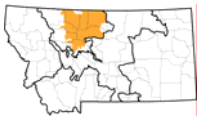
UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

ECOLOGICAL SITE DESCRIPTION



ECOLOGICAL SITE CHARACTERISTICS

Site Type: Rangeland

Site Name: Clay Pan 10-14 inch, p.z. (precipitation zone)

Site ID: R052XN086MT

Major Land Resource Area: 52XN —Northern Glaciated Plains

Physiographic Features: This ecological site occurs on level to sloping glaciated plains, stream terraces and fans. Slopes vary from 0-15%, but are usually less than 8%. This site occurs on all exposures. Elevations normally vary from 2000 to 4000 feet.

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

	Minimum	Maximum
Elevation (feet):	1875	4800
Slope (percent):	1	15

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 and very deep, well drained soils formed in glacial till. Soils occupy glacial uplands. The surface layer varies from 2-8" in depth, and has a clay loam to fine sandy loam texture. The B horizon is characterized by a hard argillic horizon (6-10'' thick), which restricts root penetration. The argillic layer has strong columnar structure. Salt accumulations are often visible in the lower part of the B horizon. These soils are usually very hard when dry and very sticky when wet. Permeability is very slow. Soil ph varies from 6.6 – 9.0. This site is characterized by the following soil components: Gerdrum, Archin, Elloam and Thoeny.

Predominant Parent Materials:
Kind: till
Origin: glaciofluvial deposits or semi-consolidated sedimentary bedrock

Surface Texture: (1) loam
(2) fine sandy loam
(3) clay loam
Surface Texture Modifier: (1) none
Subsurface Texture Group: clayey
Surface Fragments < = 3" (% cover): 0
Surface Fragments >3" (% cover): 0

Subsurface Fragments < = 3" (% Volume): 5-15
Subsurface Fragments > 3" (% Volume): 0-2
Drainage Class: Well
Permeability Class: Very slow

	Minimum	Maximum
Depth (inches):	>20	>72
Electrical Conductivity (mmhos/cm):	0	16
Sodium Adsorption Ratio:	5	25
Calcium Carbonate Equivalent (percent):	0	10
Soil Reaction (1:1 Water):	6.6	9.0
Soil Reaction (0.1M CaC12):	---	---
Available Water Capacity (inches):	4	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 consistently shows that precipitation is the principal factor altering productivity on ecological sites in the Northern Great Plains (Heitschmidt et al. 2005). The same authors concluded that grazing reduces herbage standing crop, whereas its effects on above ground net primary production varies with timing of grazing and precipitation events, along with the functional and structural composition of the plant community.

It is theorized that these lands 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 other upland ecological 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 85% of the annual production is from grasses and sedges, most of which is produced during the cool season. Forbs and shrubs contribute 5 and 10%, respectively, to total annual production. Total vegetative production averages 900 lbs/ac in normal years, 500 lbs/ac in "unfavorable" years, and 1200 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 in the absence of prescribed grazing and during prolonged drought. With favorable precipitation and/or prescribed grazing treatments, the plant community

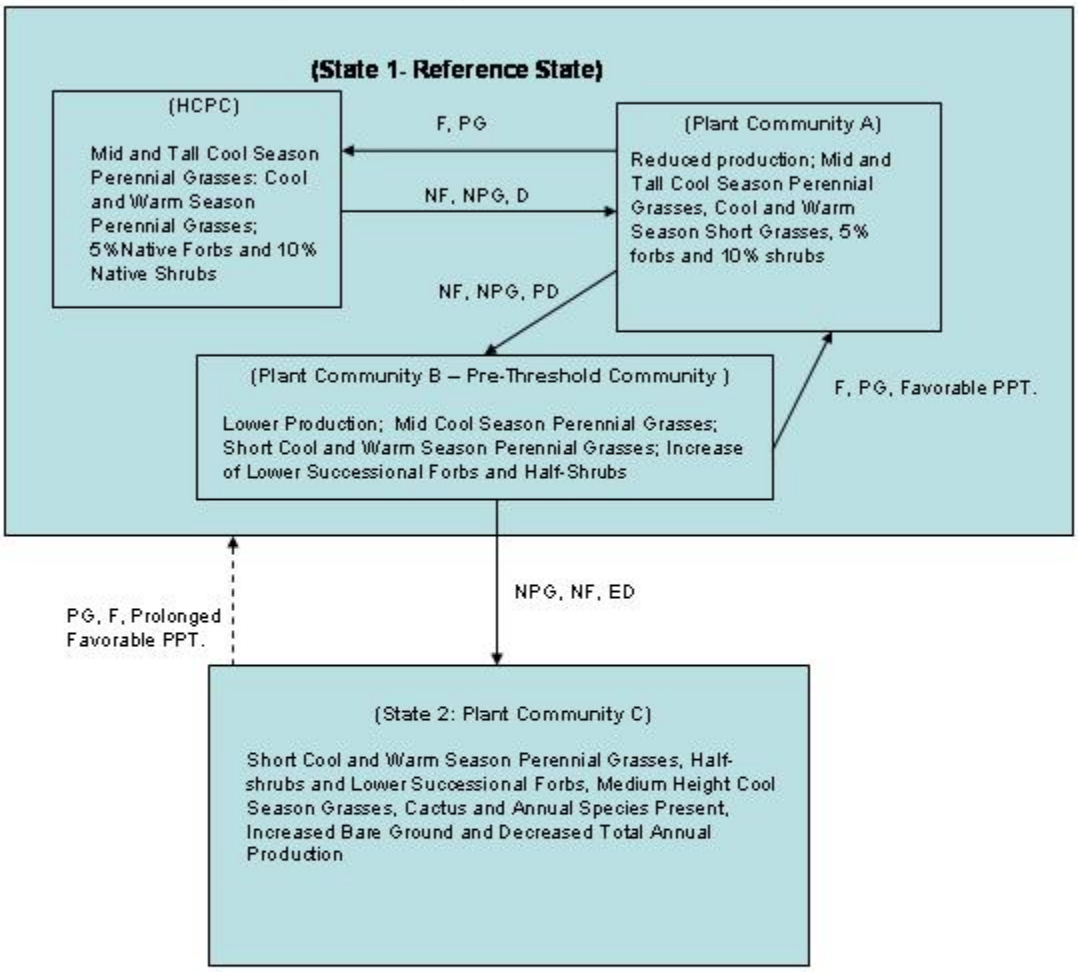
can return to the HCPC. However, succession may be slow. Trends in plant community dynamics, states, transitional pathways, and thresholds have been evaluated and determined through experience and research.

Successional pathways of the Clay Pan 10-14" p.z. ecological site 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.

Three plant communities and the successional pathways that commonly occur within the Reference State (State #1) are shown in the following diagram. In addition, the transition from State #1 to State #2 and a representative plant community in the latter state are also illustrated. Ecological processes are discussed in the plant community descriptions following the diagram.

State and Transition Model Diagram:
(see next page)

Clay Pan 10-14" p.z. RRUs 52XC, 52XN, 53AE



Legend:

NF – No Fire
F – Fire (Natural Interval 10-12 yrs)
NPG – Non-Prescribed Grazing
PG – Prescribed Grazing
PPT -- Precipitation
D – Drought (3-5 years)
PD – Prolonged Drought (5-7 years)
ED – Extended Drought (> 7 years)

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

Western/thickspike wheatgrass, bluebunch wheatgrass and green needlegrass are common cool season mid grasses on this ecological site. Alkali sacaton, a tall warm season grass occurs on this site in the eastern glaciated plains. These high-successional grasses account for about 75% of total plant production in the HCPC. Needleandthread, another cool season mid grass is common and tends to replace the green needlegrass when it is stressed by lack of moisture, grazing or etc. About 10% of the total production is comprised of a mix of warm and cool season short grasses and grasslike plants. These species include: blue grama, sandberg bluegrass, plains reedgrass, prairie junegrass, needleleaf sedge, and threadleaf sedge.

American vetch, a cool season, nitrogen-fixing legume is one of the most important members of the forb community. White and purple prairie clover are important warm season legumes. Additional nitrogen is fixed by lower successional legumes (milkvetches, scurfpeas, and prairie thermopsis). Onion, hoods phlox, scarlet globemallow, wooly plantain, and biscuitroot often occur in the HCPC. 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. Forbs contribute about 5% of the total annual production.

Nuttall saltbush, greasewood and silver sagebrush are the most important browse species occurring on this site. While the former two species make their major growth and flower during the cool season, silver sagebrush is a warm season species. Shrubs such as big sagebrush and pricklypear cactus may occur in some areas. Fringed sagebrush, a half-shrub may also be found in the HCPC. Shrubs normally make up about 10% 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 within the HCPC averages 900 lbs/ac during normal years. Thus production is 300 lbs/ac higher than it is on the Dense Clay 10-14" p.z. ecological site, and 400 lbs/ac less than on the Clayey 10-14" p.z. ecological site. Production declines as the HCPC 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 green needlegrass, bluebunch wheatgrass, and western/thickspike wheatgrass by needleandthread, blue grama, sandberg bluegrass, prairie junegrass, hairy goldenaster, 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 basal cover varies from 7-20%. Litter varies from 40-50%, and bare ground ranges from 25-45%. Thus, surface runoff and erosion are potential concerns on the Clay Pan 10-14" p.z. ecological site. Runoff and soil erosion 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 /GRASSLIKES					Annual Production in	
85% of Community			Group Allowable		Pounds Per Acre	
Common Name*	Scientific Name*	Group	Pounds Per Acre		Low	High
			Low	High		
Western wheatgrass	*Pascopyrum smithii*	1	180	360	90	180
Thickspike wheatgrass	*Elymus macrourus*	1			90	180
Green needlegrass	*Nassella viridula*				90	180
Bluebunch wheatgrass	*Pseudoroegneria spicata*				90	180
Alkali sacaton	*Sporobolus airoides*				45	90
Needle and thread	*Hesperostipa comata*				45	90
Blue grama*	*Bouteloua gracilis**				0	45
Sand dropseed*	*Sporobolus cryptandrus**				0	45
Plains reedgrass*	*Calamagrostis montanensis**				0	45
Threadleaf sedge*	*Carex filifolia**				0	45
Sandberg bluegrass*	*Poa secunda**				0	45
Praire junegrass*	*Koeleria macrantha**				0	45
Bottlebrush squirreltail*	*Sitanion hystrix**				0	45
Other native grasses*					0	45

*Max allowed for total of all species designated with * must not exceed 90 lbs/ac.

*No more than 20 lbs/ac for any one species that is designated with *.

FORBS **5% of Community**			Group Allowable Pounds Per Acre		Annual Production in Pounds Per Acre	
Common Name	Scientific Name	Group	Low	High	Low	High
American vetch	*Vicia americana*				9	45
Purple prairie clover	*Dalea purpurea*	2	18	90	9	45
White prairie clover	*Dalea candida*	2			9	45
Scarlet globemallow*	*Sphaeralcea coccinea**				0	45
Aster*	*Aster spp.**				0	45
Scurfpea*	*Psoralidium spp.**				0	45
Prairie thermopsis*	*Thermopsis rhombifolia**				0	45
Pussytoes*	*Antennaria spp.**				0	45
Bastard toadflax*	*Comandra umbellata**				0	45
Milkvetch*	*Astaglus spp.**				0	45
Hoods phlox*	*Phlox hoodii**				0	45
Other native forbs			45 lbs/ac is maximum allowed for all forbs.		*5 lbs/ac is max for any one species	

SHRUBS AND HALF-SHRUBS **10% of Community**			Group Allowable Pounds Per Acre		Annual Production in Pounds Per Acre	
Common Name	Scientific Name	Group	Low	High	Low	High
Nuttall Saltbush	*Atriplex nuttallii*				5	45
Silver sagebrush	*Artemisia cana*				0	45
Greasewood	*Sarcobatus vermiculatus*				0	45
Big sagebrush	*Artemisia tridentata*				T	45
Fringed sagewort	*Artemisia frigida*				T	15
Plains pricklypear	*Opuntia polyacantha*				0	T
Other native shrubs			90 lbs/ac is the max allowed for all shrubs.			

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								
10-15	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	15-40	0-T	0-T	T	0	10-20

Structure of Canopy Cover (%)

	Grass/Grasslike	Forb	Shrub/Vine	Tree
<= 0.5 feet	20	25	T	0
>0.5 - <=1 feet	40	50	40	0
>1 - <=2 feet	25	25	50	0
>2 - <=4.5 feet	15		10	0
>4.5 - <=13 feet				0
>13 - <= 40 feet				0

Annual Production by Plant Type:

Plant	Annual Production (lbs/AC)		
Type	Low	RV*	High
Grasses /Grasslike	425	765	1020
Forb	25	45	60
Shrub/Vine	50	90	120
Tree	T	T	T
Total	500	900	1200

*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):

Total annual production is about 80% of the HCPC. Western and thickspike wheatgrasses, and green needlegrass still contribute approximately 60% of the annual production. However, they are less vigorous and individual plant growth is reduced from what it is in the HCPC. The short grass production increases in comparison to the HCPC. Plant height and plant litter are reduced while bare ground increases. Surface runoff and soil temperature increases, infiltration decreases, and shallow-rooted short grasses and sedges gain a competitive advantage over medium height, deep-rooted cool season perennial grasses. 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.

Total shrub production continues to represent about 5% of total annual production. However, vigor of the prairie clovers and American vetch has decreased relative to the vigor of hoods phlox and other low-successional forbs. Total shrub production remains at about 10% of the total annual production.

***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 can occur within a couple of years.

***Successional Pathway from Community A to Plant Community B:**
Community A will regress to Community B under non-prescribed grazing, prolonged drought, or an extended period without fire. The rate of regression

varies with the kind, intensity, frequency, and duration of the disturbances. Severe drought may cause retrogression within a couple years.

Plant Community B (State #1):

This Community is dominated by a mix of medium and short grasses. Blue grama, threadleaf sedge, needleandthread and sandberg bluegrass increased in the community by replacing some of the mid grasses. However, western and thickspike wheatgrass and green needlegrass continue to contribute nearly 50% of the total annual production.

In comparison to Community A, the short grasses contain more blue grama, a warm season species. Sand dropseed and tumblegrass may also begin to appear in the community. Warm season forbs increase and replace American vetch and other high-successional forbs. The warm season half-shrub, fringed sagewort, increases in production. Pricklypear cactus and broom snakeweed are conspicuous in this community. Annual production is 40-60% of potential for the site.

Plant species in this community tend to exhibit more salt tolerant characteristics than the species found in the HCPC or Community A. Infiltration is moderately reduced due to adverse changes in plant community composition and/or distribution. The amount of bare ground is moderately higher than expected for this site (bare ground = 45-60%). In comparison to the HCPC, total plant cover varies from 30-40%. Litter is reduced to 10-15%, which is moderately less, relative to site potential and weather. Active rill formation is slight at infrequent intervals, mostly in exposed areas. Water flow patterns match what is expected for the site, erosion is minor with some instability and deposition (USDI and USDA 2000).

Plant community B is called the "pre-threshold community". It is critical that this community be recognized and strategies implemented to prevent further regression. Although this community can improve to either Community A or HCPC through successional processes, further disturbance will result in regression to a lower state. Once Community B regresses to a lower state, normal successional processes are restricted.

(Insert Plant Community B photo)

***Successional Pathways from Community B to Community A and HCPC**
The Clay Pan 10-14" p.z. ecological site is resilient within the Reference State. Prescribed grazing and/or a period of favorable precipitation will induce succession from Community B Community A within a reasonable time frame.

***Transition From Community B to State #2 (Community C)**
However, Community B is much less resistant to perturbations than Community A. Lower production, lower vegetative cover, less litter, and increased bare ground contribute to increase Community B's susceptibility to disturbance. Extended drought and non-prescribed grazing can lead to further retrogression (State 2). The threshold separating Communities B and C appears to be the functional threshold, below which the type, amount, and pattern of vegetation is often inadequate to prevent accelerated soil erosion.

Plant Community C (State #2):

Plant Community C is characterized by a significant reduction in species composition by weight of medium-height, cool season grasses. Wheatgrasses contribute about 25% of total annual growth. Plants produce few seed heads and are low in vigor.

This community is dominated by low-successional grasses and sedges. Blue grama, prairie junegrass, other short grasses, sedges and clubmoss contribute about 50% of the total annual production. Clubmoss cover is usually most severe on soils with loamy A and E horizons. Broom snakeweed, fringed sagewort and pricklypear cactus are conspicuous in the community. Japanese brome, cheatgrass, annual forbs (fanweed and pepperweed), and curlycup gumweed will be present. Total annual production is reduced about 75% from levels in the HCPC. Percent composition of forbs and shrubs are highly variable from place to place and from year to year in this community. Variability is apparent in productivity and occurrence of individual species.

Litter cover averages about 10%, which is a large reduction relative to site potential. Water flow patterns are numerous and there is moderate active pedestalling. In communities that are not characterized with clubmoss, bare ground is moderately to much higher than expected. There is moderate soil loss or degradation in interspaces with some degradation beneath plant canopies. 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. Reproductive capability of cool season plants is greatly reduced relative to recent climatic conditions.

(Insert Plant Community C photo)

***Transition from State #2 to higher seral state (State #1):**
Plant community C is a steady state. It is resistant to significant succession. Blue grama, other short grasses, sedges and clubmoss form a competitive community. The adverse soil conditions and a theorized inadequate seed bank of species found in State #1 greatly restrict potential for succession to State #1. When clubmoss cover is more than 20-25%, succession is not expected to occur within a reasonable length of time. However, significant succession may occur with the combination of prescribed grazing, implementation of the natural fire regime, and an extended period of favorable moisture. This potential is depicted with the dashed line in the state and transition diagram.

In comparison to more common ecological sites with moderately deep to deep soils (ie, Silty 10-14" p.z., Clayey 10-14" p.z., and Sandy 10-14" p.z.), annual production on a Clay Pan 10-14" p.z. ecological site is about 30% less. Therefore, vegetation response to mechanical treatments and range seeding will be less than the response expected on the higher producing sites (NRCS Conservation Practice Standard 548-1).

Ecological Site Interpretations

Animal Community

Livestock Management

The Clay Pan 10-14" p.z. ecological site is suited for livestock grazing. However, prescribed grazing management is needed. Forage production is somewhat limited by soil characteristics. Many species occurring in State #1 are palatable to livestock, which makes the communities 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 result in soil compaction. Any additional factor reducing infiltration and increasing runoff on this site is a management concern. Shorter grazing periods and adequate periods of rest following grazing are needed to facilitate plant regrowth and accumulate litter.

This ecological site has a component of shortgrass species, as do most other sites in the northern mixed prairie. The shortgrasses usually increase with grazing pressure and decrease with deferment 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. The Clay Pan 10-14" p.z. 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. Prescribed grazing management is always a good recommendation. Furthermore, chiseling of these soils is common in Phillips County and can be very successful given the right conditions.

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 for many species of wildlife. Antelope and mule deer prefer grazing this site because of the Nuttall saltbush and diversity of forage species. However, the landscape does not provide thermal and escape cover. The bare ground 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 tall cool season grasses or warm season grass would shorten the length of the "green forage" season. The increase of blue grama, clubmoss, hoods phlox, etc. is also associated with the loss of palatable forbs. These changes tend to adversely impact foraging opportunities for deer, antelope, upland birds, etc. Community C has very little value for most wildlife species because of insufficient vegetative structural diversity, residual grass carry-over and litter cover.

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 is the main factor limiting vegetative production on this site. Soil components in this ecological site are normally classed into 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 where ground cover is less than 50% have the greatest potential to have reduced infiltration and higher runoff.

Recreational Uses

This site provides hunting opportunities for upland game species.

Wood Products

This site has no significant value for wood products.

Other Products

Other Information

This site 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. 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 State #2. 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 Clay Pan 10-14" p.z. ecological site. The Site ID indicates in which Rangeland Resource Units (RRU) these sites occur. For example, Site ID R052XC205MT occurs in RRU 52XC. Site ID R052XN162MT occurs in RRU 52XN. Site ID R053AE061MT occurs in RRU 53AE.

Site Name	Site ID	Site Narrative
Clayey 10-14" p.z.	R052XC205MT R052XN162MT R053AE061MT	soils >20 inches in depth, higher production, and no hardpan, different species composition

Shallow to Gravel 10-14" p.z.	R052XC216MT 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.	R052XC215MT R052XN179MT R053AE078MT	soils 10-20" deep to bedrock' soils are clayey over clayey shale,
Dense Clay 10-14" p.z.	R052XC206MT R052XN172MT R053AE073MT	has less than 2" of soil over the hard argillic layer, more bare ground, and less production
Saline Upland 10-14" p.z.	R052XC210MT R052XN170MT R053AE071MT	does not have a very hard layer near surface, plant community contains salt-tolerant species

Similar Sites

Site Name	Site ID	Site Narrative
Clay Pan 10-14" p.z.	R052XC204MT	May have decrease in total annual production of bluebunch wheatgrass.
Clay Pan 10-14" p.z.	R053AE074MT	May have decrease in total annual production of bluebunch wheatgrass, and an increase in other wheatgrasses and/or needlegrass.

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 (#503)	1	1991	MT	Phillips
ECS-1				
Modified Double Sampling	0			

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.

USDA and USDI. 2000. Interpreting indicators of rangeland health. Technical Reference 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 Clay Pan 10-14" p.z. ecological site description replaces earlier dated versions of Clay Pan 10-14" p.z. descriptions in Rangeland Resource Unit 52XN, located in Section II-E-8 of the NRCS Field Office Technical Guide.

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.

Author	Date	Approval	Date
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