USDA Natural Resources Conservation Service

Ecological site R055BY060ND
Saline Lowland

Accessed: 05/18/2024

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.

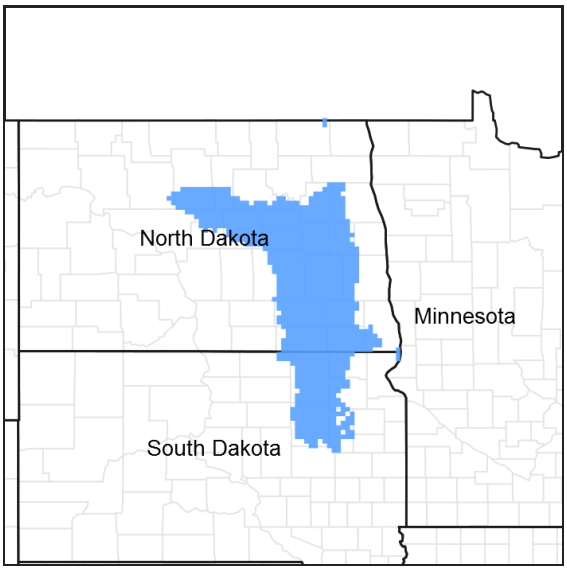


Figure 1. Mapped extent

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.

Classification relationships

Level IV Ecoregions of the Conterminous United States: 46c – Glacial Lake Basins; 46d – Glacial Lake Deltas; 46e – Tewaukon Dead Ice Moraine; 46f – End Moraine Complex; 46i – Drift Plains; 46j – Glacial Outwash; 46n – James River Lowland.

Associated sites

R055BY057ND	**Claypan**
R055BY065ND	**Subirrigated**
R055BY070ND	**Shallow Marsh**
R055BY071ND	**Wet Meadow**

Similar sites

R055BY071ND	**Wet Meadow** (055BY071ND) – Wet Meadow (WM) [Poorly drained soils found in depressions, with water table at the surface or within 1.5 feet from the surface with no evidence of salts, noticeable redoximorphic features within 6 inches or just below the organic soil layer. Found upslope from Wetlands and downslope of Subirrigated or Loamy Overflow sites; can be located within the listed associated sites. Indicator species are prairie cordgrass and northern reedgrass. This site has more production, less western wheatgrass, and a water table without a restrictive sodic layer or evidence of salts within the profile.]

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Elymus trachycaulus* (2) *Pascopyrum smithii*

Physiographic features

This site occurs on concave shallow swales or depressions, or in gently sloping drainage ways.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Pothole
Flooding duration	Long (7 to 30 days)
Flooding frequency	None to frequent
Ponding duration	Very long (more than 30 days)
Ponding frequency	None to frequent
Elevation	305–640 m
Slope	0–3%
Ponding depth	0–30 cm
Water table depth	15–107 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 55B is considered to have a continental climate – cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature are characteristic. The climate is the result of this MLRA’s location in the geographic center of North America. There are few natural barriers on the northern Great Plains. The air masses move unobstructed across the plains and account for rapid changes in temperature.

Annual precipitation ranges from 16 to 21 inches per year. The normal average annual temperature is about 41.5° F. January is the coldest month with average temperatures ranging from about 2° F (Maddock, ND) to about 11° F (Mellette, SD). July is the warmest month with temperatures averaging from about 67° F (Maddock, ND) to about 73° F (Redfield 2 NE, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 64° F. This large annual range attests to the continental nature of this MLRA's climate. Winds average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour.

Growth of native cool-season plants begins in late March and continues to early to mid July. Native warm-season plants begin growth in mid May and continue to the end of August. Green up of cool-season plants can occur in September and October when adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (average)	140 days
Freeze-free period (average)	161 days
Precipitation total (average)	533 mm

Influencing water features

Soil features

The common features of these soils is the presence of soluble salts within the rooting zone. The soils in this site are poorly to moderately well drained and formed in colluvium. The soils have a moderately rapid to very slow infiltration rate. Areas within this site can become nearly barren due to the accumulation of salts at the surface. Where vegetation is present, this site should show no evidence of rills, wind scoured areas or pedestalled plants. The soil surface is stable and intact. Sub-surface soil layers can be restrictive to water movement and root penetration. Salt accumulation strongly influences the soil-water-plant relationship.

Access Web Soil Survey (http://websoilsurvey.nrcs.gov/app/) for specific local soils information.

Table 4. Representative soil features

Surface texture	(1) Loam (2) Silt loam (3) Silty clay loam
Drainage class	Poorly drained to moderately well drained
Permeability class	Moderately rapid to slow
Soil depth	5–203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	7.62–30.48 cm
Calcium carbonate equivalent (0-101.6cm)	0–25%
Electrical conductivity (0-101.6cm)	8–16 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–25
Soil reaction (1:1 water) (0-101.6cm)	6.1–9
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

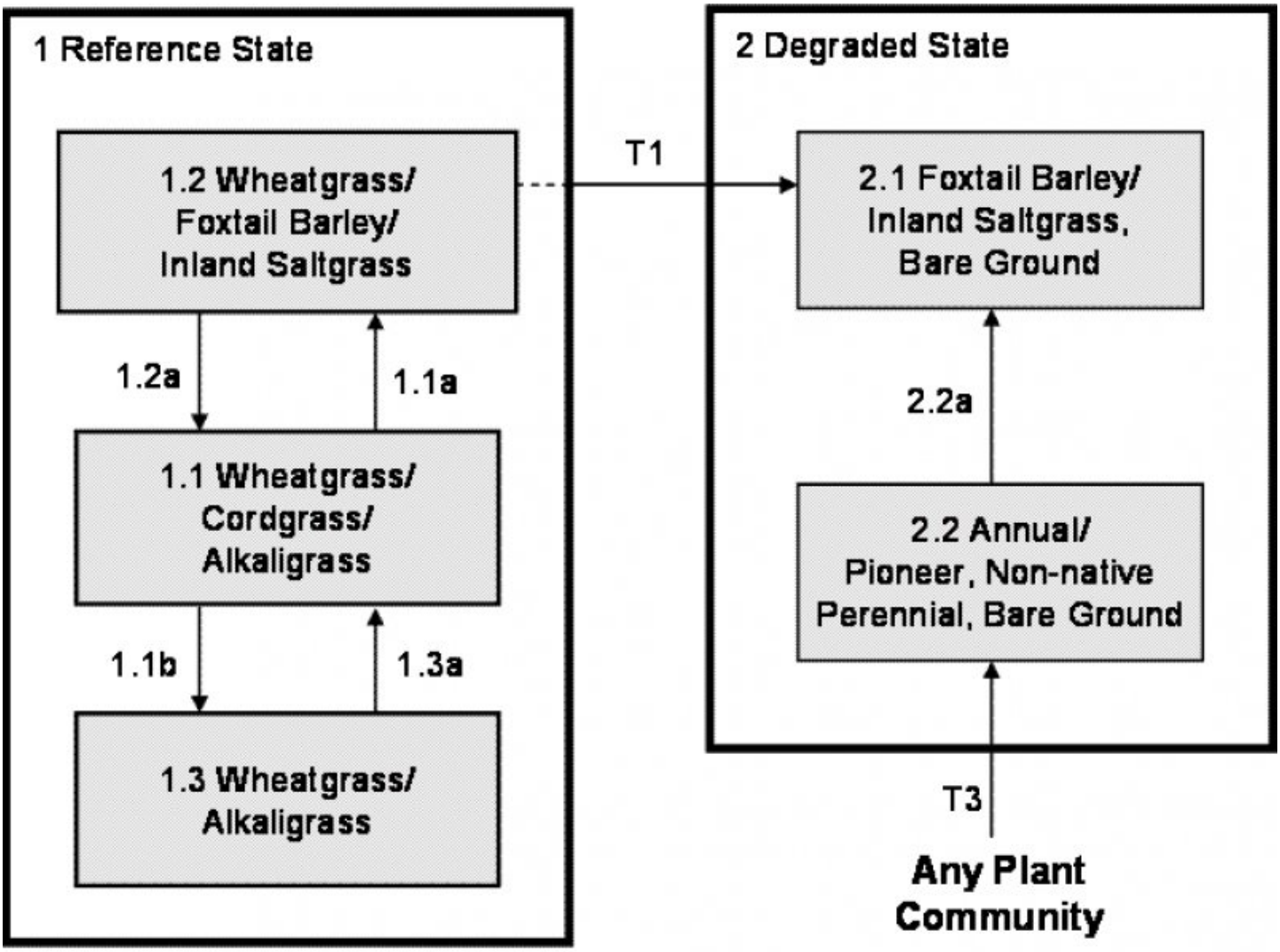
The site developed under Northern Great Plains climatic conditions, and included natural influence of large herding herbivores and occasional fire. Changes will occur in the plant communities due to weather fluctuations and/or management actions. Under adverse impacts, a relatively rapid decline in vegetative vigor and composition can occur. Under favorable conditions the site has the potential to resemble the Reference State. Interpretations for this site are based primarily on the Wheatgrass/Cordgrass/Alkaligrass Plant Community Phase (1.1). This community phase and the Reference State has been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics

ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been considered. Community phases and pathways, states, transitions, thresholds and restoration pathways have been determined through similar studies and experience.

The natural disturbance regime consisted of occasional fires caused both by natural and Native American ignition sources. Large ungulate grazing was heavy and occurred often, but usually for short durations. Grazing may have been severe when occurring after a fire event, or in areas near water sources. This ecological site has been grazed by domestic livestock since introduced into the area. The introduction of domestic livestock and the use of fencing and reliable water sources have radically changed the disturbance regime of this site. Heavy continuous grazing and/or continuous seasonal (spring) grazing, without adequate recovery periods following each grazing occurrence causes this site to depart from the Reference State. Species such as western wheatgrass and inland saltgrass will initially increase. Alkali cordgrass and Nuttall's alkaligrass will decrease in frequency and production. Heavy continuous grazing causes foxtail barley, inland saltgrass, and unpalatable forbs such as silverweed cinquefoil and dock species to increase and western wheatgrass to decrease. Inland saltgrass can eventually form into a patchy sod and bare ground will typically increase around the sod patches. Increased surface salts are common due to loss of plant cover.

Following the state and transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable states/community phases. The plant composition tables shown below have been developed from the best available knowledge at the time of this revision. As more data are collected, some of these community phases and/or states may be revised or removed, and new ones may be added. The main purpose for including the descriptions here is to capture the current knowledge and experience at the time of this revision.

State and transition model



1.1a – Heavy continuous grazing or heavy seasonal grazing; **1.2a** – Prescribed grazing with adequate recovery periods; **1.1b** – Non-use; **1.3a** – Prescribed grazing and prescribed burning; **T1** – Heavy continuous season-long grazing; **2.2a** – Time, with or without disturbances; **T3** – Cropped go-back with continuous grazing, or encroachment of non-native invasive species, or seeded areas.

State 1
Reference

This state represents the natural range of variability that dominates the dynamics of this ecological site. This state is dominated by cool-season grasses, while warm-season grasses are subdominant. Pre-European settlement, the primary disturbance mechanisms for this site in the reference condition included occasional fire and grazing by large herding ungulates. Timing of fires and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Today the primary disturbance is from a lack of fire and concentrated livestock grazing. Grasses that are desirable for livestock and wildlife can decline and a corresponding increase in less desirable grasses will occur.

Community 1.1
Wheatgrass/Cordgrass/Alkaligrass

This community evolved with grazing by large herbivores, occasional prairie fires and periodic flooding events and can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of rest. The potential vegetation is about 95 percent grasses and grass-like plants, and 5 percent forbs. The major grasses include western wheatgrass, Nuttall’s alkaligrass, and alkali and

prairie cordgrass. Other grasses present include slender wheatgrass, inland saltgrass and foxtail barley. Salt tolerant forbs such as alkali plantain, western dock and seepweed are common. Interpretations are based primarily on this plant community phase. This community phase is diverse, stable, productive and well adapted to both saline soils and the Northern Great Plains climatic conditions. Community dynamics, nutrient cycle, water cycle and energy flow are functioning properly. Litter is properly distributed with very little movement off-site and natural plant mortality is very low. This community is resistant to many disturbances except continuous grazing, tillage and/or development into urban or other uses. The diversity in plant species allows for both the fluctuation of flooding as well as large variations in climate.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	3099	4131	5139
Forb	39	128	241
Total	**3138**	**4259**	**5380**

Figure 5. Plant community growth curve (percent production by month). ND5507, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	7	36	35	10	3	6	1	0	0

Community 1.2
Wheatgrass/Foxtail Barley/Inland Saltgrass

This community develops with heavy continuous grazing with lack of adequate recovery periods during the growing season, and/or annual, early spring seasonal grazing. Lack of litter and reduced plant heights result in higher soil temperatures, poor water infiltration rates, high evapotranspiration and increased percolation of the high water table, which increases salt concentrations on the surface. This gives inland saltgrass and other salt tolerant species a competitive advantage over less tolerant species. Nuttall’s alkaligrass, slender wheatgrass, prairie cordgrass, and alkali cordgrass have decreased while western wheatgrass and inland saltgrass will initially increase in composition. Mat muhly, foxtail barley, silverleaf cinquefoil, dock and plantain will also increase in composition. As long as the herbaceous component remains intact, the plant community tends to be resilient. However, species composition can be further altered through long-term heavy continuous grazing. With loss of Nuttall alkaligrass, cordgrasses, slender wheatgrass and much of the western wheatgrass, inland saltgrass will eventually become the dominant species. This plant community is relatively stable and well adapted to increased salinity. Plant vigor, litter, plant density and production have decreased. The biological integrity, water and nutrient cycles of this plant community are becoming impaired.

Figure 6. Plant community growth curve (percent production by month). ND5507, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	7	36	35	10	3	6	1	0	0

Community 1.3
Wheatgrass/Alkaligrass

This plant community occurs when grazing is removed for long periods of time (rest) in the absence of fire. Plant composition is similar to community phase 1.1; however individual species production and frequency will be lower. Much of the nutrients are tied up in excessive litter. The nutrient cycle is slowed due to standing dead plant residues not in contact with a moist soil surface. Aboveground litter also limits sunlight from reaching plant crowns. Tall warm-season grasses (cordgrasses) die off or are reduced in density and vigor and typically develop into small but dense colonies. Thick litter and absence of grazing animals (animal impact) or fire reduces seed germination and

establishment. This plant community develops after an extended period of 10 or more years of non-use by herbivores and exclusion of fire. This plant community is resistant to change without prescribed grazing or fire. The combination of both grazing and fire is most effective in moving this plant community towards the Wheatgrass/Cordgrass/Alkaligrass Plant Community Phase (1.1). Soil erosion is low and runoff is virtually unchanged.

Figure 7. Plant community growth curve (percent production by month). ND5506, Central Black Glaciated Plains, lowland cool-season dominant.. Cool-season dominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	37	35	5	2	8	0	0	0

Pathway 1.1a
Community 1.1 to 1.2

Heavy continuous grazing (stocking rates well above capacity for extended portions of the growing season without adequate recovery) or heavy seasonal grazing (stocking rates well above capacity for a portion of the growing season, but at the same time of year every year and without adequate recovery) will shift the plant community phase to more grazing tolerant species. In pre-European times, this transition would have occurred following multiple disturbances such as extended periods of below average precipitation followed by heavy concentrations of large ungulate herbivory.

Pathway 1.1b
Community 1.1 to 1.3

Extended periods of non-use and no fire will tend to favor the cool-season grasses, and the warm-season grasses will decline.

Pathway 1.2a
Community 1.2 to 1.1

Prescribed grazing with adequate recovery between grazing events will allow the cordgrasses and Nuttall’s alkaligrass to increase in vigor and production. In pre-European times, this would have occurred where light to moderate disturbances from large ungulates occurred sporadically.

Pathway 1.3a
Community 1.3 to 1.1

Prescribed grazing (stocking levels which match the animals to the forage resource and allow adequate recovery periods between grazing events) coupled with prescribed burning (typically spring burning, but fall burning may also be effective) is the most effective method of effecting this shift.

State 2
Degraded

This State is characterized by the dominance of the shorter-statured, more saline tolerant species such as foxtail barley and inland saltgrass, the increase in bare ground, and the increased presence of salt accumulations on the soil surface. Infiltration is reduced, which allows the moisture and the salts carried by the moisture to be wicked up to the soil surface. The short-statured and shallow rooted species are more capable of withstanding the higher concentrations of salts in the soil surface. As the disturbance level increases, plant density decreases even more, giving way to annual species and invasive perennial species, as well as a further increase in bare ground.

Community 2.1
Foxtail Barley/Inland Saltgrass, Bare Ground

This plant community developed with heavy continuous season-long grazing where adequate recovery periods between grazing events were not allowed. Patches of inland saltgrass sod are typical and foxtail barley is well

distributed throughout the community. Nuttall's alkaligrass and western wheatgrass have been greatly reduced and may persist in remnant amounts, reduced in vigor. Bare ground may develop in micro lows where salt concentrations are highest. A white salt crust is common on the surface. Only a few very salt tolerant annuals, such as glasswort and seepweed, can survive. This plant community is resistant to change due to the grazing tolerance of inland saltgrass and increased surface salts. A significant amount of production and diversity has been lost when compared to the Wheatgrass/Cordgrass/Alkaligrass Plant Community Phase (1.1). Loss of key cool-season grasses and increased bare ground has negatively impacted energy flow and nutrient cycling. Water infiltration is reduced significantly due to the shallow rooting depth of inland saltgrass, and increased bare ground.

Community 2.2
Annual/Pioneer, Non-Native Perennial, Bare Ground

This plant community develops under severe disturbance and/or excessive defoliation. This can result from heavy livestock or wildlife concentration, and cropping abandonment (go-back land). The dominant vegetation includes pioneer annual grasses, forbs, invaders, and early successional biennial and perennial species. Grasses may include foxtail barley, which will dominate along with fowl bluegrass, Nuttall's alkaligrass, annual brome and western wheatgrass. The dominant forbs include curly dock, kochia, and other early successional salt tolerant species. Plant species from adjacent ecological sites may become minor components of this plant community. The community is susceptible to invasion of non-native species due to severe soil disturbances and relatively high percent of bare ground. This plant community is resistant to change, as long as soil disturbance or severe vegetation defoliation persists, thus holding back secondary plant succession. Soil erosion is potentially high in this plant community. Reduced surface cover, low plant density, low plant vigor, loss of root biomass, and soil compaction, all contribute to decreased water infiltration, increased runoff, and accelerated erosion rates. Significant economic inputs, management and time would be required to move this plant community toward a higher successional stage and a more productive plant community. Secondary succession is highly variable, depending upon availability and diversity of a viable seed bank of higher successional species within the existing plant community and neighboring plant communities. This plant community can be renovated to improve the production capability, but management changes would be needed to maintain the new plant community. Due to the highly variable nature of the plant community that may exist, no growth curve has been assigned.

Pathway 2.2a
Community 2.2 to 2.1

This community pathway occurs with the passage of time as successional processes take place and native plant species gradually begin to establish on the site again.

Transition T1
State 1 to 2

This transition is a result of heavy, continuous season-long grazing (stocking levels well above recommended rates, for the entire growing season). Grazing pressure and physical impacts of livestock on the soil surface alter the plant community. The less grazing tolerant/more palatable plant species are reduced, while the grazing tolerant species increase. Physical impacts result in increased bare ground which increases surface salinity and further enhances the salt tolerant species. The physical impacts (i.e., compaction) are greater when the soil surface is wet from short-term flooding or ponding events.

Transition T3
State 1 to 2

Severe disturbance such as concentrated livestock areas (e.g., watering sources, calving or feeding areas) or cropping abandonment. Attempts to crop these areas often fail, resulting in bare ground and weedy species such as kochia.

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State 1 to 2

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Transition T3
State 1 to 2

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Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			639–1278	
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	213–1278	–
	western wheatgrass	PASM	*Pascopyrum smithii*	213–1278	–
2	**Cordgrass**			639–1278	
	alkali cordgrass	SPGR	*Spartina gracilis*	213–1278	–
	prairie cordgrass	SPPE	*Spartina pectinata*	213–1278	–
3	**Cool-season Grasses**			426–852	
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	426–852	–
	plains bluegrass	POAR3	*Poa arida*	43–341	–
	Grass, perennial	2GP	*Grass, perennial*	0–213	–
	foxtail barley	HOJU	*Hordeum jubatum*	43–213	–
4	**Warm-season Grasses**			43–426	
	saltgrass	DISP	*Distichlis spicata*	43–341	–
	Grass, perennial	2GP	*Grass, perennial*	0–213	–
	scratchgrass	MUAS	*Muhlenbergia asperifolia*	43–128	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–128	–
5	**Grass-likes**			43–213	
	sedge	CAREX	*Carex*	43–213	–
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	0–128	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–128	–
Forb					
6	**Forbs**			43–213	
	Forb, native	2FN	*Forb, native*	0–85	–
	redwool plantain	PLER	*Plantago eriopoda*	0–85	–
	silver cinquefoil	POAR8	*Potentilla argentea*	43–85	–
	western dock	RUAQ	*Rumex aquaticus*	0–85	–
	seepweed	SUAED	*Suaeda*	43–85	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	0–85	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	0–43	–
	marsh arrowgrass	TRPA28	*Triglochin palustris*	0–43	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–43	–
	povertyweed	IVAX	*Iva axillaris*	0–43	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–43	–
	silverscale saltbush	ATAR2	*Atriplex argentea*	0–43	–

Animal community

This site is well adapted to managed grazing by domestic livestock. The predominance of herbaceous plants across all plant community phases best lends these sites to grazing by cattle but other domestic grazers with differing diet preferences may also be a consideration depending upon management objectives. Often, the current plant community does not entirely match any particular plant community (as described in the ecological site description). Because of this, a resource inventory is necessary to document plant composition and production. Proper interpretation of this inventory data will permit the establishment of a safe, initial stocking rate for the type and class of animals and level of grazing management. More accurate stocking rate estimates should eventually be

calculated using actual stocking rate information and monitoring data.

Hydrological functions

Available water is the principal factor limiting forage production on this site. Inherent soil salinity indirectly influences the availability of water to plants growing on the site. This site is dominated by soils in hydrologic group D. Infiltration varies from moderately slow to slow and runoff potential varies from low to moderate depending on soil hydrologic group and ground cover. In many cases, areas with greater than 75% ground cover have the greatest potential for high infiltration and lower runoff. An exception would be where short grasses form a strong sod and dominate the site.

Areas where ground cover is less than 50% have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational uses

This site offers open space and opportunity for intermittent viewing and/or hunting of a few wildlife species.

Wood products

No appreciable wood products are present on the site.

Other products

Seed harvest of native plant species can provide additional income on this site.

Inventory data references

Information presented here has been derived from NRCS and other federal/state agency clipping and inventory data. Also, field knowledge of range-trained personnel was used. All descriptions were peer reviewed and/or field-tested by various private, state and federal agency specialists. Those involved in developing this site description include: Stan Boltz, NRCS Range Management Specialist; Michael D. Brand, State Land Dept., Director Surface Management; David Dewald, NRCS State Biologist; Paul Drayton, NRCS District Conservationist; Jody Forman, NRCS Range Management Specialist; Dennis Froemke, NRCS Range Management Specialist; Jeff Printz, NRCS State Range Management Specialist; Kevin Sedivec, Extension Rangeland Management Specialist; Shawn Dekeyser, North Dakota State University; Rob Self, The Nature Conservancy and Lee Voigt, NRCS Range Management Specialist.

Other references

High Plains Regional Climate Center, University of Nebraska, 830728 Chase Hall, Lincoln, NE 68583-0728. (http://hpccsun.unl.edu)
USDA, NRCS. National Water and Climate Center, 101 SW Main, Suite 1600, Portland, OR 97204-3224. (http://wcc.nrcs.usda.gov)
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USDA, NRCS, Various Published Soil Surveys.

Contributors

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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.

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Date	04/19/2012
Approved by	Jeff Printz
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None.

2. **Presence of water flow patterns:** None.

3. **Number and height of erosional pedestals or terracettes:** None.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is 5% or less with bare patches less than 2 inches in diameter and not connected. Slickspots of varying size can occur in complex with this site and will be mostly bare ground with sparse, salt-tolerant vegetation. Slickspots typically have salt crusting at the surface.

5. **Number of gullies and erosion associated with gullies:** None.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None.

7. **Amount of litter movement (describe size and distance expected to travel):** None.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil aggregate stability should be 5 or greater. Soil surface has high root content and is resistant to erosion.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Use soil series description for depth, color and structure of A horizon/surface layer.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** High grass canopy and small gaps between plants reduces raindrop impact and slows overland flow, providing increased time for infiltration to occur. Healthy, deep rooted native grasses enhance infiltration and reduce 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):** None. Some soils within this ESD have a naturally occurring platy structure observable at the surface

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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: Mid cool-season grasses = Tall and mid warm-season rhizomatous

    Sub-dominant: Mid, cool-season bunchgrasses >

    Other: Short warm-season grasses > grass-likes = forbs

    Additional: Due to differing root structure and distribution, Kentucky bluegrass and smooth bromegrass do not fit into reference plant community F/S groups.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** None.

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14. **Average percent litter cover (%) and depth (in):** In contact with soil surface.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Representative value = 3800 lbs/ac air dry with a range of 2800 to 4800 lbs/acre air dry depending upon growing conditions.

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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:** State and local noxious, Kentucky bluegrass, smooth bromegrass, Russian olive

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17. **Perennial plant reproductive capability:** All species exhibit high vigor relative to climatic conditions. Do not rate based solely on seed production. Perennial grasses should have vigorous rhizomes or tillers

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