Ecological site R053AE071MT
Saline Upland (SU) (Legacy)
RRU 53AE

Last updated: 6/14/2023
Accessed: 04/22/2026

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.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This ecological site occurs on nearly level to moderately sloping fans and terraces in the uplands. It is associated with shale beds and soils have a clay loam to clay surface layer, subsoil, and underlying material. Soils contain salt and/or alkali accumulations and salt-tolerant species dominate the plant community. Slopes are usually less than 8%. Elevations normally vary from 2200 to 4000 feet.

Table 2. Representative physiographic features

Landforms	(1) Terrace (2) Fan (3) Fan apron
Flooding frequency	None
Ponding frequency	None
Elevation	570 – 1,370 m
Slope	0 – 10 %
Aspect	Aspect is not a significant factor

Climatic features

A semi-arid, temperate climate characterizes the Glaciated Plains. The predominance of cool season species has evolved to take advantage of the precipitation regime that peaks in late spring-early summer (June). Seventy-five percent of the annual precipitation usually falls as steady, soaking, frontal system rains. Summer rains usually come with thunderstorms. Precipitation is the most important factor influencing production (Heitschmidt et al 2005). Severe drought occurs on average in two out of every ten years (Cooper, et al., 2001).

Table 3 Representative climatic features

Frost-free period (average)	120 days
Freeze-free period (average)	140 days
Precipitation total (average)	360 mm

Influencing water features

Soil features

These deep, well drained soils formed in alluvium and glacial till. The soils usually contain a 2-3-inch surface layer, a 2-3 inch clay subsoil, and a strongly saline underlying material to a depth of > 60 inches. The surface texture is clay loam or silty clay; subsoil textures are usually clay or silty clay. Permeability is very slow. Salt tolerant plants dominate the site. Soil ph varies from 6.6 – 9.6. This site is characterized by the following taxonomic units: Benz and Nobe.

Table 4. Representative soil features

Surface texture	(1) Clay loam (2) Silty clay (3) Loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Very slow
Soil depth	50 – 150 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	7.62 – 12.7 cm

Calcium carbonate equivalent (0-101.6cm)	0 – 10 %
Electrical conductivity (0-101.6cm)	0 – 20 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	10 – 70
Soil reaction (1:1 water) (0-101.6cm)	6.6 – 9.6
Subsurface fragment volume <=3" (Depth not specified)	Not specified
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

This site developed through time under the influence of climate, geological materials, fire, plants and animals. Research on upland ecological sites consistently shows that precipitation is the principal factor altering productivity (Heitschmidt et al. 2005). The same authors concluded that grazing reduces herbage standing crop, whereas its effects on aboveground net primary production vary with timing of grazing and precipitation events, along with the functional and structural composition of the plant community. Some ecologists believe that these lands may have burned on a natural interval of 10-12 years (Frost 1998). However, environmental characteristics of this site limit herbage production and subsequent fuel accumulation. Therefore, in comparison to normal upland range sites, the role of natural fire is probably less significant in the development of this site. The resultant historic climax plant community (HCPC) is the basis for plant community interpretations. The HCPC has been determined by evaluating rangeland relic areas, and other areas protected from excessive disturbance.

The HCPC is comprised of a mixture of cool and warm season grasses and shrubs. About 70% of the annual production is from grasses and sedges, most of which is produced during the cool season. Forbs and shrubs contribute 5% and 25%, respectively, to total annual production. Total vegetative production averages 500 lbs/ac in normal years, 350 lbs/ac in “unfavorable” years, and 600 lbs/ac in “favorable” years.

This site is moderately resilient to disturbance because soil characteristics limit plant growth. Departures from the HCPC generally result from management actions, drought, and/or a change in the natural fire regime. The site is considered fragile in the sense that vegetative vigor and composition will rapidly decline with continued adverse impacts. With favorable precipitation and/or prescribed grazing treatments, plant communities that are in the high seral state can return to the HCPC. In contrast, significant succession is unusual within early-seral communities.

State and Transition Diagram

Successional pathways of Saline Upland 10-14” p.z. ecological sites cannot be satisfactorily described using traditional theories of plant succession leading to a single climax community (Briske et al. 2005). As the HCPC regresses to an early seral state, it is theorized that a threshold is crossed somewhere within the mid-seral state. Plant communities occurring below this threshold are in a steady state. Succession back to the HCPC does not occur within a reasonable length of time, and/or without a large input of energy.

Two plant communities and the successional pathways that commonly occur within the Reference State (State #1) are shown in the following diagram. The transitions from State #1 to State #2 (Plant Community B) and State #3 (Plant Community C) are also illustrated. Ecological processes are discussed in the plant community descriptions that follow the diagram.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	**Native perennial grasses**			6-392	
	western wheatgrass	PASM	*Pascopyrum smithii*	224-336	–
	alkali sacaton	SPAI	*Sporobolus airoides*	56-112	–
	saltgrass	DISP	*Distichlis spicata*	6-84	–
2	**Native perennial grasses and grasslikes**			6-56	
	Grass, perennial	2GP	*Grass, perennial*	6-11	–
	blue grama	BOGR2	*Bouteloua gracilis*	6-11	–
	threadleaf sedge	CAFI	*Carex filifolia*	6-11	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	6-11	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	6-11	–
	Sandberg bluegrass	POSE	*Poa secunda*	6-11	–
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	6-11	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	6-11	–
Forb					
3	**Native perennial forbs**			6-28	
	Forb, perennial	2FP	*Forb, perennial*	6-11	–
	aster	ASTER	*Aster*	6-11	–
	milkvetch	ASTRA	*Astragalus*	6-11	–
	bastard toadflax	COUM	*Comandra umbellata*	6-11	–
	povertyweed	IVAX	*Iva axillaris*	6-11	–
	spiny phlox	PHHO	*Phlox hoodii*	6-11	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	6-11	–
Shrub/Vine					
4	**Native shrubs and half-shrubs**			1-140	
	greasewood	SAVE4	*Sarcobatus vermiculatus*	84-140	–
	Nuttall's saltbush	ATNU2	*Atriplex nuttallii*	84-140	–
	Shrub, broadleaf	2SB	*Shrub, broadleaf*	1-28	–
	silver sagebrush	ARCA13	*Artemisia cana*	6-28	–
	prairie sagewort	ARFR4	*Artemisia frigida*	6-28	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0-1	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0-1	–

Table 6. Community 1.2 plant community composition

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

Table 7. Community 2.1 plant community composition

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

Table 8. Community 3.1 plant community composition

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

Animal community

Livestock Management The Saline Upland 10-14” p.z. ecological site is suited for livestock grazing. However, prescribed grazing management is needed. Forage production is limited by soil chemistry. Species composition is susceptible to heavy stocking and season long grazing. The cool season medium height grasses are generally selectively grazed giving the short grasses a competitive advantage. Grazing during early spring may also result in soil compaction. Any additional factor reducing infiltration and increasing runoff on this site is a management concern. Shorter grazing periods developed in conjunction with adequate periods of deferment to facilitate regrowth, replenish carbohydrate pools, and accumulate litter on the soil surface are recommended. The Saline Upland 10-14” p.z. ecological site has a short grass component, as do most other sites in the northern mixed prairie. The short grasses usually increase with grazing and decrease with protection or prescribed grazing. However, succession is not guaranteed in the Northern Great Plains. Sampling four-year old ungrazed exclosures and grazed areas with 35% utilization, Vogel and Van Dyne (1966) found essentially the same basal cover of grasses, sedges, forbs, litter and bare soil on protected and grazed sites. They concluded that four years was too short of a time for cover to change significantly. Hofmann and Ries (1989) observed similar results following a four-year study in North Dakota. Even after 41 years of exclosure, changes in species composition can be relatively small when the site is in the dry, low production portion of northern mixed prairie (Brand and Goetz, 1986). They concluded that site characteristics limited the development of potential vegetation with the exclusion of grazing, but the potential impacts of prescribed grazing on succession were not discussed. This ecological site is not as productive as the sites evaluated by Vogel and Van Dyne, Hofmann and Ries, or by Brand and Goetz. Therefore, range managers should recognize the environmental limitations of this site. While a prescribed grazing system is always a good recommendation, it may not guarantee significant succession. Seeding and/or mechanical treatment are not recommended. This ecological site is suited for prescribed grazing by livestock. Because of the terrain and propensity of shrubs, this site may be more compatible for sheep, rather than cattle grazing. Although poisonous plants are not normally a problem, greasewood can cause some livestock losses. Most of the problems develop when livestock are moved onto this site in late summer or early fall. If the livestock are moved into this site from upland sites where forage is mature and limiting, grazing animals often ingest a high quantity of greasewood leaves. This can be dangerous because plants are high in oxalates and can cause bloat or poisoning. However, greasewood and some of the associated species are nutritious, and growing livestock can make good weight gains. Wildlife Interpretations The HCPC associated with this ecological site provides diverse and valuable wildlife habitat. This site often occurs as a mosaic with other ecological sites, thus creating “ecotones” that serve as a magnet to attract many species of wildlife. Antelope and mule deer prefer grazing this site because of the Nuttall saltbush and other shrubs. When this site occurs in the landscape as a mosaic with other sites, thermal and escape cover are provided for many species of wildlife. The lack of species diversity limits the value of the site for some species of wildlife. The bare ground and lack of litter also limits the potential of the site for upland birds and for ground-nesting birds. This ecological site becomes less valuable for deer and antelope when plant diversity declines with regression. For example, the disappearance of either the alkali sacaton or western wheatgrass, and the reduction of Nuttall saltbush would shorten the length of the “green forage” season. The increase of blue grama, hoods phlox etc. is associated with the loss of palatable forbs. These changes also adversely impact foraging opportunities for deer, antelope, upland birds, etc. Because of insufficient vegetative structural diversity, residual grass carry-over and litter cover, the value of Communities B and C for wildlife habitat are greatly reduced. Plant Preferences by Animal Kind Refer to NRCS Field Office Technical Guide, Section IIE, General Information, for tables displaying plant preferences by livestock and wildlife.

Hydrological functions

Water and alkalinity are the main factors limiting vegetative production on this site. Soil components in this ecological site are normally in Hydrologic Group D. These soils have a medium to very high runoff potential, with hydrologic runoff curves of 89 to 80. Field investigations are needed to adjust the runoff curves when plant communities deteriorate from the HCPC. Areas with ground cover less than 50% have the greatest potential for reduced infiltration and higher runoff.

Recreational uses

This site provides hunting opportunities for upland game species. Outdoor enthusiasts may also appreciate the serenity and openness of is site.

Wood products

This site has no significant value for wood products.

Other information

This ecological site is not highly resistant to disturbances. Species diversity is adversely affected by season long continuous grazing and by heavy stocking. Medium height grasses are replaced by short grasses. There is also a shift from predominately herbaceous plants in

State #1 to more woody plants in States #2 and #3. The number of structural/functional groups is reduced with regression from the HCPC. The amount of solar energy that is captured and converted to carbohydrates for plant growth is reduced in States #2 and #3. A reduction in total vegetative growth results in less potential vegetation that can be transformed into litter. Litter reductions result in less infiltration, and more runoff and soil erosion.

Inventory data references

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Approval

Kirt Walstad, 6/14/2023

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	03/30/2005
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Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills: Rills should not be present in HCPC. On slopes at or > 8%, in plant community A, rills would be visible, ½ inch deep or more, linear, rarely exceeding 1 foot in length. Distance between rills is irregular.**

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2. **Presence of water flow patterns: Water flow patterns should not be present in HCPC. On slopes at or > 8%, in plant community A, water flow patterns would be visible as long (more than 1feet) and continuous across the landscape.**

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3. **Number and height of erosional pedestals or terracettes: Pedestals or terracettes would essentially be nonexistent in HCPC. On slopes at or than 8%, if in plant community A, pedestals and terracettes are frequent and ½ - ¾ inch above the soil surface.**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground): 40-50% of the soil surface could be bare in HCPC. If in plant community A, 45-60% of the soil surface can be exposed.**

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5. **Number of gullies and erosion associated with gullies: Gullies are not evident in any of the State 1 reference plant communities.**

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6. **Extent of wind scoured, blowouts and/or depositional areas: Wind scoured, blowouts and/or depositional areas are not evident in any of the State 1 reference plant communities.**

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7. **Amount of litter movement (describe size and distance expected to travel): Litter movement is not expected with HCPC. On slopes > 8%, in plant community A, litter, both fine and coarse, movement is visible, into depressions or natural obstacles.**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values): Stability class anticipated to be 4 or 5 under plant canopy. In all State 1 reference plant communities, soil stability class is expected to be 2 or 3 from the large interspaces.**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness): The surface layer is usually 0-2” deep and typically have clay loam and silty clay. Surface color is light brownish gray. Soil organic matter ranges from 0.5-2%.**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** In HCPC,, 40-50% plant canopy and 30-50% basal cover with small gaps between plants should reduce raindrop impact and slow overland flow, providing increased time for infiltration to occur. Healthy, deep rooted native grasses enhance infiltration and reduce runoff. Infiltration rate is very slow. If in plant community A, 20-30% plant canopy and 30-40% basal cover with large gaps between plants, amplifies raindrop impact and increases overland flow. The site tends to be more xeric as runoff increases. Because of the high sodium content, exposed soil can develop a hard crust as the sodium disperses the soil particles.

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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):** No compaction layer should be evident in any of the State 1 plant communities. Restrictive, very hard claypan begins at 4 - 6 inches.

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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: HCPC: Mid-stature, cool season rhizomatous grasses> mid stature, warm season bunch grasses> short warm season rhizomatous grasses > shrubs > forbs. Plant community A: Mid-stature, cool season rhizomatous grasses> short warm season rhizomatous grasses > mid stature, warm season bunch grasses > shrubs > forbs.

    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):** Plant mortality and decadence very low in HCPC and Plant community A. In periods of drought, shrubs would exhibit decadence in the state 1 reference communities

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14. **Average percent litter cover (%) and depth (in):** Litter cover is in contact with soil surface. Litter decreases in Plant community A to 30-40% and depth is immeasurable.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 350 - 600 #/acre.

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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:** Blue grama, inland saltgrass, bottlebrush squirreltail, poverty weed, knotweeds, plains prickly pear, broom snakeweed, greasewood.

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17. **Perennial plant reproductive capability: All species have a somewhat restricted ability to reproduce in HCPC. In Plant community A, plant seedlings will be weighed in favor of marginal and undesirable species. Replacement of desirable species will be very few.**