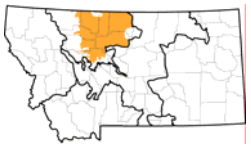
UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

ECOLOGICAL SITE DESCRIPTION



ECOLOGICAL SITE CHARACTERISTICS

Site Type: Rangeland

Site Name: Saline Upland10-14 inch, p.z. (precipitation zone)

Site ID: R052XN170MT

Major Land Resource Area: 52XN —Northern Glaciated Plains

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.

Land Forms:
(1) terrace
(2) fan
(3) fan apron

	Minimum	Maximum
Elevation (feet):	1875	4500
Slope (percent):	0	8

Water Table Depth (inches):

Flooding:

Frequency: none
Duration: none

Ponding:

Depth (inches): none
Frequency: none
Duration: none

Runoff Class: medium to very high

Aspect: occurs on all aspects

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).

	Minimum	Maximum
Frost-free period (days):	85	123
>32F, 90% probability = Minimum 50% probability = Maximum		
Freeze-free period (days):	116	142
>28F, 90% probability = Minimum 50% probability = Maximum		
Mean annual precipitation (inches):	10	14

Climate Stations:
(1) #241088 - Breddete
(2) #241692 - Chester
(3) #243558 - Glasgow AP
(4) #243996 – Havre WSOAP
(5) #245572 - Medicine Lake
(6) #247500 - Shelby

Influencing Water Features

This site is not influenced by water from wetlands or streams.

Representative 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.

Predominant Parent Materials:
Kind: alluvium
Origin: glaciofluvial deposits or semi-consolidated shale

Surface Texture:
(1) clay loam
(2) silty clay
(3) loam

Surface Texture Modifier: none
Subsurface Texture Group: clayey
Surface Fragments < = 3" (% cover): 0
Surface Fragments >3" (% cover): 0
Subsurface Fragments < = 3" (% Volume): 0-T
Subsurface Fragments > 3" (% Volume): 0-T

Drainage Class: Well
Permeability Class: Very slow

	Minimum	Maximum
Depth (inches):	>20	>60
Electrical Conductivity (mmhos/cm):	4	>16
Sodium Adsorption Ratio:	10	70
Calcium Carbonate Equivalent (percent):	0	10
Soil Reaction (1:1 Water):	6.6	9.6
Soil Reaction (0.1M CaC12):	---	---
Available Water Capacity (inches):	3	5

Plant Communities

Ecological Dynamics of the Site

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.

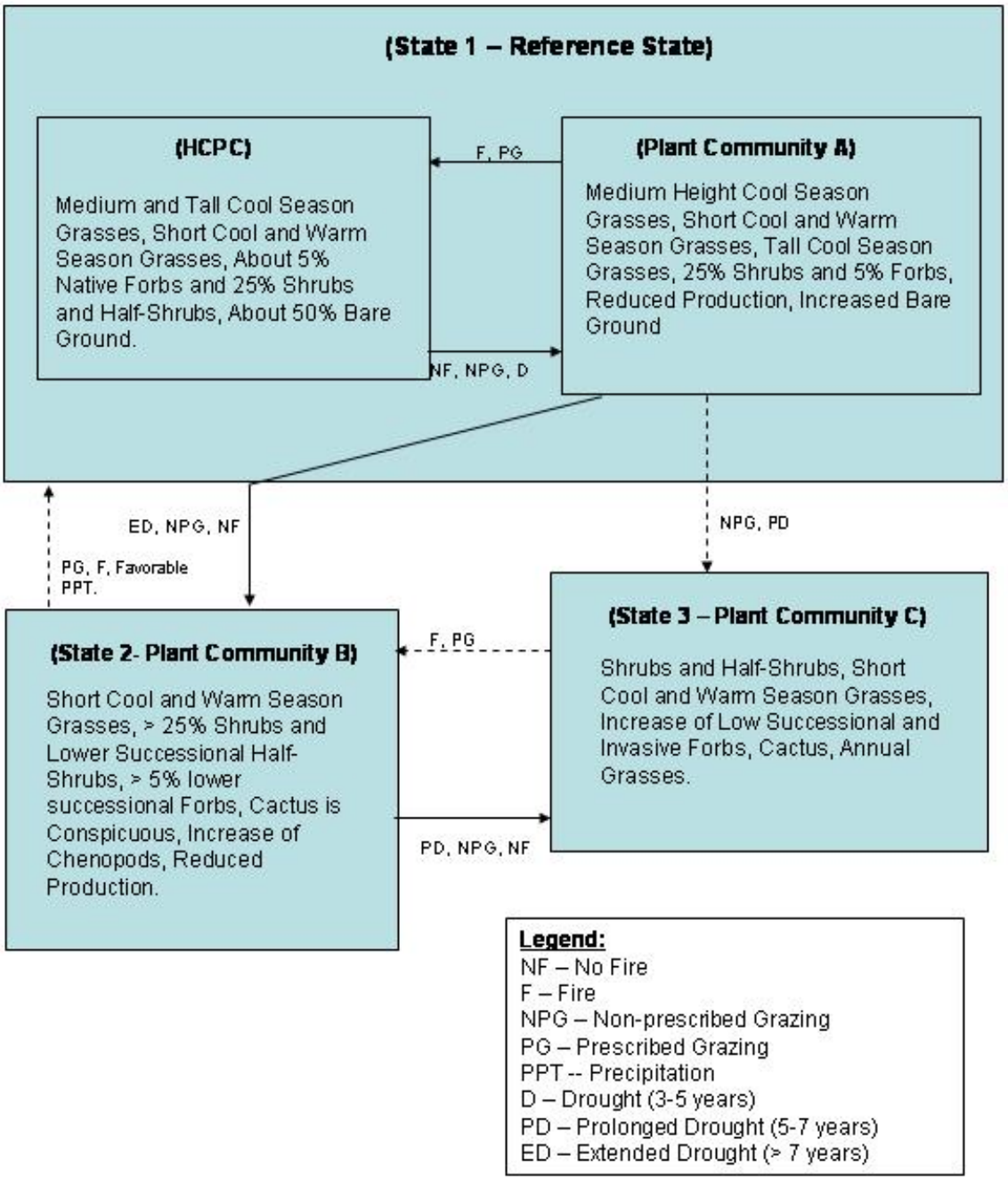
This site is moderately resilient to disturbance because soil characteristics limit plant growth. Departures from the HCPC generally result from management actions, drought, and/or a change in the natural fire regime. The site is considered fragile in the sense that vegetative vigor and composition will 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.

Saline Upland 10-14" p.z. RRUs 52XC, 52XN, 53AE



State #1: Historic Climax Plant Community (HCPC):

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.

(Insert HCPC Plant Community photo)

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.

Historic Climax Plant Community Plant Species Composition:

GRASSES /GRASSLIKE

70% of Community

Common Name*	Scientific Name	Group	Group Allowable Pounds Per Acre		Annual Production in Pounds Per Acre	
			Low	High	Low	High
Western wheatgrass	*Pascopyrum smithii*				200	300
Alkali sacaton	*Sporobolus airoides*				50	100
Inland saltgrass	*Distichlis spicata*				5	75
Blue grama*	*Bouteloua gracilis**		*No more than 50 lbs		5	25
Sand dropseed*	*Sporobolus cryptandrus**		total for all species,		5	25
Plains reedgrass*	*Calamagrostis montanensis**		and no more than 10		5	25
Threadleaf sedge*	*Carex filifolia**		lbs for any one		5	25
Sandberg bluegrass*	*Poa secunda**		species.		5	25
Nuttall's alkaligrass*	*Puccinellia nuttalliana**				50	100
Praire junegrass*	*Koeleria macrantha**				5	25
Other native grasses					5	25

FORBS

5% of Community

Common Name	Scientific Name	Group	Group Allowable Pounds Per Acre		Annual Production in Pounds Per Acre	
			Low	High	Low	High
Scarlet globemallow	*Sphaeralcea coccinea*				5	25
Aster	*Aster spp.*				5	25
Poverty weed	*Iva axillaris*		No more than		5	25
Bastard toadflax	*Comandra umbellate*		10 lbs/ac for a		5	25
Milkvetch	*Astragalus spp.*		single species.		5	25
Hoods phlox	*Phlox hoodii*				5	25
Other native forbs					25 lbs/ac is maximum allowed for all forbs.	

SHRUBS AND HALF-SHRUBS

25% of Community

Common Name	Scientific Name	Group	Group Allowable Pounds Per Acre		Annual Production in Pounds Per Acre	
			Low	High	Low	High
Nuttall Saltbush	*Atriplex nuttallii*				75	125
Greasewood	*Sarcobatus vermiculatus*				75	125

Silver sagebrush	*Artemisia cana*		5	25
Fringed sagewort	*Artemisia frigida*		5	25
Broom snakeweed	*Gutierrezia sarothrae*	125 lbs/ac is the max	0	0
Plains pricklypear	*Opuntia polyacanta*	allowed for all shrubs.	0	T
Other native shrubs			0	25

Structure and Cover

Soil Surface Cover (%)

Basal Cover				Non-Vascular Plants	Biological Crust	Litter	Surface Fragments >1/4 & <= 3"	Surface Fragments > 3"	Bedrock	Water	Bare Ground
Grass/ Grasslike	Forb	Shrub/ Vine	Tree								
5-10	1-2	1-5	0								

Ground Cover (%)

Vegetative Cover						Non-Vegetative Cover					
Grass/ Grasslike	Forb	Shrub/ Vine	Tree	Non-Vascular Plants	Biological Crust	Litter	Surface Fragments >1/4 & <= 3"	Surface Fragments > 3"	Bedrock	Water	Bare Ground
				0-1	0-1	20-30	0-T	0-T	T	0	50-60

Structure of Canopy Cover (%)

	Grass/Grasslike	Forb	Shrub/Vine	Tree
<= 0.5 feet	20	25	T	0
>0.5 - <=1 feet	50	50	40	0
>1 - <=2 feet	25	25	50	0
>2 - <=4.5 feet	5		10	0
>4.5 - <=13 feet				0
>13 - <= 40 feet				0

Annual Production by Plant Type:

Plant Type	Annual Production (lbs/AC) Low	RV*	High
Grasses/Grasslike	245	350	420
Forb	20	25	30
Shrub	85	125	150
Total	350	500	600

*RV means "representative value".

***Successional Pathway from HCPC to Plant Community A:**
Non-prescribed grazing, drought and/or a cessation of the natural fire regime will cause regression from HCPC to Community A.

Plant Community A (State #1):

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.

***Successional Pathway from Community A to HCPC:**
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.

***Transitional Pathways from Community A to Communities B & C:**
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). 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.

(Insert Plant Community A photo)

Plant Community B (State #2):

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.

(Insert Plant Community B photo)

***Successional Pathways from Community B to State #1:**
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 from Community B (State #2) to Community C (State #3):**
Community B is much less resistant to disturbance than Community A. Lower production, lower vegetative cover, less litter, and increased bare ground increases Community B's susceptibility to disturbance. Extended drought and non-prescribed grazing can cause regression to State #3 (Community C).

Plant Community C (State #3):

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.

(Insert Plant Community C photo)

***Successional Pathways between Communities C and B:**
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.

Ecological Site Interpretations

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.

Hydrology 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 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.

Supporting Information

Associated Sites The following sites may be found in association with the Saline Upland 10-14" p.z. ecological site. The Site ID indicates in which Rangeland Resource Units (RRU) these sites occur. For example, Site ID R052XN162MT occurs in RRU 52XN.

Site Name	Site ID	Site Narrative
Clayey 10-14" p.z.	R052XN162MT	soils >20 inches in depth, higher production, and no hardpan, different species composition
Shallow to Gravel 10-14" p.z.	R052XN176MT	similar position in landscape, soils with depth restriction that limits available moisture, soils 10-20" deep to sands or loamy sands
Shallow Clay 10-14" p.z.	R052XN179MT	soils 10-20" deep to bedrock' soils are clayey over clayey shale,
Clay Pan 10-14" p.z.	R052XN086MT	has 2-8" of soil over the hard argillic layer, less bare ground, and higher production

Dense Clay 10-14" p.z.	R052XN172MT	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

Site Name	Site ID	Site Narrative
Saline Upland 10-14" p.z.	R052XC210MT R053AE071MT	

State Correlation

This site has been correlated with the following states: Montana

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

Type Locality

State: MT
County:
Township:
Range:
Section:
UTM: Datum: NAD__ _____E ____N
General Description:
Sensitivity: Yes___ No___

Relationship to Other Classifications:

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.

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
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