USDA Natural Resources
Conservation Service

Ecological site R052XN170MT
Saline Upland (SU) 10-14" p.z.

Last updated: 1/24/2024
Accessed: 05/12/2025

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): 052X–Brown Glaciated Plains

The Brown Glaciated Plains, MLRA 52, is an expansive, agriculturally and ecologically significant area. It consists of approximately 14.5 million acres and stretches across 350 miles from east to west, encompassing portions of 15 counties in north-central Montana. This region represents the southwestern limit of the Laurentide Ice Sheet and is considered to be the driest and westernmost area within the vast network of glacially derived prairie pothole landforms of the northern Great Plains. Elevation ranges from 2,000 feet (610 meters) to 4,600 feet (1,400 meters).

Soils are primarily Mollisols, but Entisols, Inceptisols, Alfisols, and Vertisols are also common. Till from continental glaciation is the predominant parent material, but alluvium and bedrock are also common. Till deposits are typically less than 50 feet thick, and in some areas glacially deformed bedrock occurs at or near the soil surface (Soller, 2001). Underlying sedimentary bedrock largely consisting of Cretaceous shale, sandstone, and mudstone (Vuke et al., 2007) is commonly exposed on hillslopes, particularly along drainageways. Significant alluvial deposits occur along glacial outwash channels and major drainages, including portions of the Missouri, Teton, Marias, Milk, and Frenchman Rivers. Large glacial lakes, particularly in the western half of the MLRA, deposited clayey and silty lacustrine sediments (Fullerton et al., 2013).

Much of the western portion of this MLRA was glaciated towards the end of the Wisconsin age, with the maximum glacial extent occurring approximately 20,000 years ago (Fullerton et al., 2004). The result is a geologically young landscape that is predominantly a level till plain interspersed with lake plains and dominated by soils in the Mollisol and Vertisol orders. These soils are very productive and generally are well suited to dryland farming. Much of this area is aridic-ustic. Crop-fallow dryland wheat farming is the predominant land use. Areas of rangeland typically are on steep hillslopes along drainages.

The rangeland, much of which is native mixedgrass prairie, increases in abundance in the eastern half of the MLRA. The Wisconsin-age till in the north-central part of this area typically formed large disintegration moraines with steep slopes and numerous poorly drained potholes. A large portion of Wisconsin-age till occurring on level terrain that would typically be optimal for farming has large amounts of less-suitable sodium-affected Natrustalfs. Significant portions of Blaine, Phillips, and Valley Counties were glaciated approximately 150,000 years ago during the Illinoisan age. Due to erosion and dissection of the landscape, many of these areas have steeper slopes and more exposed bedrock than areas glaciated during the Wisconsin age (Fullerton and Colton, 1986).

While much of the rangeland in the aridic-ustic portion of MLRA 52 is classified as belonging to the “dry grassland” climatic zone, sites in portions of southern MLRA 52 may belong to the “dry shrubland” climatic zone. The dry shrubland zone represents the northernmost extent of the big sagebrush (Artemisia tridentata) steppe on the Great Plains. Because similar soils occur in both southern and northern portions of the MLRA, it is currently hypothesized that climate is the primary driving factor affecting big sagebrush distribution in this area. However, the precise factors are not yet fully understood.

Sizeable tracts of largely unbroken rangeland in the eastern half of the MLRA and adjacent southern Saskatchewan are home to the northern Montana population of greater sage grouse (Centrocercus urophasianus), and large portions of this area are considered to be a Priority Area for Conservation (PAC) by the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service, 2013). This population is unique among sage grouse populations in the fact that many individuals overwinter in the big sagebrush steppe (dry shrubland) in the southern portion of the MLRA and then migrate to the northern portion of the MLRA, which lacks big sagebrush (dry grassland), to live the rest of the year (Smith, 2013).

Areas of the till plain near the Bearpaw and Highwood Mountains as well as the Sweetgrass Hills and Rocky Mountain foothills are at higher elevations, receive higher amounts of precipitation, and have a typic-ustic moisture regime. These areas have significantly more rangeland production than the drier aridic-ustic portions of the MLRA and have enough moisture to produce crops annually rather than just bi-annually, as in the drier areas. Ecological sites in this higher precipitation area are classified as the moist grassland climatic zone.

Classification relationships

NRCS Soil Geography Hierarchy
• Land Resource Region: Northern Great Plains
• Major Land Resource Area (MLRA): 052 Brown Glaciated Plains
• Climate Zone: Dry Shrubland

National Hierarchical Framework of Ecological Units (Cleland et al., 1997; McNab et al., 2007)
• Domain: Dry
• Division: Temperate Steppe
• Province: Great Plains-Palouse Dry Steppe Province 331
• Section: Northwestern Glaciated Plains 331D
• Subsection: Montana Glaciated Plains 331Dh
• Landtype Association/Landtype Phase: N/A

National Vegetation Classification Standard (Federal Geographic Data Committee, 2008)
• Class: Xeromorphic Woodland, Scrub and Herb Vegetation Class (3)
• Subclass: Cool Semi-Desert Scrub and Grassland Subclass (3.B)
• Formation: Cool Semi-Desert Scrub and Grassland Formation (3.B.1)
• Division: Cool Semi-Desert Scrub and Grassland Division (3.B.1.Ne)
• Macrogroup: Artemisia tridentata - Artemisia tripartita ssp. tripartita - Purshia tridentata Steppe and Shrubland Macrogroup (3.B.1.Ne.3)
• Group: Artemisia tridentata ssp. wyomingensis - Artemisia tridentata ssp. tridentata Steppe and Shrubland Group (3.B.1.Ne.3.a)
• Alliance: Artemisia tridentata ssp. wyomingensis Dry Steppe and Shrubland Alliance
• Association: No existing correlation

EPA Ecoregions
• Level 1: Great Plains (9)
• Level 2: West-Central Semi-Arid Prairies (9.3)
• Level 3: Northwestern Glaciated Plains (42)
• Level 4: North-Central Brown Glaciated Plains (42o) and Glaciated Northern Grasslands (42j)

Ecological site concept

This provisional ecological site occurs on fans, fan aprons, and terraces where salts have accumulated.

The distinguishing characteristic of this site is that soils contain less than 35 percent clay in the upper 4 inches and that saline, sodic, or saline-sodic conditions are evident in the upper 20 inches of soil. Soils for this ecological site are typically very deep (more than 60 inches) and derived from fine-loamy alluvium or outwash deposits. Soil textures in the upper 4 inches are typically loam, clay loam, silt loam, or silty clay loam. Soils typically have an ochric epipedon. Characteristic vegetation is western wheatgrass (Pascopyrum smithii), alkali sacaton (Sporobolus airoides), and Nuttall's saltbush (Atriplex nuttallii).

Associated sites

R052XN162MT	**Clayey (Cy) 10-14" p.z.** soils >20 inches in depth, higher production, and no hardpan, different species composition
R052XN176MT	**Shallow to Gravel (SwGr) 10-14" p.z.** similar position in landscape, soils with depth restriction that limits available moisture, soils 10-20” deep to sands or loamy sands
R052XN179MT	**Shallow Clay (SwC) 10-14" p.z.** soils 10-20” deep to bedrock’ soils are clayey over clayey shale
R052XN086MT	**Claypan (Cp) 10-14" p.z.** has 2-8” of soil over the hard argillic layer, less bare ground, and higher production
R052XN172MT	**Dense Clay (DC) 10-14" p.z.** has a hard restrictive layer in the soil at or near the surface, salt tolerant plants may be present but are rarely dominant

Similar sites

R052XC210MT	**Saline Upland (SU) 10-14" p.z.** Same concept change in species in a different LRU.
R053AE071MT	**Saline Upland (SU) (Legacy) RRU 53AE** Same concept change in species in a different MLRA.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex nuttallii* (2) *Sarcobatus vermiculatus*
Herbaceous	(1) *Pascopyrum smithii* (2) *Sporobolus airoides*

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
Runoff class	Medium to very high
Flooding frequency	None
Ponding frequency	None
Elevation	671–1,219 m
Slope	0–8%
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding frequency	Not specified

Ponding frequency	Not specified
Elevation	572–1,372 m
Slope	Not specified

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 4. Representative climatic features

Frost-free period (characteristic range)	85-123 days
Freeze-free period (characteristic range)	116-142 days
Precipitation total (characteristic range)	254-356 mm
Frost-free period (average)	94 days
Freeze-free period (average)	125 days
Precipitation total (average)	305 mm

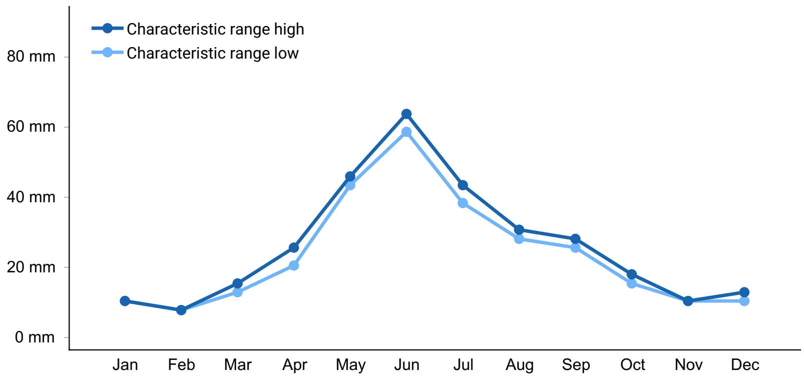


Figure 1. Monthly precipitation range

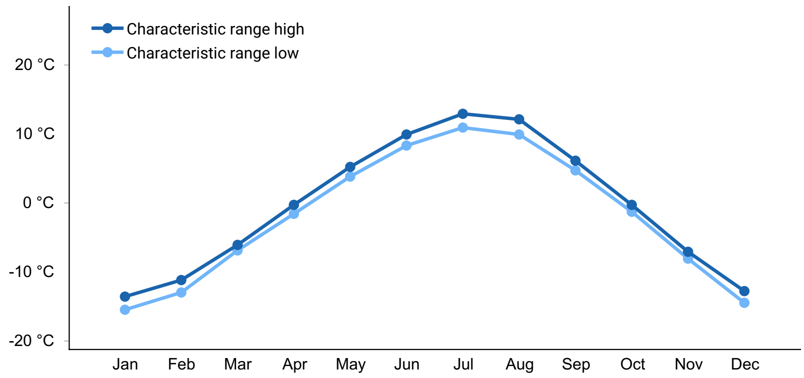


Figure 2. Monthly minimum temperature range

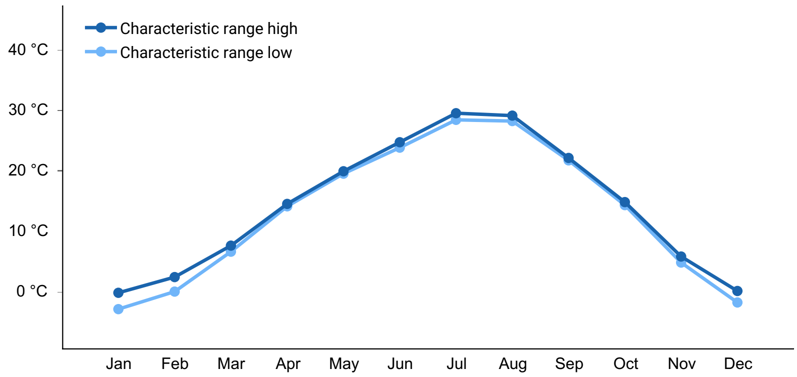


Figure 3. Monthly maximum temperature range

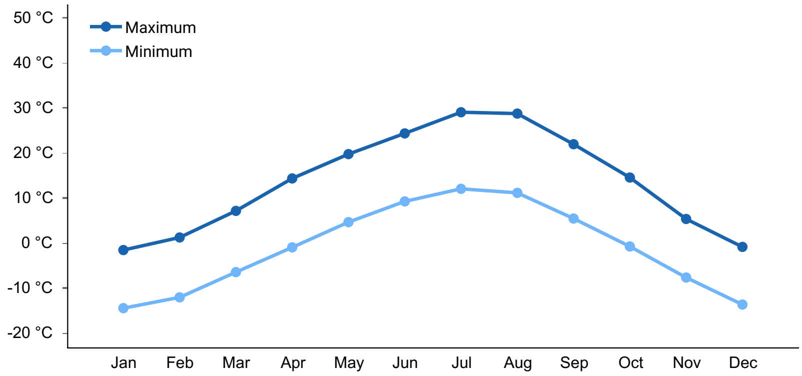


Figure 4. Monthly average minimum and maximum temperature

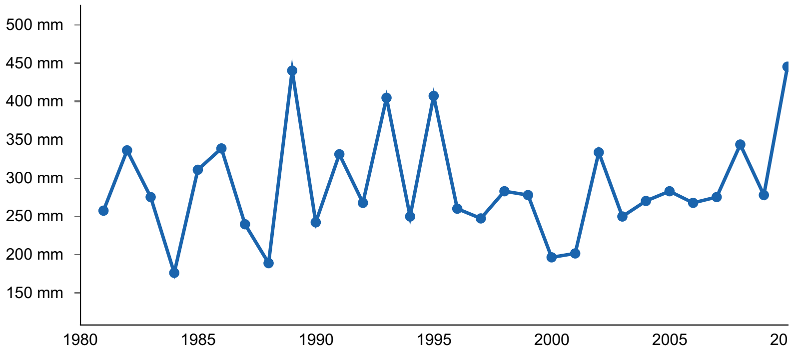


Figure 5. Annual precipitation pattern

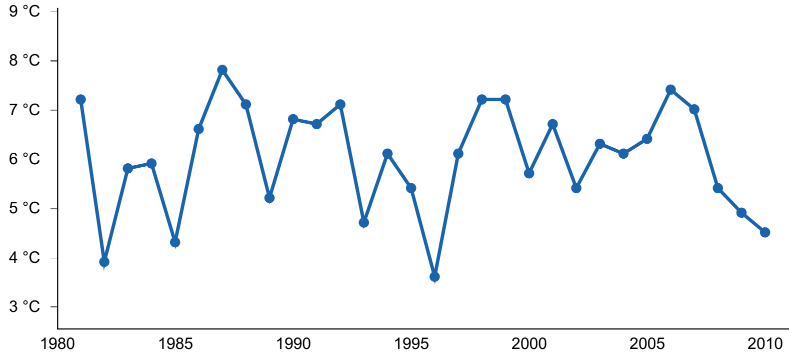


Figure 6. Annual average temperature pattern

Climate stations used

- (1) CHESTER [USC00241692], Chester, MT
- (2) GLASGOW [USW00094008], Glasgow, MT
- (3) HAVRE CITY CO AP [USW00094012], Havre, MT

- (4) SHELBY [USC00247500], Shelby, MT

Influencing water features

This site is not influenced by water from streams.

Wetland description

This site is not influenced by water from wetlands.

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 – 9.0. This site is characterized by the following taxonomic units: Benz and Nobe.

Table 5. Representative soil features

Parent material	(1) Alluvium (2) Glaciofluvial deposits–shale
Surface texture	(1) Clay loam (2) Silty clay (3) Loam
Family particle size	(1) Fine
Drainage class	Well drained
Permeability class	Very slow
Soil depth	51–198 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	7.62–12.7 cm
Calcium carbonate equivalent (Depth not specified)	0–10%
Electrical conductivity (Depth not specified)	4–16 mmhos/cm
Sodium adsorption ratio (Depth not specified)	10–70
Soil reaction (1:1 water) (Depth not specified)	6.6–9.6
Subsurface fragment volume <=3" (Depth not specified)	0–1%
Subsurface fragment volume >3" (Depth not specified)	0–1%

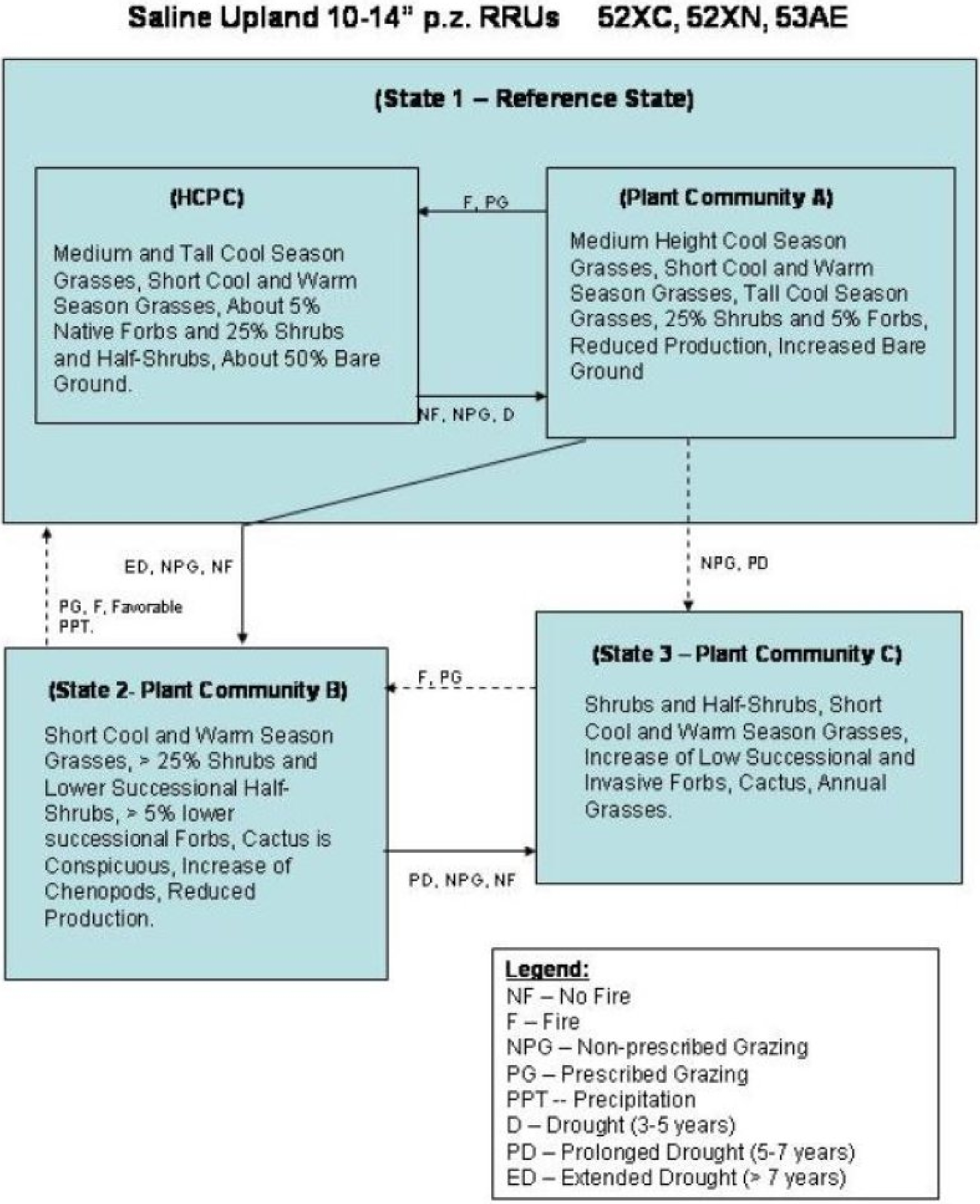
Ecological dynamics

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



State 1
Reference State

Community 1.1
Historic Climax Plant Community (HCPC) Medium and tall cool-season grasses, short cool-

and warm-season grasses, about 5 percent native fors and 25 percent shrubs and half-shrubs, about 50 percent bare ground.

Medium and tall cool-season grasses, short cool- and warm-season grasses, about 5 percent native fors and 25 percent shrubs and half-shrubs, about 50 percent bare ground. The cool season western wheatgrass and warm season alkali sacaton are the dominant plants on this ecological site. They account for about 60% of the total annual production in the HCPC. Drought and non-prescribed grazing reduces the competitiveness of the dominant species, and allows lower successional grasses (Nuttall's alkali grass, inland saltgrass, plains reedgrass, blue grama and prairie junegrass) to increase on the site. About 10% of the total production is composed of a mix of warm and cool season short grasses and sedges. Forbs contribute about 5% of the total annual production. Poverty sumpweed, onion, hoods phlox, scarlet globemallow, wooly plantain, and biscuitroot are common forbs. The latter group contains a mix of warm and cool season species whose relative occurrence on the site is largely influenced by the timing and amount of precipitation. Nuttall saltbush and greasewood are two common shrubs on this site. Both species make most of their growth during the cool part of the growing season. While Nuttall saltbush is rated a valuable forage plant for livestock and wildlife, greasewood can be poisonous in some situations. Pricklypear cactus and fringed sagewort (a warm season half-shrub) can occur in the HCPC. Shrubs normally make up about 25% of the total annual production. Broom snakeweed, annual bromes, and annual forbs are not a part of the HCPC. Their presence indicates possible ecological deterioration, or downward trend. Trend is difficult to interpret because large areas of bare ground between plants are fairly common. Total annual production averages 500 lbs/ac during normal years. However, production declines as the site regresses from the HCPC to lower successional communities. Regression may result from grazing management strategies that do not allow adequate recovery periods between grazing events, drought, and/or the disruption of the normal fire sequence. The above disturbances favor the replacement of alkali sacaton and western wheatgrass by blue grama, sandberg bluegrass, prairie junegrass, poverty weed, hairy golden aster, and hoods phlox. Nuttall saltbush may also be replaced by broom snakeweed, fringed sagewort, etc. Cheatgrass and Japanese brome may invade the site. As the result of these vegetative changes, there is less litter to protect the soil and less infiltration. Hydrologic cycles are impaired when plant communities are unable to effectively use precipitation. Plant cover (litter and canopy of grasses, forbs and shrubs) is from 40-50%. Basal cover varies from 7-15%. Litter varies from 20-30%. Consequently, bare ground averages 50%. Thus, infiltration rates are lower, and runoff and erosion are higher than desired on this ecological site. Runoff and soil erosion normally increase as the HCPC regresses to earlier seral states. The major plant species composition and production by dry weight are shown for the HCPC in the following table. Total annual production has been derived from several sources, and has been adjusted to represent a typical annual moisture cycle.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	275	392	471
Shrub/Vine	95	140	168
Forb	22	28	34
Total	**392**	**560**	**673**

Table 7. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0%
Grass/grasslike foliar cover	0%
Forb foliar cover	0%
Non-vascular plants	0-1%
Biological crusts	0-1%
Litter	20-30%
Surface fragments >0.25" and <=3"	0-1%
Surface fragments >3"	0-1%
Bedrock	0%

Water	0%
Bare ground	50-60%

Table 8. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	1-5%
Grass/grasslike basal cover	5-10%
Forb basal cover	1-2%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 9. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-1%	0-20%	0-25%
>0.15 <= 0.3	–	0-40%	0-50%	0-50%
>0.3 <= 0.6	–	0-50%	0-25%	0-25%
>0.6 <= 1.4	–	0-10%	0-5%	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Community 1.2
Plant Community A Medium-height cool-season grasses, short cool- and warm-season grasses, tall cool-season grasses, 25 percent shrubs and 5 percent forbs, reduced production, increased bare ground.

Medium-height cool-season grasses, short cool- and warm-season grasses, tall cool-season grasses, 25 percent shrubs and 5 percent forbs, reduced production, increased bare ground. Non-prescribed grazing and drought reduce plant height and plant litter. Surface runoff and soil temperature increases, infiltration decreases, and shallow-rooted short grasses (sandberg bluegrass, blue grama, and prairie junegrass) and sedges gain a competitive advantage over medium height, deep-rooted cool)season perennial grasses (alkali sacaton and western wheatgrass). They are able to compete more successfully with the mid-grasses because of the ability of relatively shallow root systems to utilize shallowly penetrating moisture, characteristic of this site. In contrast to the HCPC, total annual production is 60-80% of potential production (400 vs. 500 lbs/ac). Western wheatgrass and alkali sacaton contribute less than 50% of the annual production. They are less vigorous and individual plant growth is reduced from what it is in the HCPC. Production of the short grasses increases relative to their percentage contribution in the HCPC. Although a few annual forbs are present on disturbed areas, the forb component continues to contribute about 5% of the total annual production. Total shrub production remained at about 25%; however, production of fringed sagewort increased at the expense of Nuttall saltbush and greasewood. Plant community A is called the "pre-threshold community". It is critical that this community be recognized and strategies implemented to prevent further regression. Compared to the HCPC, water flow patterns are more numerous than expected, there is slight to moderate active pedestalling, there is more bare ground than expected, there is moderate movement of smaller size litter deposits into depressions or against obstructions, infiltration is slightly to moderately affected by the shift toward more short grasses in the plant community, and the reproductive capability of alkali sacaton and western wheatgrass is somewhat limited relative to recent climatic conditions(USDI and USDA 2000). Although Community A can improve to the HCPC through successional processes, further disturbance will result in regression to a lower state. Once Community A regresses to a lower state, normal successional processes are restricted.

Pathway 1.1A
Community 1.1 to 1.2

No fire, non-prescribed grazing, drought (3 to 5 years) Non-prescribed grazing, drought and/or a cessation of the natural fire regime will cause regression from HCPC to Community A.

Pathway 1.2A
Community 1.2 to 1.1

Fire, prescribed grazing Favorable growing conditions, the implementation of prescribed grazing, or periodic fire will move Plant Community A to the HCPC. This succession is possible within a couple of years.

State 2
Degraded State

Community 2.1
Plant Community B Short cool- and warm-season grasses, greater than 25 percent shrubs and lower successional half-shrubs, greater than 5 percent lower successional forbs, cactus is conspicuous, increase of chenopods, reduced production.

Short cool- and warm-season grasses, greater than 25 percent shrubs and lower successional half-shrubs, greater than 5 percent lower successional forbs, cactus is conspicuous, increase of chenopods, reduced production. This Community is dominated by a mix of cool and warm season short grasses. Blue grama, threadleaf sedge, sandberg bluegrass and other low successional grasses expanded their influence in the community by replacing most of the alkali sacaton and western wheatgrass. A few "stunted" western wheatgrass plants persist in this community. Poverty weed, hoods phlox, and other low successional forbs contribute more than 5% of the total annual production. The density of fringed sagewort and broom snakeweed (warm season half-shrubs) increase relative to their presence in the State 1 Communities. Pricklypear cactus is usually conspicuous in this community. Total annual production averages 300 lbs/ac. In comparison to the HCPC, total plant basal cover averages about 10%. Litter varies from 10-15%. Bare ground increases to more than 60%. Thus, pedestalling, rills, flow patterns and litter deposits are visible.

State 3
Invaded State

Community 3.1
Plant Community C Shrubs and half-shrubs, short cool- and warm-season grasses, increase of low successional and invasive forbs, cactus, annual grasses.

Shrubs and half-shrubs, short cool- and warm-season grasses, increase of low successional and invasive forbs, cactus, annual grasses. Plant Community C is dominated by Nuttall saltbush, greasewood, fringed sagewort, and broom snakeweed. There has been a significant reduction in percentage of western wheatgrass. The remaining wheatgrasses produce few seed heads and lack vigor. Inland saltgrass, sandberg bluegrass, blue grama and other low-successional grasses and sedges contribute about 50% of the total annual production. Annual bromes and pricklypear cactus are conspicuous in the community. An increase in chenopod species is possible, but not enough sites have been inventoried to be certain. Total annual production averaged 200 lbs/ac, a 33% reduction from Community B. Litter cover averages about 10%. Water flow patterns are numerous and there is moderately active pedestalling. Bare ground is moderately to much higher than expected. Compared to the HCPC, there has been a structural shift from medium height to short grasses, and a functional shift from cool to warm season plants, and an increase in shrub species. Reproductive capability of cool season plants is greatly reduced relative to recent climatic conditions.

Transition T1A
State 1 to 2

Extended drought (greater than 7 years), non-prescribed grazing, no fire Plant Community A will regress to Community B (State 2) under non-prescribed grazing, prolonged drought, or following periodic wildfire (which would reduce competitiveness of shrubs). Regression rates vary with the intensity and frequency of the disturbances. Severe drought may cause retrogression within a couple years.

Transition T1B
State 1 to 3

Non-prescribed grazing, prolonged drought (5 to 7 years) It is theorized that Community A may also regress to Plant Community C under non-prescribed grazing and an extended period lacking a natural fire regime. The absence of fire would allow the shrubs to remain competitive against the short grasses. This transition is shown with a dashed arrow in the state and transition model. Regression rates vary with the intensity and frequency of the disturbances. Severe drought may cause retrogression within a couple years.

Restoration pathway R2A
State 2 to 1

Prescribed grazing, fire, favorable precipitation Plant community B is not noted for its resiliency. Plant Community B is a steady state and significant succession is not expected to occur. However, succession to State 1 may be possible with the combination of prescribed grazing and a prolonged period of favorable moisture. This potential succession is indicated by a dashed line in the state and transition diagram.

Transition T2A
State 2 to 3

Prolonged drought (5 to 7 years), non-prescribed grazing, no fire Community B is much less resistant to disturbance than Community A. Lower production, lower vegetative cover, less litter, and increased bare ground increases Community Bs susceptibility to disturbance. Extended drought and non-prescribed grazing can cause regression to State 3 (Community C).

Restoration pathway R3A
State 3 to 2

Fire, prescribed grazing Community C is resistant to significant succession. It is theorized that another threshold separates Communities B and C. Blue grama and the other short grasses and sedges form a competitive community. The adverse soil conditions characteristic of this site, and a theorized shortage of wheatgrass and alkali sacaton seeds in the seed bank greatly restrict potential for significant succession. Succession is not expected to occur within a reasonable length of time. However, succession may be possible with the combination of fire to reduce shrub competition, prescribed grazing to allow preferred species the opportunity to regain vigor and set seed, and a prolonged period of favorable precipitation. This potential succession is indicated by a dashed line in the state and transition diagram. Mechanical treatments and range seeding are not normally recommended on this site. Ecological processes will be adversely affected by poorly planned range improvement efforts.

Additional community tables

Table 10. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrasses**			224–336	
	western wheatgrass	PASM	*Pascopyrum smithii*	224–336	–
2	**Warm-season Grasses**			56–196	
	alkali sacaton	SPAI	*Sporobolus airoides*	56–112	–
	saltgrass	DISP	*Distichlis spicata*	6–84	–
3	**Miscellaneous Grasses**			6–56	
	Sandberg bluegrass	POSE	*Poa secunda*	56–112	–
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	6–28	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	6–28	–
	Grass, native	2GN	*Grass, native*	6–28	–
	blue grama	BOGR2	*Bouteloua gracilis*	6–28	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	6–28	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	6–28	–
	threadleaf sedge	CAFI	*Carex filifolia*	6–28	–
Forb					
4	**Forbs**			22–34	
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	6–28	–
	aster	ASTER	*Aster*	6–28	–
	povertyweed	IVAX	*Iva axillaris*	6–28	–
	bastard toadflax	COUM	*Comandra umbellata*	6–28	–
	milkvetch	ASTRA	*Astragalus*	6–28	–
	spiny phlox	PHHO	*Phlox hoodii*	6–28	–
	Forb, native	2FN	*Forb, native*	6–28	–
Shrub/Vine					
5	**Dominant Shrubs**			84–140	
	Nuttall's saltbush	ATNU2	*Atriplex nuttallii*	84–140	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	84–140	–
6	**Miscellaneous Shrubs**			0–140	
	silver sagebrush	ARCA13	*Artemisia cana*	6–28	–
	prairie sagewort	ARFR4	*Artemisia frigida*	6–28	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–28	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–1	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–1	–

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 predominantly 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

Data Source Number of Records Sample Period State County
SCS-Range-417
ECS-1
Modified Double Sampling
Ross, R. L. and H. E. Hunter. 1976. Climax vegetation of Montana. USDA Soil Conservation Service. Bozeman, MT.
USDA-SCS-MT 1981 Technical Range Site Description

Other references

Brand, M.D. and H. Goetz. 1986. Vegetation of exclosures in Southwestern North Dakota. J. Range Manage. 39:434-437.
Briske, D. D., S. D. Fuhlendorf, and F. E. Smeins, 2005. State-and-transition models, thresholds, and rangeland health: a synthesis of ecological concepts and perspectives.
Rangeland Ecol. Manage 58:1-10.
Frost, C. C. 1998. Presettlement fire frequency regimes of the United States: a first approximation. Pages 70-81. in Teresa L. Pruden and Leonard A. Brennan (eds.). Fire in ecosystem management: shifting paradigm from suppression to prescription. Tall Timbers Fire Ecology Conference Proceedings. No. 20. Tall Timbers Research Station, Tallahassee, FL.
Heitschmidt, R. K., K. D. Klement, and M. R. Haferkamp. 2005. Interactive effects of drought and grazing on Northern Great Plains rangelands. Rangeland Ecol. Manage. 58:11-19.
Hofmann, L. and R.E. Ries. 1989. Animal performance and plant production from continuously grazed cool-season reclaimed and native pastures. J. Range Manage. 42:248-251.
U.S. Department of Interior and U.S. Department of Agriculture. 2000. Interpreting indicators of rangeland health. Tech. Ref. 1734-6.
Vogel, W.G. and G.M. Van Dyne. 1966. Vegetation responses to grazing management on a foothill sheep range. J. Range Manage. 19:80-85.

Contributors

Kirt Walstad

Approval

Kirt Walstad, 1/24/2024

Acknowledgments

Site Description Revisions
The 2005 Saline Upland 10-14” p.z. ecological site description replaces earlier dated versions of the Saline Upland 10-14” p.z. description in Rangeland Resource Unit 52XN.
This 2005 revision incorporates the State and Transition Model theory, additional data on site productivity, and an improved understanding of many rangeland health indicators.
Site Description Approval
This ecological site description is approved with the understanding that it is no more than another step in our

continual effort to update the NRCS technical guide. In order to facilitate the process, NRCS field personnel are encouraged to forward existing information and/or new data that can be used to improve the utility of this site description. Please forward the information and data to the State Rangeland Management Specialist.
Authors Date Approval Date
Dr. John Lacey 02/28/2005 Loretta J. Metz 03/19/2005
Maxine Rasmussen, Area RMS, Glasgow, MT
Jon Siddoway, Area RMS, Great Falls, MT
Rick Bandy, Area RSS, Great Falls, MT
Greg Snell, Area RSS, Glasgow, MT

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)	Siddoway/Bandy
Contact for lead author	Great Falls Area Office, Great Falls, MT Reference site used? No
Date	04/19/2005
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Slopes are between 0 – 8%, generally, and bare ground will be 50-60%, so past and current rill activity is expected on this site after rain storms or following melting of adequate snow depths within a short time period.

2. **Presence of water flow patterns:** Because the soil surface is not well covered and slopes greater than zero are common on this site there will be evidence of water flow patterns. Sodium & salt content in these soils restricts water intake into the soil.

3. **Number and height of erosional pedestals or terracettes:** Where there is adequate slope and unsheltered distance, pedestals and terracettes will be shallower towards the top of the slope and deeper towards the bottom of the slope.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground will be 50 – 60% across this site.

5. **Number of gullies and erosion associated with gullies:** Past gully erosion may be evident on this site. Active gullies should not be present, but can occur after severe storms.

6. **Extent of wind scoured, blowouts and/or depositional areas:** These areas will be rare on this site.

---

7. **Amount of litter movement (describe size and distance expected to travel):** Litter movement may move over extensive distances relative to other sites due to the presence of larger areas of bare ground. Size of the litter would reflect the more common plant tissue (leaves & reproductive culms) in the reference state – mainly western wheatgrass.

---

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Areas under plant canopies and areas of bare soil on this site will have values between 1 and 4.

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface structure is platy to blocky; A horizon depth is 1 – 3".

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Even with the dominance of taller, deeper-rooted bunchgrasses infiltration on this site is restricted due to the presence of sodium in the soil and the extensive bare ground, so runoff will be more common on this site with more moderate storm events.

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** Will not be present generally, but there may be areas that have "healed" from former bison trails and wallows as well as from more current livestock trailing, which will have a compaction layer below the soil surface.

---

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: Cool season, rhizomatous grasses (Western wheatgrass) > shrubs >warm season taller bunchgrasses (alkali sacaton) = cool season, taller bunchgrasses (Nuttall alkaligrass) > warm season rhizomatous grasses (inland saltgrass) > perennial forbs.

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Will be low for all functional groups in a given year. Prolonged droughts which last more than 2 years may show increases in mortality and decadence for all plant groups.

---

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):** 300 - 700 #/acre. This would be the expected production for the reference state during adequate moisture years. 500 pounds would be the expected production in a 12 inch precipitation zone.

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:** Foxtail barley, kochia, a variety of annual or biennial weedy forbs.

17. **Perennial plant reproductive capability:** Due to the soil restrictions on this site, seed production can be unpredictable. Bunchgrasses will generally produce seeds in good moisture years, however the cool & warm season rhizomatous grasses may not necessarily produce seed even with adequate moisture.