonal angles which eventually lead to a field of patterned, polygonal ground (Lachenbruch 1962; Kerfoot 1972). The first polygons on the ground are large (35 to 325 feet) but subsequent soil cracking can result in smaller polygonal divisions (15 to 25 feet) (Black 1952).

During spring snowmelt, these soil cracks fill with water that immediately freeze marking the start of an ice wedge. This ongoing process results in the growth of ice wedges. As the ground warms each summer, the ice wedges are comparatively more rigid than the surrounding soils. The ice wedge block is heaved upward and/or the adjacent soils move along the side of the ice (Leffingwell 1915); either action results in a bulge in the once flat ground. After centuries of continued ice wedge growth, low-center polygon are expressed on the landscape. A well-developed low-center polygon has a center that is depressed relative to its boundary. Low-center, ice-wedge polygons have three distinct microtopographic positions: ice-wedge trough, adjacent rim, and the low-center of the polygon. Analyses of the Colville River floodplain indicate that complete development of high-density, low-centered polygons can take 1500–3000 years (Jorgenson et al. 1998).

Low-center polygons transition to high-center polygons over varying timescales. A well expressed high-center polygon has a raised center relative to its boundary and has two distinct microtopographic positions: domed center and ice-wedge trough. The transition from low- to high-center polygon can result from multiple combined processes (Black 1952). First, thermal erosion of the ice wedge can cause the low-center rim to subside or collapse. Second, organic and mineral soil can fill the low-center of polygon, which can occur from vegetative growth, soil creep, and/or windblown soil deposition. Each process ultimately results in the once concave shaped depression now being a flat to convex shaped dome. While the transition from low- to high-center polygons can naturally take thousands of years (Jorgenson et al. 1998), this transition is greatly hastened due to climate change and/or anthropogenic ground disturbances (Billings and Peterson 1980; Jorgenson et al. 2006; Liljedahl et al. 2016).

Thermokarst State

Thermal erosion of ice wedges leads to ground subsidence. In areas without significant subsidence, the dome of the polygon is relatively flat (herein called low-relief, high-center polygons). In areas with significant ice-wedge degradation and subsidence, the dome of the polygon can be several feet higher compared to the trough (herein called high-relief, high-center polygons). As relief increases on the polygon dome, ponding decreases and soils become drier. These changes in hydrology result in the increases of cover and dominance of dwarf ericaceous shrubs and decreases to sedge tussock cover. In the National Petroleum Reserve, high-relief, high-center polygons are most common in the center of relict lakebeds.

Drained Lakes

Across the Arctic Coastal Plain MLRA, lakes are a dominant landform. On the eolian plains in the National Petroleum Reserve, these lakes are believed to have an origin dating back to the last Ice Age (Jorgenson and Shur 2007). In this MLRA, there is a mixture of water filled lake basin and relict lakebeds. At some point in the past, water filled lakes were breached and drained. This occurs when streams, drainageways, and flood plain approach lake basins and thermal erosion of ice and thaw of permafrost create exit pathways for water.

In the National Petroleum Reserve, lake basins follow a chronosequence with 5 distinct stages related to genesis and microtopography of ice-wedge polygons (Jorgenson and Shur 2007). The first stage lacks microtopography related to polygons; the second stage has disjunct low rims of low-center polygons; the third stage has low-density, low-centered polygons; the fourth stage has high density, low-center polygons; and the fifth stage has mixed high- and low-center polygons. The last three stages in this chronosequence relate to this Arctic Ice-Wedge Polygon Complex.

Due to this extended timescale and differences in response to disturbance, drained lakebeds were divided into two ecological site concepts. Younger relict lakebeds without abundant ice-wedge polygons belong to this Arctic Sedge Peat Frozen Depressions ecological site. Older relict lakebeds with abundant ice-wedge polygons belong to the Arctic Ice-Wedge Polygon Complex.

Landforms and Ice-Wedge Polygons

In the National Petroleum Reserve soil survey, low-center polygon are not common on the slopes of plains. These slopes are stable features and have long ago transitioned to high-center polygon. Landforms with only high-center polygons are associated with the Arctic High-Center Polygon Complex. Landforms like stream terraces and drained lake basins commonly have both low- and high-center polygons. These landforms have soils and vegetation that will have different responses to disturbance and are associated with this Arctic Ice-Wedge Polygon Complex.

State and transition model

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 11. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 12. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 13. Community 2.2 plant community composition

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

Not available

Hydrological functions

Not available

Recreational uses

Not available

Wood products

Not available

Other information

Not available

Inventory data references

The vegetation modeled for this site has limited data coverage across the MLRA and is considered provisional. The associated model was largely developed from literature review, NRCS staff with working knowledge of the area, and sample plots from the National Petroleum Reserve – Beaufort Coastal Plain soil survey (AK760). Tier 2 sampling plots used to develop the reference state are below: Tier 2 sampling plots used to develop the grazing state. Plot numbers as recorded in NASIS with associated community phase. Community 1.1 2021AK185030, 2021AK185698, 2021AK185700, 2021AK185707, 2021AK185709, 2021AK185105, 2021AK185111, 2021AK185114, 2021AK185421, 2023AK185406, 2023AK185409, 2023AK185414, 2023AK185415, 2023AK185428, 2023AK185802, 2023AK185808, 2023AK185821, 2023AK185114 Community 1.2 2021AK185032, 2023AK185108, 2023AK185117, 2023AK185120, 2023AK185122, 2023AK185405, 2023AK185410, 2023AK185429, 2023AK185431 Community 1.3 2023AK185430, 2024AK185005 Community 2.1 2021AK185132, 2021AK185140, 2023AK185119, 2023AK185422, 2023AK185820 Community 2.2 2021AK185133, 2024AK185011

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Approval

Blaine Spellman, 5/22/2025

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Marji Patz provided quality control review of these provisional ecological sites.

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	08/31/2026
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. Number and extent of rills:

2. Presence of water flow patterns:

3. Number and height of erosional pedestals or terracettes:

4. Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):

5. Number of gullies and erosion associated with gullies:

6. Extent of wind scoured, blowouts and/or depositional areas:

7. Amount of litter movement (describe size and distance expected to travel):

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

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

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

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

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

Dominant:

Sub-dominant:

Other:

Additional:

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:
