USDA Natural Resources
Conservation Service

Ecological site R053AE058MT
Loamy Steep (Lostp) (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.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This site occurs on slopes of rolling till plains, hills and hill slopes. Slopes are in excess of 15%. This site occurs on all exposures. Elevations normally range from 2000 to 3500 feet.

Table 2. Representative physiographic features

Landforms	(1) Till plain (2) Hill
Flooding frequency	None
Ponding frequency	None
Elevation	1,875–3,800 ft
Slope	15–60%
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)	12 in

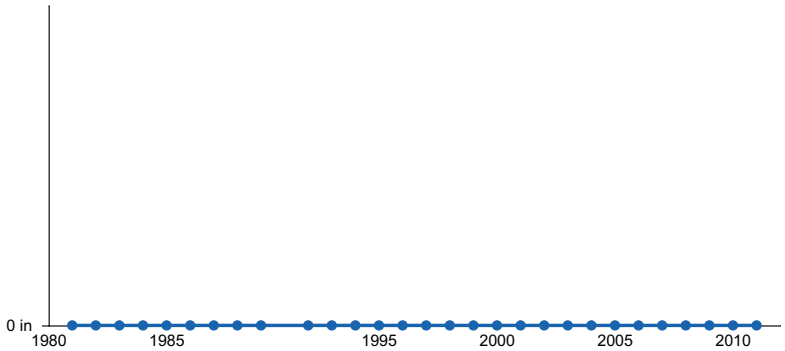


Figure 1. Annual precipitation pattern

Influencing water features

Soil features

These soils formed in glacial till. The surface layer of these soils vary from 0-3 inches in depth and typically have loam, silt loam, gravelly loam or silty clay loam texture. Underlying material, to a depth of 60 inches or more, has a clay loam texture. Permeability is moderate to moderately slow, and available water capacity is high. Effective rooting depth is >60 inches. Where this soil is under native vegetation, the average wetting depth is about 24 inches. Runoff is medium to very high rapid, and the hazard of water erosion is high. The hazard of soil blowing is also high. Soils are often calcareous. The following soil taxonomic units characterize this site: Zahill and Hillon. Soil ph normally ranges from 7.4 to 8.4.

Table 4. Representative soil features

Surface texture	(1) Gravelly loam (2) Silt loam (3) Clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Slow to moderately slow
Soil depth	20–72 in
Surface fragment cover <=3"	0–35%
Surface fragment cover >3"	0–5%
Available water capacity (0-40in)	4–7 in
Calcium carbonate equivalent (0-40in)	0–15%
Electrical conductivity (0-40in)	0–4 mmhos/cm
Sodium adsorption ratio (0-40in)	0–8
Soil reaction (1:1 water) (0-40in)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–10%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

This ecological site developed under Northern Great Plains climatic conditions, the natural influence of herbivory and a fire frequency of 5-7 years (Frost 1998). Plant community interpretations are based on the Historic Climax Plant Community (HCPC).

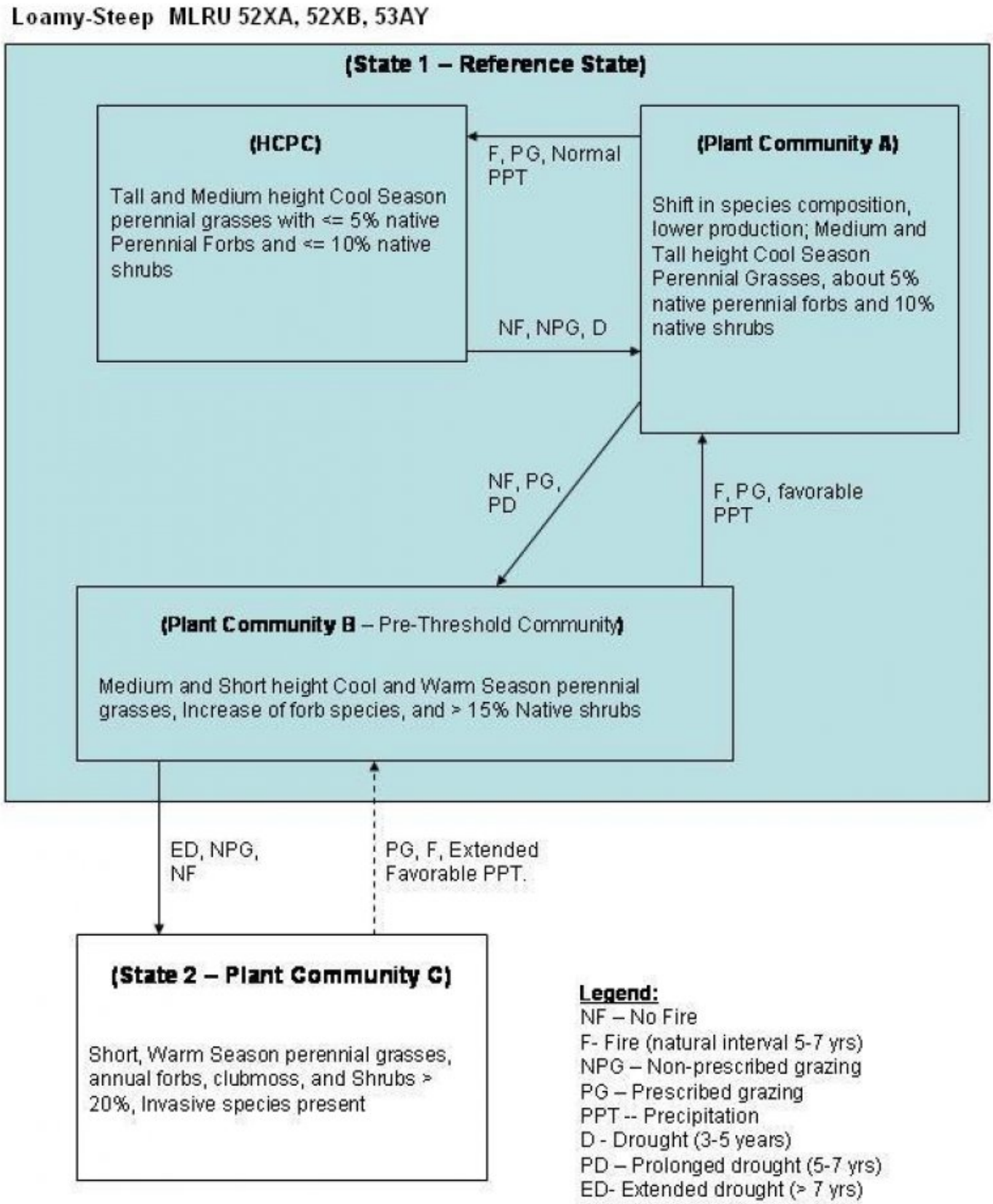
Changes in the HCPC are brought about by frequency, timing and intensity of past grazing use, series of dry or wet years, or disturbances by fire, insect infestations, noxious weed colonization and recruitment, etc. As the HCPC regresses to lower seral stages, the deep-rooted perennial grasses are replaced by blue grama, sandberg bluegrass, fringed sagewort, hoods phlox, threadleaf sedge, hairy gold aster, and dense clubmoss. The dominance of these short grasses, warm season forbs and half-shrubs in the plant community disrupts ecological processes, impairs the biotic integrity of the site, and adversely affects resiliency. The system's ability to recover to higher seral states is restricted or impeded.

State and Transition Diagram

Traditional theories of plant succession leading to a single climax community are inadequate for understanding the complex successional pathways of this ecological site in the glaciated plains (Stringham et al. 2003). This ecological site is more aptly described using state-and-transition vegetation dynamics in a non-linear framework. A "state" is an alternative, persistent vegetation community that is not simply reversible in the linear successional framework. States are depicted as seral stages, while pathways between states are "transitions." The latter can be transient or persisting (crosses a threshold). Transitions may be triggered by climatic events, fire, grazing, farming, etc.

Three important plant communities and associated successional pathways for the Reference state (State #1), and the transitions across a threshold to State #2 are illustrated below for the Loamy-Steep site in the Glaciated Plains.

State and transition model



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

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

The interpretive plant community for this site is the Historic Climax Plant Community (HCPC). Cool and warm season tall and mid-grasses (such as little bluestem, bluebunch wheatgrass, green needlegrass, western wheatgrass, thickspike wheatgrass, porcupine grass and needleandthread grass) dominate the HCPC. These grasses represent about 75% of the total annual plant production in the community. Little bluestem is the dominant bunchgrass on Loamy-Steep sites in the eastern Glaciated plains. Less common species in the HCPC include short grasses and sedges (plains muhly, prairie junegrass, threadleaf sedge, plains reedgrass and blue grama). These short grasses and grasslike plants contribute about 10% of the annual production. Dotted gayfeather, black sampson, scurfpeas, and prairie clovers are important warm season forbs. American vetch may be the most important cool season forb. In addition to being desirable forage, it also fixes nitrogen. Total forb production normally represents less than 5% of the total annual production. Winterfat is a common warm season shrub that is highly prized as browse for livestock and wildlife. Rose and snowberry, two cool season shrubs often are present on the site. Silver sagebrush and fringed sagewort, two warm season shrubs may also be found on the site. Overall, shrubs account for about 10% of the annual plant production. Annual production of the Historic Climax Plant Community (HCPC) on Silty-Steep 10-14” p.z. ecological sites in the Glaciated Plains is not fully documented by either range inventory data collected (in 2001 and 2004) on the Fort Peck or Fort Belknap Indian Reservations, or with soil-vegetation correlation data (NRCS-417 Forms) in Northeastern Montana. Inventory data indicates that Similarity indices (SI) of 55-75% were associated with annual production estimates of 925 lbs/ac. Thus, 1200 lb/ac is accepted as a reasonable average production estimate for the HCPC, as inventoried and reported in the August 1981 range site description. Average annual production is expected to increase and decrease, respectively on more mesic and xeric portions of the eastern Glaciated plains. The HCPC is well adapted to the Glaciated Plains. Precipitation is the most important factor influencing production (Heitschmidt et al 2005). The functional and structural diversity of plant species (annuals, perennials, cool and warm season grasses, forbs and shrubs) optimize the capture of solar energy and maximize subsequent plant growth through the efficient use of available soil water and nutrient cycling. When disturbances reduce the competitiveness of tall cool season grasses of the HCPC, warm season perennial forbs (hairy golden aster, scurfpea), annual forbs (wooly plantain, etc.) half-shrubs (fringed sagewort, etc.) and annual bromes often invade the community. The HCPC is resilient. With proper grazing management and non-drought conditions, the species characteristic of the HCPC will replace these lower successional species within a few years. Litter is in contact with 50-60% of the soil surface. About 10% of the soil surface is bare ground (i.e., unprotected by litter, rock, moss, and plant canopy). Because of the slope, vegetation and soils, rills, water flow patterns, and some movement of litter are noticeable following a rainfall event.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	725	1020	1230
Shrub/Vine	85	120	150
Forb	40	60	70
Total	**850**	**1200**	**1450**

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	0-5%
Biological crusts	0-2%
Litter	50-55%
Surface fragments >0.25" and <=3"	0-3%
Surface fragments >3"	0-2%

Bedrock	0%
Water	0-1%
Bare ground	0-10%

Table 7. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	5-10%
Grass/grasslike basal cover	20-25%
Forb basal cover	1-5%
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 (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	15-25%	5-15%	35-45%
>0.5 <= 1	–	35-45%	35-45%	45-55%
>1 <= 2	–	25-35%	35-45%	5-10%
>2 <= 4.5	–	5-15%	5-15%	0-5%
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.2
Plany Community A (State #1)

*Successional pathway from HCPC to Community A (State #1): Successional pathways from the HCPC are influenced by frequency, timing and intensity of grazing, precipitation patterns, fire, insect infestations, noxious weed colonization and recruitment, etc. As communities regress from HCPC, medium and short grasses increase at the expense of mid and tall cool season grasses. The medium and short grasses consist of cool (prairie junegrass, upland sedges, and sandberg bluegrass) and warm season grasses (blue grama and plains reedgrass) and grasslike plants. Plant Community A (State #1): Total plant production averages about 1,000 lbs/ac in this Plant Community, or about 80% of the production in the HCPC. The decrease in production results from a shift in species composition. Needleandthread grass, threadleaf sedge, blue grama and plains reedgrasss increased at the expense of the tall, more palatable grasses (bluebunch wheatgrass, green needlegrass, western/thickspike wheatgrasses and little bluestem). In comparison to the HCPC, production of blue grama, prairie junegrass, plains reedgrass, threadleaf sedge and other short grasses increased. They now account for about 20% of the total annual production. Exact response by these species varies with the kind of disturbance (drought, grazing, etc.) and with precipitation (amount and timing). Total production of native forbs remains at about 5% of annual production of the site. However, the palatable species (prairie clovers, American vetch and dotted gayfeather) decrease in abundance

(relative to the HCPC). The open niches allow hairy goldenaster, bastard toadflax, prairie thermopsis, etc. to become more abundant. Shrubs continue to account for about 10% of the total production. However, species such as fringed sagewort and silver sagebrush increase (relative to the HCPC). Similarity index values from 55-75% are associated with this community. In contrast to the HCPC, range conservationists have moderate concerns regarding lower successional plants, lower infiltration rates and potentially higher runoff rates, plant functional/structural group shifts, and decreasing amount of litter. *Successional Pathway from Community A to HCPC: Plant Community A is resilient. Successional processes can readily return Plant Community A to the HCPC during normal precipitation cycles. Succession is facilitated by prescribed grazing, the incorporation of the natural fire regime into the system, etc. *Successional Pathway from Community A to Community B: Plant community A is resistant. However, prolonged drought, non-prescribed grazing, and the removal of fire from the system will result in retrogression to Community B. The causative factors of regression are usually apparent with careful observation.

Community 1.3
Plant Community B (State #1)

Plant Community B is dominated by needleandthread grass, blue grama, plains reedgrass, prairie junegrass and upland sedges. However, individual plants of green needlegrass, western/thickspike wheatgrass and little bluestem remain in the Community. The short grass and grass-like plants make up about 30% of the total production. Total vegetative production declines to about 800 lbs/ac in a normal year. Hairy goldenaster, scarlet globemallow, scurfpeas and other warm season forbs increase at the expense of the prairie clovers and American vetch. Forbs account for about 10% total annual production. Fringed sagewort, a half-shrub increases at the expense of winterfat. Silver sagebrush and rose also increase on some sites. Shrubs account for about 15% of the total plant production. SI values for this community vary from 35-55%. Litter provides cover for about 30% of the ground, while bare ground increases to about 25%. Rills, water flow patterns and litter movement are evident on the site. The tall cool season grasses have poor vigor, with little seed production. Most of the seedlings and young plants appear to represent short grasses and warm season forbs. Lower successional plant species and some invasive species are a significant part of the community. Japanese brome and cheatgrass are usually present wherever rodents or other disturbances create an open niche. Plant Community B is fairly resilient, but it is not highly resistant to disturbance. It is the “pre-threshold” community. Therefore, it is critical that this community be recognized and strategies implemented to prevent further regression. Community B can readily regress to a lower state, from which succession back to the HCPC community or Plant Community A would be restricted. *Successional Pathway from Community B to Higher Communities: Favorable precipitation and prescribed grazing are normally required for succession to higher successional communities (Community A or HCPC). Management strategies should focus on grazing deferment to increase vigor and seed production of desirable plants, and to increase litter cover. Increasing litter is extremely critical because of the steep slopes. *Transition from Community B to State #2: Plant Community B will regress to a lower state with any combination of extended drought, non-prescribed grazing and unfavorable climatic patterns. This transition from Community B to State #2 represents a threshold, or a point in space and time at which one or more of the primary ecological processes responsible for maintaining the sustained equilibrium of the state degrades beyond the point of self-repair.

State 2
Plant Community C (State #2)

Community 2.1
Plant Community C (State #2)

State #2 is dominated by blue grama, prairie junegrass, sandberg bluegrass, prairie sandreed, other short grasses, and clubmoss. However, a few individual western wheatgrass, little bluestem, etc. plants seem to persist longer than they do on surrounding ecological sites. The ability of these palatable plants to persist on the Loamy-Steep site is probably a reflection of lighter grazing use. Cattle prefer grazing areas with less than 15% slope, and those areas adjacent to livestock water developments. Red threeawn, Japanese brome and cheatgrass often invade this Community. Wooly plantain, hoods phlox, hairy goldenaster and bastard toadflax are common forbs. Fringed sagewort usually increases. Silver sagebrush and rose may also increase. The most palatable shrubs are nearly absent. SI values of less than 25% are associated with State #2. Surface runoff and soil erosion are a serious concern on the Loamy-Steep site. The decrease in plant cover and litter increases the susceptibility to erosion. Less vegetative growth is available for transfer to litter, and nutrient cycling is delayed or impeded. As bare ground increases, infiltration decreases and/or surface runoff and soil evaporation increases. Because ecological

processes of the site are no longer balanced and sustained, shallow rooted, warm season species continue to gain a competitive advantage over the deep rooted, cool season species. The biotic integrity of the site is degraded. In comparison to the State #1 communities, State #2 is less efficient in capturing solar energy and converting it to carbohydrates for plant growth. Total vegetative production averages about 400 lbs/ac. The absence of tall and mid cool season perennial grasses, plus the shift from cool season plants to warm season plants, indicates that the structural and functional processes of this site have been disrupted. However, if the soil surface is stable and does not erode, site potential may not be significantly impaired. *Transition from State #2 to State #1: Plant community succession across a threshold to a higher state is ecologically difficult in most ecosystems. A significant input of energy is often required for succession to occur. However, in the eastern Glaciated Plains, significant succession on Clayey and Shallow Clay was facilitated by the implementation of prescribed grazing, and a favorable precipitation pattern (Branson and Miller 1981). Although it is not known whether a threshold was crossed, their research clearly demonstrates that ecological processes can be maintained and/or restored, and succession to higher communities is possible. The rate of succession measured on Willow Creek was logically influenced by the genetic pool of HCPC plants (seed plants, rhizomes, and seed bank) remaining on the site (Dyksterhuis 1949). In instances of prolonged favorable climatic conditions combined with proper management, the significant input of energy that is normally required to move this site across the threshold (from State #2 to State #1) may not be needed. Because of the steep slopes, mechanical treatments and range seeding are not recommended. Ranchers should be aware of the limitations of this site. Rather than trying to change nature, managers must learn to live within the environmental boundaries of this site. Prescribed grazing management should be a requirement for this site.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Native perennial grasses**			180–360	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	90–180	–
	western wheatgrass	PASM	*Pascopyrum smithii*	90–180	–
2	**Native perennial grasses**			1–1020	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	1–300	–
	little bluestem	SCSC	*Schizachyrium scoparium*	200–300	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	120–240	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	90–180	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	90–180	–
	green needlegrass	NAVI4	*Nassella viridula*	90–180	–
3	**Native perennial grasses and grasslikes**			1–120	
	Grass, perennial	2GP	*Grass, perennial*	1–40	–
	blue grama	BOGR2	*Bouteloua gracilis*	1–40	–
	threadleaf sedge	CAFI	*Carex filifolia*	1–40	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	1–40	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	1–40	–
	Sandberg bluegrass	POSE	*Poa secunda*	1–40	–
Forb					
4	**Native perennial forbs**			12–60	
	dotted blazing star	LIPU	*Liatris punctata*	12–60	–
	American vetch	VIAM	*Vicia americana*	12–60	–
5	**Native perennial forbs**			12–60	
	white prairie clover	DACA7	*Dalea candida*	12–60	–

	white prairie clover	DACA7	*Dalea candida*	12–60	–
	purple prairie clover	DAPU5	*Dalea purpurea*	12–60	–
6	**Native perennial forbs**			1–60	
	Forb, perennial	2FP	*Forb, perennial*	1–10	–
	pussytoes	ANTEN	*Antennaria*	1–10	–
	aster	ASTER	*Aster*	1–10	–
	milkvetch	ASTRA	*Astragalus*	1–10	–
	bastard toadflax	COUM	*Comandra umbellata*	1–10	–
	buckwheat	ERIOG	*Eriogonum*	1–10	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	1–10	–
	beardtongue	PENST	*Penstemon*	1–10	–
	spiny phlox	PHHO	*Phlox hoodii*	1–10	–
	scurfpea	PSORA2	*Psoralidium*	1–10	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	1–10	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	1–10	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	1–10	–
	prairie thermopsis	THRH	*Thermopsis rhombifolia*	1–10	–
	lesser spikemoss	SEDE2	*Selaginella densa*	0–1	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–1	–
Shrub/Vine					
7	**Native shrubs and half-shrubs**			15–60	
	winterfat	KRLA2	*Krascheninnikovia lanata*	15–60	–
8	**Native shrubs and half-shrubs**			1–120	
	Shrub, broadleaf	2SB	*Shrub, broadleaf*	1–30	–
	silver sagebrush	ARCA13	*Artemisia cana*	1–30	–
	prairie sagewort	ARFR4	*Artemisia frigida*	1–30	–
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	1–30	–
	creeping juniper	JUHO2	*Juniperus horizontalis*	1–30	–
	rose	ROSA5	*Rosa*	1–30	–
	snowberry	SYMPH	*Symphoricarpos*	1–30	–
9	**Native shrubs and half-shrubs**			0–1	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–1	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–1	–

Animal community

Livestock Management

This site evolved with trampling, defoliation (ungulates, grasshoppers and jackrabbits, and other herbivores), fire and drought. Its plant communities are moderately resistant to disturbances which may alter ecological processes. They are also moderately resilient. Following perturbations such as drought, which allows blue grama and other increasers to increase at the expense of the mid and tall grasses, succession occurs with subsequent rainfall. Thus, the HCPC, or Communities A and B may be present at any given time in State #1. During “average” years, the site has the potential to produce 1200 lbs of forage per acre.

Forage production shows far greater variations in response to changes in annual precipitation than to different grazing intensities (Heitschmidt et al 2005) However, proper stocking rates and prescribed grazing is needed to ensure that the site remains in a high seral or HCPC state. Without proper grazing management the mid-to-tall grass community will regress to a blue grama, prairie junegrass, dense clubmoss community. In comparison to the high seral state, suggested stocking rates on sites in the early seral state represent a 4-fold reduction. Experience indicates that prescribed grazing prevents further deterioration in State #2. Furthermore, significant plant succession may occur within a reasonable time frame. Very few livestock losses are reported from poisonous plants.

Similarity index values of 35-55% characterized most of the Loamy-Steep sites inventoried on the Fort Peck and Fort Belknap Reservations in 2001-2004. SI values of less than 25% were not encountered. In contrast, SI's of less than 25% were frequently associated with adjacent Loamy sites. Similar observations occur on other ranches in the Glaciated Plains. In contrast to adjacent Loamy site (often near water) where very few highly palatable cool season grasses remain because of repeated, frequent grazing events, a fairly diverse mix of desirable, cool season plants often grow on the Loamy-Steep site. The higher range health rating of this site probably results from less livestock grazing. Utilization of plants growing on slopes and on sites more distant from water developments is normally less than it is for plants growing on lower, more gently sloping terrain that is situated near watering facilities.

This site is suitable for livestock grazing from May through October. The grass-dominant plant community is better suited for cattle, rather than sheep grazing.
However, sheep are better adapted to grazing the steep slopes, especially if watering facilities are relatively distant. Therefore, a mix of cattle and sheep usage often merits consideration.

Wildlife Interpretations

State #1 of the Loamy-Steep ecological site includes the HCPC and two additional communities. This state provides forage for mule deer during most of the year. However, the overall forage potential is limited by the relatively low production and diversity of forbs and shrubs. Low shrub cover also limits the potential of the site for thermal and escape cover. Most deer use occurs along the edges of the site where it borders deciduous wooded draws, badland sites, etc.

Species diversity and cover associated with the HCPC or other communities in the Reference State also provide habitat for sharp-tailed grouse and other upland birds. Most wildlife usage occurs along the "ecotones" between the Loamy-Steep site and wooded draws. The relative absence of big sagebrush limits the potential of this site for sage grouse habitat. The few sage grouse that exist in the Glaciated Plains are associated with silver sagebrush.

Species diversity and litter also provide favorable habitats for deer mice, rabbits and other small mammals. Golden eagles, redtail and ferruginous hawks are often circling over the landscape searching for prey.

Communities that are in State #2 are much less suitable for big game, upland birds and most species of small mammals. Prairie dogs usually are not a problem on Loamy-Steep sites because slopes are greater than 15%. Prairie dogs prefer slopes of 1-10%.

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

Soils associated with this ecological site are in Hydrologic Soil Groups B and C. Infiltration rates are generally moderate. The runoff potential is medium to very high, varying with slope and ground cover.

Good hydrologic conditions exist on Loamy-Steep sites that are either in a high seral state or at the HCPC (State #1). Canopy cover (grass, forbs and shrubs) is greater than 90% in these communities, which is conducive to high infiltration rates and minimizes runoff and erosion.

Communities in early seral states (State #2) are generally considered to be in poor hydrologic condition. Concerns

are valid. The excessive amount of bare ground results from inadequate plant cover and litter. Therefore, infiltration decreases and surface runoff increases. The desirable tall and mid-grasses are unable to effectively utilize available moisture. Water and wind erosion are major concerns on Loamy-Steep sites. Prescribed grazing management is needed to restore vigor of the higher-successional plants and to replenish or maintain about 50% litter to protect the soil resource.

Recreational uses

Hunters are probably the most common recreational user this ecological sites. The site is also used by hikers and photographers. Many of these sites show symptoms of exuberant off-road ATV use. ATV use should be discouraged on these sites.

Wood products

This site has no significant value for wood products.

Other information

The Loamy-Steep ecological site in the eastern Glaciated Plains is resistant to perturbations. However, the site loses its resiliency when the plant community regresses from State #1 to State #2. Reproductive capability of the higher successional plants and annual production declines as the site moves toward the threshold separating State #1 from State #2. Annual production in early seral states is less than 1/4 of the potential at HCPC. Thus, litter and the number of structural/functional groups are adversely affected.

Inventory data references

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Approval

Kirt Walstad, 6/14/2023

Rangeland health reference sheet

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

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

Indicators

1. **Number and extent of rills:** Careful examination will yield slight evidence of rills following a rainfall event in HCPC. If in Plant community A, careful examination will yield slight evidence of rills regardless of precipitation event. In HCPC and in plant community A, rill would be less than ½ inch deep, linear, but short in length. If in Plant community B, rills are readily observed; regularly spaced, ½ inch deep, linear and exceeding 1 foot but not exceeding 3 feet.

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2. **Presence of water flow patterns:** Careful examination will yield slight evidence of water flow patterns following a rainfall event in HCPC. If in Plant community A, careful examination will yield slight evidence of water flow patterns regardless of precipitation event. If in Plant community B, water flow patterns are readily observed.

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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 will 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):** Up to 10% of the soil surface is bare ground in HCPC & Plant community A. If in Plant Community B, 11 to 25% of the soil surface is bare ground.

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5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present. Existing gullies should be ″healed″ with a good vegetative cover in all State 1 reference plant communities.

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

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7. **Amount of litter movement (describe size and distance expected to travel):** Some litter movement is evident following a rainfall event in HCPC. If in Plant community A, some litter movement is evident regardless of precipitation event. If in Plant community B, litter, both fine and coarse, movement is readily observable.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class anticipated to be 4 to 6.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The surface layer is 0-7" deep and typically have loam, silt loam, gravelly loam or silty clay loam textures. Surface color ranges from dark grayish brown to dark brown. Soil organic matter ranges from 0.5-2% with a high of 4%.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** In HCPC, 85-90% plant canopy and 75-80% 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 moderate to moderately slow. If in plant community A, 85-90% plant canopy and 75-80% basal cover with small gaps between plants will still reduce raindrop impact and decrease overland flow. If in plant community B, 30-60% plant canopy and 50-75% basal cover with moderate gaps between plants, intensifies raindrop impact and increases overland flow. The site tends to be more xeric as runoff increases.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer or soil surface crusting should be evident in any of the State 1 plant communities.

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

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

    Sub-dominant: Plant community B: Mid-stature cools season bunch grasses > mid-stature, cool season rhizomatous grasses > short stature, warm 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 40-50% and depth is reduced to 0.5 inch. Litter decreases to about 10% in Plant community B and is less than ¼ inch deep.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 800 - 1450 #/acre from Plant community B to HCPC.

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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:** Needle and thread, threadleaf sedge, Hood's phlox, prickly pear, creeping juniper, fringed sagewort, blue grama.

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17. **Perennial plant reproductive capability:** All species are capable of reproducing 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.
