USDA Natural Resources
Conservation Service

Ecological site R053AE073MT
Dense Clay (DC) (Legacy) RRU 53AE

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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.

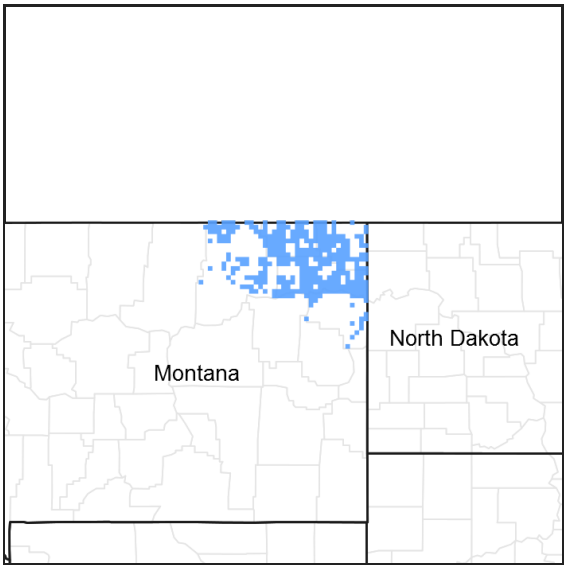


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This ecological site occurs on nearly level to gently rolling uplands, low terraces and fans. Slopes are usually less than 8%, but can go as high as 12%. Elevations normally vary from 2000 to 4000 feet.

Table 2. Representative physiographic features

Landforms	(1) Terrace (2) Fan (3) Plain
Flooding frequency	None
Ponding frequency	None
Elevation	572–1,219 m

Slope	1–12%
Aspect	Aspect is not a significant factor

Climatic features

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

Table 3. Representative climatic features

Frost-free period (average)	129 days
Freeze-free period (average)	104 days
Precipitation total (average)	305 mm

Influencing water features

Soil features

These deep, well drained soils formed in alluvium. The soils usually contain a two-inch silty clay surface over hardpan. These soils are usually very hard when dry and very sticky when wet. They typically have a high content of sodium (alkali) which causes a dispersed condition and restricts water intake into the soil. Permeability is very slow. Root development is severely restricted by the surface crust, hard subsoil and alkalinity. Soil ph varies from 6.6 - 9.0. This site is characterized by the following soil components: Bowdoin, Absher, Vaeda and Vanda.

Table 4. Representative soil features

Surface texture	(1) Clay (2) Silty clay (3) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Moderately well drained to well drained
Permeability class	Very slow
Soil depth	51–183 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	7.62–12.7 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
Electrical conductivity (0-101.6cm)	2–16 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	5–25
Soil reaction (1:1 water) (0-101.6cm)	6.1–9
Subsurface fragment volume <=3" (Depth not specified)	0–10%

Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

This site developed through time under the influence of climate, geological materials, fire, plants and animals. In comparison to normal upland range sites, environmental characteristics of this site limit herbage production and subsequent fuel accumulation. Although the role of natural fire is probably less significant in the development of this site, fires may have occurred on a natural interval of 10-12 years (Frost 1998). Research 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 varies with timing of grazing and precipitation events, along with the functional and structural composition of the plant community.

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 tall and medium height cool season grasses, forbs 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 600 lbs/ac in normal years, 350 lbs/ac in “unfavorable” years, and 900 lbs/ac in “favorable” years.

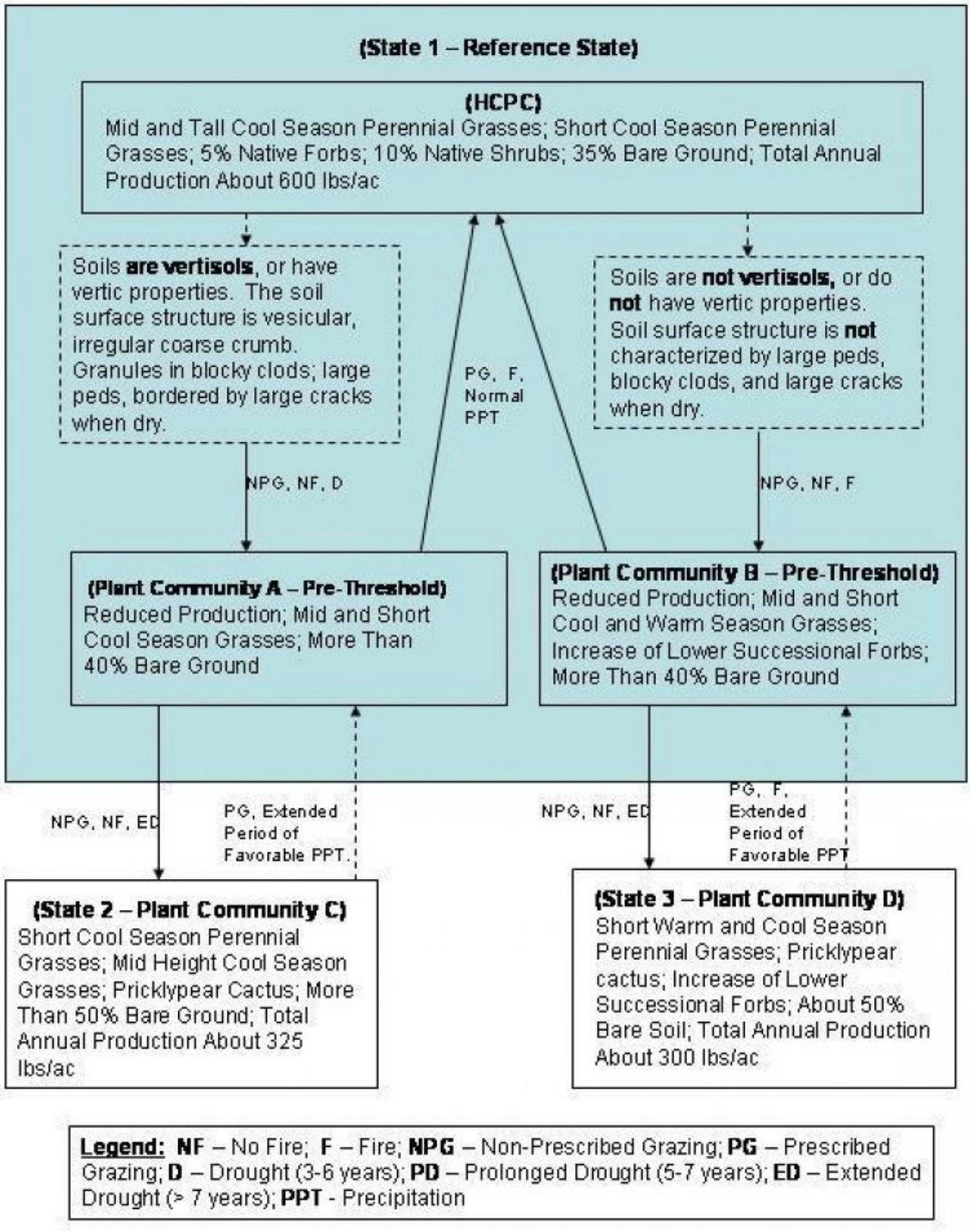
This site is moderately resilient to disturbance because plant growth is limited by soil characteristics. Departures from the HCPC generally result from management actions, drought, and/or a change in the natural fire regime. The site is considered fragile in the sense that vegetative vigor and composition will rapidly decline with continued adverse impacts. With favorable precipitation and/or prescribed grazing treatments 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 Dense Clay 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 usually 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 transitions from Plant Community A (State #1) and from Plant Community B (State #1) to Plant Communities C (State #2) and D (State #3), are also illustrated. Ecological processes are discussed below in the plant community descriptions.

State and transition model

Dense Clay MLRU 52XA, 52XB, 53AY



Legend: **NF** – No Fire; **F** – Fire; **NPG** – Non-Prescribed Grazing; **PG** – Prescribed Grazing; **D** – Drought (3-6 years); **PD** – Prolonged Drought (5-7 years); **ED** – Extended Drought (> 7 years); **PPT** - Precipitation

State 1

State #1: Historic Climax Plant Community (HCPC)

Community 1.1
State #1: Historic Climax Plant Community (HCPC)

Western/thickspike wheatgrasses and green needlegrass are common cool season mid grasses on this ecological site. They account for about 80% 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 pressure, etc. About 5% of the total production is comprised of a mix of cool season short grasses and grasslike plants. These species include sandberg bluegrass, 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. Milk vetches and prairie thermopsis are additional members of the legume family which may occur in the HCPC. Other common forbs include onion, hoods phlox, scarlet globemallow, wooly plantain, and biscuitroot. 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 and winterfat are the two most important browse species occurring on the site. While Nuttall saltbush expresses itself during the cool season, winterfat is a warm season plant. Shrubs such as big sagebrush, greasewood, silver sagebrush, pricklypear cactus and fringed sagebrush 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 averages 600 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. Following regression from the HCPC, soil structure appears to influence species composition. Surface layers that are vesicular, with large angular peds (blocky clods, etc) appear to limit or restrict the establishment and growth of short grasses (especially blue grama) (White and Lewis 1969). Consequently, the percentage of bare ground increases as the production of green needlegrass and western wheatgrass decline on these soils. In contrast, production of shallow-rooted and/or predominantly lateral-rooted species such as needleandthread, blue grama, sandberg bluegrass, prairie junegrass, hairy goldenaster, and hoods phlox increase when surface soils are more granular, with smaller peds, etc. The large cracks that form between the peds of the heavy soils are theorized to restrict shallow root growth and/or shear the lateral roots that have thin cortices, resulting in a reduction of the short grasses. Regardless of soil shrink/swell realities, winterfat and Nuttall saltbush may also be replaced by broom snakeweed, fringed sagewort, etc on the site. 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 averages 15%. Litter varies from 40-50%. Consequently, bare ground may range from 35-55%. Thus, infiltration is not optimized and runoff and erosion are not minimized on the Dense Clay 10-14” p.z. ecological site. Runoff and soil erosion normally increase as the HCPC regresses to earlier seral states.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	336	572	857
Shrub/Vine	39	67	101
Forb	17	34	50
Tree	1	1	1
Total	**393**	**674**	**1009**

Table 6. 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	40-50%
Surface fragments >0.25" and <=3"	0-1%
Surface fragments >3"	0-1%
Bedrock	0-1%
Water	0%
Bare ground	30-40%

Table 7. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	1-5%
Grass/grasslike basal cover	9-12%
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 8. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-5%	15-25%	20-30%
>0.15 <= 0.3	–	35-45%	40-60%	40-60%
>0.3 <= 0.6	–	55-60%	20-30%	20-30%
>0.6 <= 1.4	–	5-10%	0-5%	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Community 1.2
Plant Community A (State #1)

*Successional Pathway from HCPC to Plant Communities A and B (State #1): Non-prescribed grazing, drought and/or a cessation of the natural fire regime will cause regression from HCPC to Communities A or B. The pathway to Community A occurs on soils with vesicular, irregular, coarse granules, and blocky clods. Large cracks form between the peds (aggregates) as these soils dry. The pathway to Plant Community B occurs on soils with much smaller soil peds. Large cracks between peds are not a normal occurrence on these soils. The regression to either Plant Community A or B may occur within a couple of years. Plant Community A (State #1): Range inventories conducted by NRCS on the Fort Peck and Fort Belknap Reservations indicate similarity indices of 45-64% are

indicative of Community A. Non-prescribed grazing and drought reduce plant height and plant litter. Bare ground increases as the production of HCPC species decline. Surface runoff and soil temperature increases, and infiltration decreases. Production of shallow-rooted short grasses and sedges is limited by the large cracks that form between the peds as the soils dry. Pricklypear cactus is conspicuous in this community. In contrast to the HCPC, total annual production averages about 475 lbs/ac. However, western and thickspike wheatgrasses and green needlegrass still contribute 70% of the annual production. However, they are less vigorous and individual plant growth is reduced from what it is in the HCPC. Production of the short grasses and lower-successional forbs increases slightly to what it was in the HCPC. Although total shrub production did not change, production of silver sagebrush tends to replace production of winterfat and Nuttall saltbush. Plant community A is called a “pre-threshold community”. It is critical that this community be recognized and strategies implemented to prevent further regression. Although this community can improve to the HCPC through successional processes, further disturbance will result in regression to a lower state (State #2). Once Community A regresses to a lower state, normal successional processes are restricted.

Community 1.3
Plant Community B (State #1)

NRCS range inventories indicate that Community B is characterized by similarity indices of 45-64%. The 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 continued to contribute about 50% of the total annual production (average of 375 lbs/ac.). In comparison to the HCPC, sandberg bluegrass, blue grama, and other short grasses have increased. In addition, sand dropseed and tumblegrass may appear in the community. Warm season forbs increase and replace American vetch and other high-successional forbs. The warm season half-shrub, fringed sagewort, may also increase in this community. Pricklypear cactus and broom snakeweed are conspicuous. In comparison to the HCPC, litter varies from 25-35%. Bare ground increases to 50-60%. Thus, rills, flow patterns and movement of litter deposits are visible. Plant community B is called a “pre-threshold community”. It is critical that this community be recognized and strategies implemented to prevent further regression. Although this community can improve to the HCPC through successional processes, further disturbance will result in regression to a lower state (State #3). Once Community B regresses to a lower state, normal successional processes are restricted. (Insert Plant Community B photo) *Successional Pathways from Plant Communities A and B to HCPC: The Dense Clay 10-14” p.z. site is resilient within the Reference State. Normal growing conditions, the implementation of prescribed grazing, or the re-introduction of the natural fire regime will move Plant Communities A and B to the HCPC. This succession can occur within a couple of years. *Transitions from Communities A & B to Plant Communities C & D: Plant Communities A & B are much less resistant to disturbance than the HCPC. Lower production, lower vegetative cover, less litter, and increased bare ground increases susceptibility to disturbance, stress etc. Extended drought and non-prescribed grazing are the most common causes of retrogression to either States #2 or #3.

State 2
Plant Community C (State #2)

Community 2.1
Plant Community C (State #2)

Regression of Plant Community A crosses a threshold and results in Plant Community C. This community is a steady state, which is resistant to change. It is characterized by a significant reduction in production of medium-height, cool season grasses. The amount of bare ground increases significantly. The wheatgrasses contributed about 50% of total annual growth. Individual wheatgrass plants produce few seed heads and can be low in vigor. Similarity indices during the NRCS inventories on Fort Peck and Fort Belknap (2001-2004) were less than 35% for this Community. Pricklypear cactus, broom snakeweed and annual bromes are often common in this community. Total annual production averaged 325 lbs/ac, a 20% reduction from Community A. Litter cover averages about 15%. Water flow patterns are numerous and there is moderate active pedestalling. Bare ground is moderately to much higher than expected. Compared to the HCPC, production of tall and medium height grasses has decreased, and bare ground has increased. The ecological processes of energy flow, hydrologic cycle, and nutrient cycle are disrupted.

State 3
Plant Community D (State #3)

Community 3.1
Plant Community D (State #3)

Regression of Plant Community B ends in Plant Community D. This community is a steady state, which is resistant to change. It is characterized by a mix of warm and cool season short grasses. Blue grama, needleandthread and sandberg bluegrass are the most common plants. Western and thickspike wheatgrasses contribute about 15% to the total annual production. Production of low-successional forbs decreased relative to Community B. Total annual production usually varies from 250-300 lbs/ac during favorable years. The NRCS inventories indicate a few winterfat and Nuttall saltbush plants persist in this community. However, dry weight production of these high-successional shrubs decreased relative to the dry weight production of broom snakeweed, pricklypear cactus and fringed sagewort. *Successional Pathways Between Communities C and D: Differences in soil structure are largely responsible for the species composition of these two plant communities. Therefore, successional pathways between these communities are unlikely. *Transition from Plant Communities C & D to Communities A & B: Plant communities C & D are resistant to significant succession. The adverse soil conditions and a theorized inadequate seed bank of high successional species greatly restrict potential for succession to State #1. Although succession usually does not occur within a reasonable length of time, anecdotal evidence indicates succession may occur with the combination of prescribed grazing, the resumption of a normal fire regime, and an extended period of favorable precipitation. Favorable environmental factors may favor succession of Plant Communities C and D to Plant Communities A and B, respectively. These possibilities are depicted by dashed arrows in the state and transition diagram. In comparison to “normal” ecological sites (Loamy 10-14” p.z., Clayey 10-14” p.z. and Sandy 10-14” p.z.) having soils > 20 inches in depth, the average annual aboveground production on this Dense Clay 10-14” p.z. ecological site is 50-60% less. Mechanical treatments and range seeding are not recommended on this site.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Native perennial grasses**			269–404	
	tufted wheatgrass	ELMA7	*Elymus macrourus*	135–202	–
	western wheatgrass	PASM	*Pascopyrum smithii*	135–202	–
2	**Native perennial grasses and grasslikes**			34–404	
	green needlegrass	NAVI4	*Nassella viridula*	101–202	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	34–101	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	34–101	–
3	**Native perennial grasses and grasslikes**			1–67	
	Grass, perennial	2GP	*Grass, perennial*	1–11	–
	blue grama	BOGR2	*Bouteloua gracilis*	1–11	–
	threadleaf sedge	CAFI	*Carex filifolia*	1–11	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	1–11	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	1–11	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	1–11	–
	Sandberg bluegrass	POSE	*Poa secunda*	1–11	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	1–11	–
Forb					
4	**Native perennial forbs**			7–34	
	American vetch	VIAM	*Vicia americana*	7–34	–
5	**Native perennial forbs**			1–28	
	Forb, perennial	2FP	*Forb, perennial*	1–11	–
	pussytoes	ANTEN	*Antennaria*	1–11	–
	aster	ASTER	*Aster*	1–11	–
	milkvetch	ASTRA	*Astragalus*	6–11	–
	bastard toadflax	COUM	*Comandra umbellata*	1–11	–
	beardtongue	PENST	*Penstemon*	1–11	–
	spiny phlox	PHHO	*Phlox hoodii*	1–11	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	1–11	–
	prairie thermopsis	THRH	*Thermopsis rhombifolia*	1–11	–
Shrub/Vine					
6	**Native shrubs and half-shrubs**			7–67	
	Nuttall's saltbush	ATNU2	*Atriplex nuttallii*	7–67	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	7–67	–
7	**Native shrubs and half-shrubs**			1–45	
	Shrub, broadleaf	2SB	*Shrub, broadleaf*	1–22	–
	silver sagebrush	ARCA13	*Artemisia cana*	1–22	–
	prairie sagewort	ARFR4	*Artemisia frigida*	1–22	–
	big sagebrush	ARTR2	*Artemisia tridentata*	1–22	–
8	**Native shrubs and half-shrubs**			1–2	
	plains pricklypear	OPPO	*Opuntia polyacantha*	1–2	–

Animal community

Livestock Management

The Dense Clay 10-14” p.z. ecological site is suited for livestock grazing. However, prescribed grazing management is needed. Forage production is limited by a hardpan and excessive sodium. 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 on soils with low shrink/swell potential. Grazing during early spring may result in soil compaction. Any additional factors reducing infiltration and increasing runoff on this site is a management concern. Shorter grazing periods, adequate periods of non-use following grazing to facilitate plant regrowth and an accumulation of litter are recommended.

The Dense Clay 10-14” p.z. ecological site that has large peds (aggregates) in the surface soil does not have a significant component of short grass species. The blocky clods and large cracks are not conducive for the growth of shallow-, lateral-rooted short grasses. In contrast, the soils without the large peds do have a short grass component as the site transitions from HCPC to other plant communities. The short grasses usually increase with grazing and decrease with adequate plant rest and recovery periods found in prescribed grazing management systems. However, succession in direct response to a change in grazing pressure 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, seeding and/or mechanical treatment are not recommended.

Wildlife Interpretations

The HCPC associated with the Dense Clay 10-14” p.z. 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 magnets for many species of wildlife. Antelope and mule deer prefer grazing this site because of the Nuttall saltbush and winterfat, which are high in protein and palatable year-round. However, the landscape does not provide adequate thermal and escape cover. The lack of species diversity limits the value of the site for many 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.

The Dense Clay 10-14” p.z. ecological site becomes less valuable for deer and antelope when plant diversity declines with regression. For example, the disappearance of either the tall warm season grass or cool season grasses would shorten the length of the “green forage” season and reduce the standing residual height. 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. Although Communities C and D have very little value for most wildlife species because of insufficient vegetative structural diversity, residual grass carry-over and litter cover, their habitat is critical for such species as the upland plover.

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 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 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. Photographers are able to capture the beauty of big bare areas with huge cracks, and the blossoms of pricklypear cactus.

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. 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

SCS-Range-417 2 1991-1992 MT Phillips

ECS-1
Modified Double Sampling 30 2001-2004 MT Blaine, Phillips, Valley, Daniels, Roosevelt

*The range inventories on Fort Peck and Belknap Reservations mapped thousands of acres of the Dense Clay range site. The inventory data indicated significant production of needleandthread and blue grama. The actual occurrence of these species on the Dense Clay 10-14” p.z. site needs to be verified in the field. It is suggested that the field review examine the relationship between the current and past mapping and classification of soils into the Dense Clay, Clay Pan and the former Panspots range sites.

USDA-SCS-MT 1981 Technical Range Site Description

Other references

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Approval

Kirt Walstad, 6/14/2023

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

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Date	03/30/2005
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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3. **Number and height of erosional pedestals or terracettes:** Pedestals or terracettes would essentially be nonexistent in HCPC. If in plant community A, careful examination on slopes > 8% yield occasional pedestals and terracettes approximately ¼ inch above the soil surface. If in plant community B, pedestals and terracettes are frequent and ½ - ¾ inch above the soil surface.

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

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

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

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

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

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The surface layer is usually 0-3” deep and typically have clay, silty clay and silty clay loam textures. Surface color ranges from light brownish gray to grayish brown. Soil organic matter ranges from 1-2% with a high of 3% and a low of 0.5%

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** In HCPC and Plant community A, 40-50% plant canopy and 30-65% basal cover with small gaps between plants should reduce raindrop impact and slow overland flow, providing increased time for infiltration to occur. Healthy, deep rooted native grasses enhance infiltration and reduce runoff. Infiltration rate is very slow. If in plant community B, 30-40% plant canopy and 30-40% basal cover with large gaps between plants, amplifies raindrop impact and increases overland flow. The site tends to be more xeric as runoff increases. Because of the high sodium content, exposed soil can develop a hard crust as the sodium disperses the soil particles.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer should be evident in any of the State 1 plant communities.
    Restrictive, very hard claypan begins at 3-4 inches.

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

    Sub-dominant: Plant community B: Short warm season rhizomatous grasses = short cool season bunch grasses > mid-stature, cool season rhizomatous grasses > shrubs = forbs.

Other:

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Plant mortality and decadence very low in HCPC and Plant community A. In periods of drought, shrubs would exhibit decadence in the state 1 reference communities.

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

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 600 - 1100 #/acre.

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

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