USDA Natural Resources Conservation Service

Ecological site R055CY036SD
Saline Subirrigated

Last updated: 2/01/2024
Accessed: 05/15/2024

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.

MLRA notes

Major Land Resource Area (MLRA): 055C–Southern Black Glaciated Plains

The Southern Black Glaciated Plains (55C) is located within the Northern Great Plains Region. It is entirely within South Dakota encompassing about 10,835 square miles (Figure 1). The elevation ranges from 1,310 to 1,970 square feet. The MLRA is on nearly level to undulating glacial till plains interrupted by steeper slopes adjacent to streams and moraines. The James River is an under-fit stream. Its valley was carved by floodwaters draining glacial Lake Dakota and is filled with glacial outwash and alluvial deposits. (USDA-NRCS, 2006).

The dominant soil order in this MLRA is Mollisols. The soils in the area dominantly have a mesic soil temperature regime, an ustic soil moisture regime, and mixed or smectitic mineralogy. They generally are very deep, well drained to very poorly drained, and clayey or loamy. This area supports natural prairie vegetation characterized by western wheatgrass (Pascopyrum smithii), green needlegrass (Nassella viridula), needle and thread (Hesperostipa comata), and porcupinegrass (Hesperostipa spartea) with Prairie cordgrass (Spartina pectinata), and reed canarygrass (Phalaris arundinacea) as the dominant vegetation on the poorly drained soils. (USDA-NRCS, 2006).

Classification relationships

Major Land Resource Area (MLRA): Southern Black Glaciated Plains (55C) (USDA-NRCS, 2006)

USFS Subregions: North Central Glaciated Plains Section (251B); Yankton Hills and Valleys Subsection (251Bf); Western Glaciated Plains Section (332B); James River Lowland Subsection (332Bb); North Central Great Plains Section (332D); Southern Missouri Coteau Slope Subsection (332Dd); Southern Missouri Coteau Subsection (332De) - (Cleland et al., 2007).

US EPA Level IV Ecoregion: Southern Missouri Coteau (42e); Southern Missouri Coteau Slope (42f); James River Lowland (46n) - (USEPA, 2013)

Ecological site concept

The Saline Subirrigated ecological site typically occurs along the edges of drainageways or closed depressions. Soils are somewhat poorly drained which have a water table within 2 to 5 feet of the soil surface that persists longer than the wettest part of the growing season, typically until the month of August. The soils will have visible salts within 16 inches of the soil surface. Dominant vegetation is adapted to the high salinity. Vegetation in the Reference State is dominated by warm-season grasses including big bluestem, Indiangrass, and switchgrass. Forbs include seepweed, goldenrods, and cinquefoil. Change in disturbance regime may lead to a Degraded State where foxtail barley and inland saltgrass are common

Associated sites

R055CY002SD	**Linear Meadow** These sites occur in drainageways. Soils are poorly and very poorly drained and have a water table within 0 to 2 feet of the soil surface that persists longer than the wettest part of the growing season, typically until the month of August. The central concept soil series is Lawet, but other series are included.
R055CY003SD	**Subirrigated** These sites occur in drainageways. Soils are somewhat poorly drained and have a water table within 2 to 5 feet of the soil surface that persists longer than the wettest part of the growing season typically until the month of August. The central concept soil series is Crossplain, but other series are included.
R055CY004SD	**Wet Meadow** These sites occur in a basin or closed depression. Soils are poorly drained and the site ponds water for 4 to 8 weeks in the spring of the year or after a heavy rain. The central concept soil series is Tetonka, but other series are included.
R055CY006SD	**Limy Subirrigated** These sites occur along the edges of drainageways. Soils are somewhat poorly drained and have a water table within 2 to 5 feet of the soil surface that persists longer than the wettest part of the growing season, typically until the month of August. Soils will effervesce with acid at or near the surface. The central concept soil series is Davison but other series are included.
R055CY007SD	**Saline Lowland** These sites typically occur in drainageways, but can occur along the edges of larger closed depressions. Soils are poorly and very poorly drained and have a water table within 0 to 2 feet of the soil surface that persists longer than the wettest part of the growing season, typically until the month of August. The soils will have visible salts within 16 inches of the soil surface. The central concept soil series is Salmo, but other series are included.

Similar sites

R055CY006SD	**Limy Subirrigated** The Limy Subirrigated site is in a similar landscape position, but will not have visible salts within 16 inches of the soil surface. The Limy Subirrigated site will have more little bluestem and more green needlegrass than a Saline Subirrigated site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Sorghastrum nutans*

Physiographic features

The Saline Subirrigated ecological site typically occurs along the edges of drainageways or closed depressions.

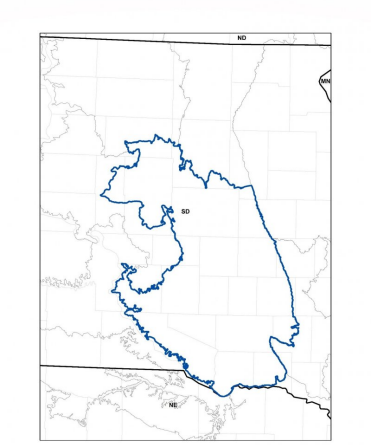


Figure 1. Site Distribution Map for the Saline Subirrigated Site in MLRA 55C.

Table 2. Representative physiographic features

Landforms	(1) Drainageway (2) Closed depression
Runoff class	Low
Flooding frequency	None to frequent
Ponding duration	Brief (2 to 7 days)
Ponding frequency	None
Elevation	396–610 m
Slope	0–6%
Water table depth	61–152 cm

Climatic features

MLRA 55C is considered to have a continental climate: Cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature may also abound. The climate is the result of this MLRA's location near the geographic center of North America. There are few natural barriers on the Northern Great Plains, and air masses move freely across the plains and account for rapid changes in temperature.

Annual precipitation typically ranges from 19 to 25 inches per year. The average annual temperature is about 47°F. January is the coldest month with average temperatures ranging from about 15°F (Howard, South Dakota [SD]), to about 20°F (Wagner, SD). July is the warmest month with temperatures averaging from about 73°F (Howard, SD), to about 77°F (Wagner, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 58°F. This large annual range attests to the continental nature of this area's climate. Hourly winds are estimated to average about 12 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 11 mph 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 mph.

Growth of cool-season plants begins in early to mid-March, slowing or ceasing in late June. Warm-season plants begin growth about mid-May and continue to early or mid-September. Green-up of cool-season plants may occur in September and October when adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (characteristic range)	122-129 days
Freeze-free period (characteristic range)	137-150 days
Precipitation total (characteristic range)	559-660 mm
Frost-free period (actual range)	114-130 days
Freeze-free period (actual range)	133-155 days
Precipitation total (actual range)	533-686 mm
Frost-free period (average)	125 days
Freeze-free period (average)	143 days
Precipitation total (average)	610 mm

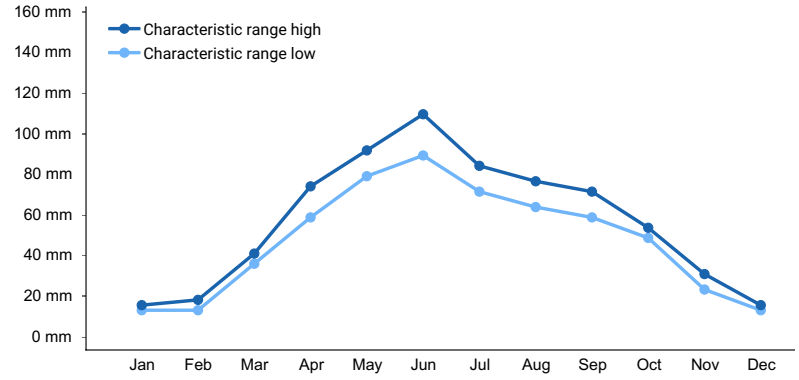


Figure 2. Monthly precipitation range

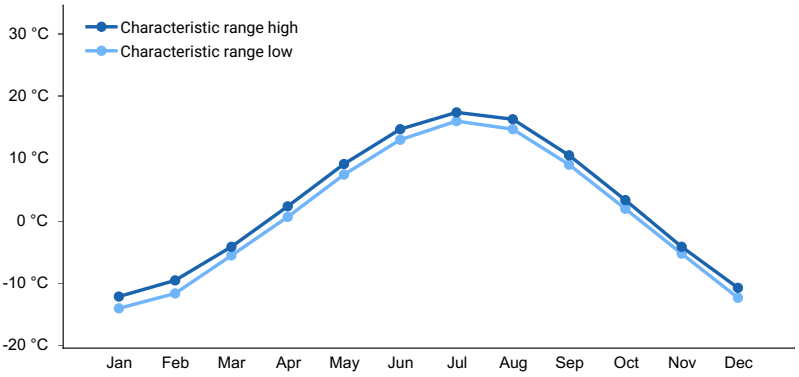


Figure 3. Monthly minimum temperature range

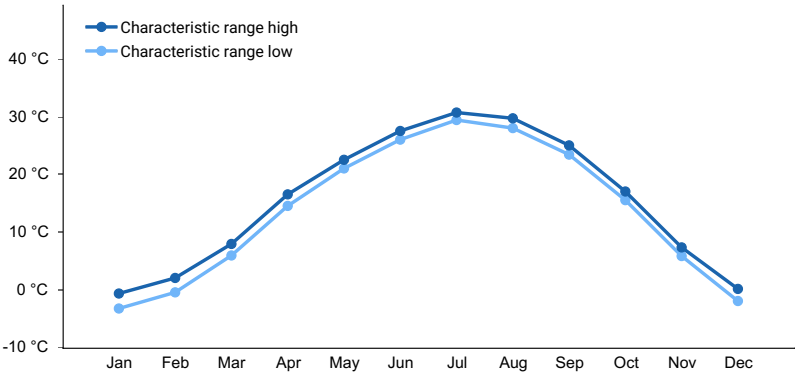


Figure 4. Monthly maximum temperature range

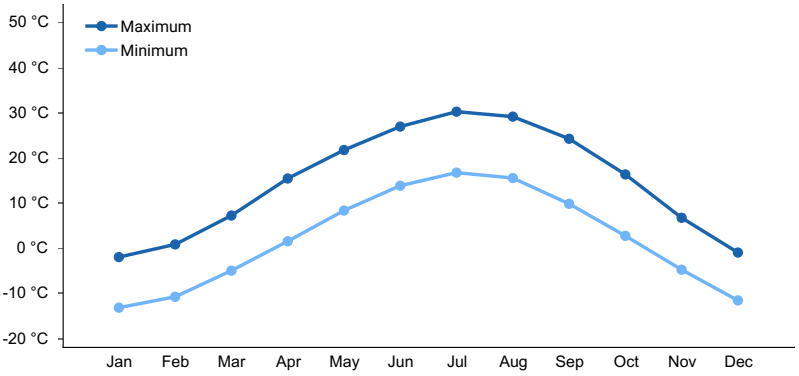


Figure 5. Monthly average minimum and maximum temperature

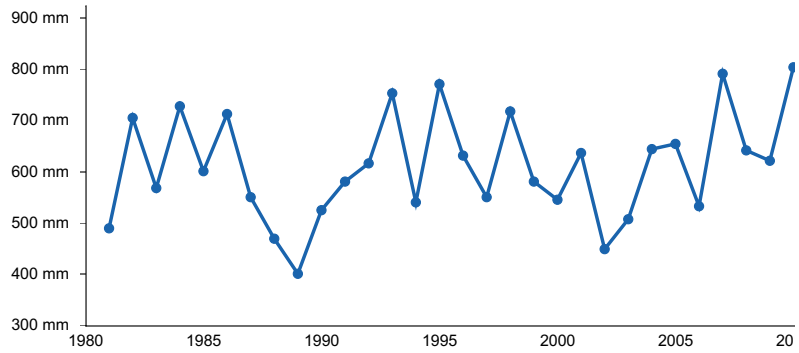


Figure 6. Annual precipitation pattern

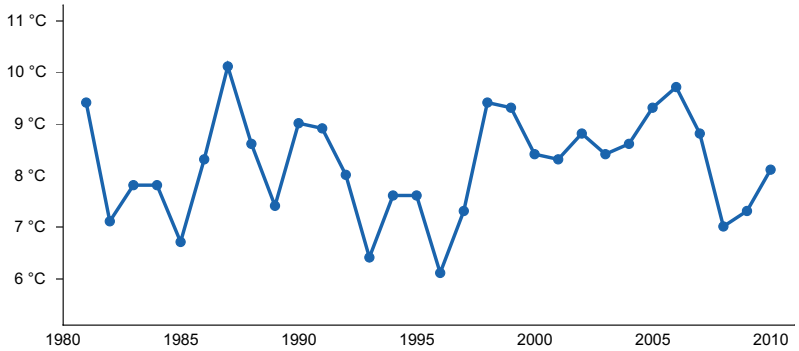


Figure 7. Annual average temperature pattern

Climate stations used

- (1) FAULKTON 1 NW [USC00392927], Faulkton, SD
- (2) REDFIELD [USC00397052], Redfield, SD
- (3) MILLER [USC00395561], Miller, SD
- (4) HURON RGNL AP [USW00014936], Huron, SD
- (5) DE SMET [USC00392302], De Smet, SD
- (6) HOWARD [USC00394037], Howard, SD
- (7) FORESTBURG 4 NNE [USC00393029], Artesian, SD
- (8) CHAMBERLAIN MUNI AP [USW00094943], Chamberlain, SD
- (9) CHAMBERLAIN 5 S [USC00391621], Chamberlain, SD
- (10) ACADEMY 2NE [USC00390043], Platte, SD
- (11) MITCHELL MUNI AP [USW00094950], Mitchell, SD
- (12) MITCHELL [USC00395669], Mitchell, SD
- (13) ALEXANDRIA [USC00390128], Alexandria, SD
- (14) SALEM 5NE [USC00395360], Salem, SD
- (15) BRIDGEWATER [USC00391032], Bridgewater, SD
- (16) MARION [USC00395228], Marion, SD
- (17) MENNO [USC00395481], Menno, SD
- (18) TYNDALL [USC00398472], Tyndall, SD
- (19) WAGNER [USC00398767], Wagner, SD
- (20) ARMOUR [USC00390296], Armour, SD

Influencing water features

This site has a season water table of 1.5 to 2.5 feet.

Soil features

The Saline Subirrigated site typically occurs along the edges of drainageways or closed depressions. Soils are somewhat poorly drained which have a water table within 2 to 5 feet of the soil surface that persists longer than the wettest part of the growing season typically until the month of August. The soils will have visible salts within 16

inches of the soil surface. The central concept soil series is Davison, moderately saline.

Table 4. Representative soil features

Surface texture	(1) Loam
Drainage class	Somewhat poorly drained
Permeability class	Moderate
Soil depth	203 cm
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	12.7–30.48 cm
Electrical conductivity (Depth not specified)	0–8 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0–6
Soil reaction (1:1 water) (Depth not specified)	5.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

State and Community Phases
The information in this Ecological Site Description, including the state-and-transition model (STM), was developed based on historical data, 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.

The site which is located in the Southern Black Glaciated Plains Region developed under Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or man-caused wildfire (often of light intensities), fluctuating water tables and flooding events, and other biotic and abiotic factors that typically influence soil and site development. Changes will occur in the plant communities due to short-term weather variations, impacts of native and exotic plant and animal species, and management actions. While the following plant community descriptions describe more typical transitions that will occur, severe disturbances, such as periods of well below average precipitation, can cause significant shifts in plant communities and species composition that may not be described within this document.

Heavy, continuous grazing without adequate recovery periods following each grazing occurrence over several years causes this site to depart from the interpretive plant community. Species such as little bluestem (*Schizachyrium scoparium*) and sedge (Carex) will initially increase. Big bluestem, Indiangrass, and switchgrass will decrease in frequency and production. Heavy, continuous grazing causes inland saltgrass (*Distichlis spicata*) to increase and eventually develop into a sod condition. Extended periods of non-use and no fire will result in a plant community having high litter levels which favors an increase in species such as spikerush (*Eleocharis palustris*), sedge, foxtail barley (*Hordeum jubatum*), and prairie cordgrass. Grazing, especially if adequate recovery periods are not allowed may be more detrimental on this site than haying. Biotic integrity on this site may be maintained more readily through periodic haying than through grazing.

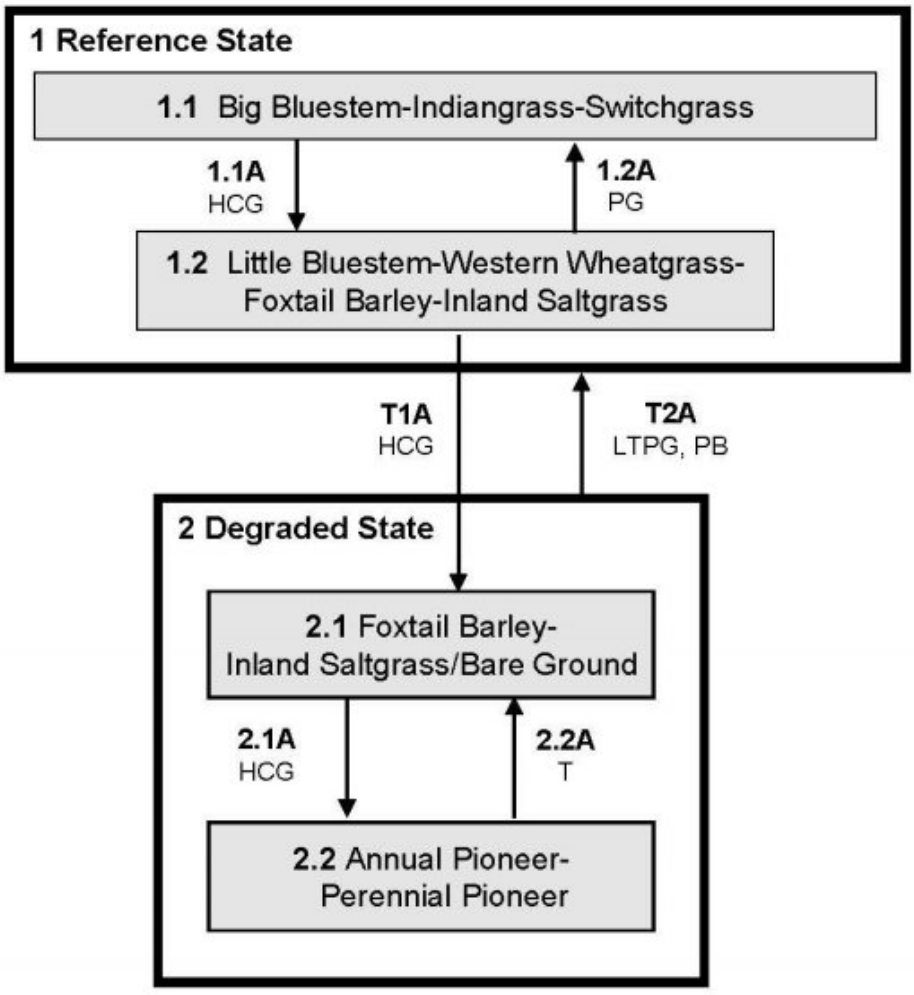
Interpretations are primarily based on the 1.1 Big Bluestem-Indiangrass-Switchgrass Plant Community Phase. It has been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily to lightly grazed areas, seasonal use pastures, and historical accounts also have been used. Plant community phases, states,

transitional pathways, and thresholds have been determined through similar studies and experience.

The following is a diagram that illustrates the common plant community phases that can occur on the site and the transition and community pathways between them. The ecological processes will be discussed in more detail in the plant community descriptions following the diagram.

State and transition model

Saline Subirrigated – R055CY036SD



LEGEND
Saline Subirrigated – R055CY036SD

HCG – Heavy, continuous grazing
LTPG – Long-term prescribed grazing
PB – Prescribed burning
PG – Prescribed grazing
T – Time w/wo disturbances

Figure 8. State-and-Transition Model and Legend for the Saline Subirrigated Site in MLRA 55C.

Code	Process
T1A	Heavy, continuous grazing
T2A	Long term prescribed grazing, prescribed burning
1.1A	Heavy, continuous grazing
1.2A	Prescribed grazing with recovery periods
2.1A	Heavy, continuous grazing
2.2A	Time w/wo disturbance

Figure 9. Matrix for the Saline Subirrigated Site in MLRA 55C.

State 1
Reference State

The Reference State represents the natural range of variability that dominates the dynamics of this ecological site (ES). This state is dominated by warm-season grasses. Prior to European settlement of North America, the primary disturbance mechanisms for this site in the Reference condition included periods of below and above average precipitation, periodic fire, and herbivory by insects and large ungulates. Timing of fires and herbivory coupled with weather events dictated the dynamics that occurred within the natural range of variability. In some locations, this site likely received relatively heavy grazing pressure. Tall warm-season grasses would have declined, and shorter-statured grass and grass-likes would have increased. Today, this state 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.

Community 1.1
Big Bluestem-Indiangrass-Switchgrass

Interpretations are based primarily on the 1.1 Big Bluestem-Indiangrass-Switchgrass Plant Community Phase (this is also considered to be the Reference Community). The potential vegetation is about 85 percent grasses or grass-like plants and 15 percent forbs. The community is dominated by warm-season grasses. The major grasses include big bluestem, Indiangrass, switchgrass, and little bluestem. Other grass or grass-like species include prairie cordgrass, slender wheatgrass (*Elymus trachycaulus*), western wheatgrass, sideoats grama (*Bouteloua curtipendula*), alkali sacaton (*Sporobolus airoides*), plains bluegrass (*Poa arida*), and sedge. This plant community is resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high tolerance to drought. This is a sustainable plant community in regards to site and soil stability, watershed function, and biologic integrity.

Community 1.2
Little Bluestem-Western Wheatgrass-Foxtail Barley-Inland Saltgrass

This plant community evolves under heavy, continuous grazing or from over utilization during extended drought periods. The potential plant community is made up of approximately 90 percent grasses and grass-like species and 10 percent forbs. Dominant grass and grass-like species include little bluestem, western wheatgrass, foxtail barley, inland saltgrass, and slender wheatgrass. Grass and grass-like species of secondary importance include big bluestem, sedge, spikerush, plains bluegrass, prairie cordgrass, and switchgrass. Forbs commonly found in this plant community include Pursh seepweed (*Suaeda calceoliformis*), goldenrod (Solidago), cudweed sagewort (*Artemisia ludoviciana*), silverleaf cinquefoil (*Potentilla argentea*), alkali plantain (*Plantago eriopoda*), Cuman ragweed (*Ambrosia psilostachya*), and annual marshelder (*Iva annua*).

Pathway 1.1A
Community 1.1 to 1.2

Heavy, continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites will shift this community to the 1.2 Little Bluestem-Western Wheatgrass-Foxtail Barley-Inland Saltgrass Plant Community Phase.

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing (possibly including periodic) rest will convert this plant community to the 1.1 Big Bluestem-Indiangrass-Switchgrass Plant Community Phase.

State 2
Degraded State

The Degraded State is characterized by the dominance of the shorter-statured, more saline tolerant species such as foxtail barley and inland saltgrass, an 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/Bareground

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. Tall warm-season grasses are nearly absent, and little bluestem, slender wheatgrass, and western wheatgrass have been greatly reduced and may persist in remnant amounts, reduced in vigor. Bare ground may develop where salt concentrations are highest. A white salt crust may form on the soil surface. The forb component is comprised of salt tolerant species such as Pursh seepweed and silverleaf cinquefoil.

Community 2.2
Annual Pioneer-Pioneer Perennial

This plant community developed under continuous, heavy grazing or other excessive disturbances. The potential plant community is made up of approximately 40 to 80 percent grasses and grass-like species and 20 to 60 percent forbs. The species present in this phase are highly variable but often include non-native invasive and early seral species. Plant diversity is low (plant richness may be high but areas are often dominated by a few species). The ecological processes are difficult to restore because of the loss of plant diversity and overall soil disturbance. Soil erosion is potentially very high because of the bare ground and shallow rooted herbaceous plant community. Water runoff will increase and infiltration will decrease due to animal related soil compaction and loss of root mass due to low plant diversity and vigor. This plant community will require significant economic inputs and time to move towards another plant community. This movement is highly variable in its succession. This is due to the loss of diversity (including the loss of the seed bank), within the existing plant community, and the plant communities on adjacent sites.

Pathway 2.1A
Community 2.1 to 2.2

Heavy, continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites will shift this community to the 2.2 Annual Pioneer-Perennial Pioneer Plant Community Phase.

Pathway 2.2A
Community 2.2 to 2.1

This community pathway occurs with the passage of time as successional processes take place and perennial plants gradually begin to establish on the site again. This pathway will lead to the 2.1 Foxtail Barley-Inland Saltgrass/Bareground Plant Community Phase.

Transition T1A
State 1 to 2

Heavy, continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season and often at the same time of year each year), will likely lead this 1.2 Little Bluestem-Western Wheatgrass-Foxtail Barley-Inland Saltgrass Plant Community Phase within the Reference State (State 1) over a threshold leading to the 2.1 Foxtail Barley-Inland Saltgrass/Bareground Plant Community Phase within the Degraded State (State 2). Grazing repeatedly in the early growing season can expedite this shift by causing mechanical disturbance due to trampling.

Restoration pathway T2A
State 2 to 1

Long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high-density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels possibly including periodic rest), prescribed burning (occurring every 3 to 5 years), and a return to normal disturbance regime levels may lead this plant community phase over a threshold to the Reference State (State 1). Wetland restoration techniques may be necessary to restore biotic integrity and plant diversity and productivity.

Additional community tables

Other information

Ecological Site Correlation Issues and Questions:

• NOTE: At the time this PESD is established there are no soil series in NASIS in the Saline Subirrigated ecological site, but will be in future projects.

• Reference and alternative states within the state and transition model are may not be fully documented and may require additional field sampling for refinement.

Inventory data references

There is no NRCS clipping data and other inventory currently available for this site. Information presented here has been derived using field observations from range-trained personnel. Those involved in developing this site include: Stan Boltz, Range Management Specialist, NRCS; and Bruce Kunze, Soil Scientist, NRCS.

Data Source Sample Period State County
NONE

Other references

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Contributors

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Approval

Suzanne Mayne-Kinney, 2/01/2024

Acknowledgments

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Additional Information Acknowledgment: Jason Hermann (Jason.Hermann@usda.gov), Area Rangeland Management Specialist, USDA-NRCS, Redfield, SD.

This Provisional Ecological Site concept has passed both Quality Control and Quality Assurance processes. Officially approved for publication by David Kraft as of 11/12/2020.

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be

known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	05/15/2024
Approved by	Suzanne Mayne-Kinney
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):

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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

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17. **Perennial plant reproductive capability:**
