Ecological site R053AE061MT
Clayey (Cy) (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 usually consists of deep soils on flood plains and fans, tills from heavy clay shales on the till plain, and moderately deep soils on uplands. Slopes vary from 1- 15%, but are usually less than 8%. Elevations generally range from 2,000 to 3,500 feet.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Alluvial fan (3) Terrace
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to rare
Ponding frequency	None
Elevation	570 – 1,220 m
Slope	0 – 20 %
Water table depth	180 cm

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)	130 days
Freeze-free period (average)	100 days
Precipitation total (average)	310 mm

Influencing water features

Soil features

These soils formed in place in glacial till underlain by shale. Some of the soils formed in material derived from shale or in alluvium derived from glacial till or shale. The alluvium was deposited in the valleys on some of the bordering uplands, low terraces, fans and flood plains. The light brownish gray clay surface layer of these soils is usually less than 5 inches in depth. The clay soils are more than 20 inches deep. Soils are well drained. Permeability is very slow. Soil ph varies from 6.1-8.4. This site is characterized by the following soil components: Abor, Lohler, Marias, Bacovey, and Marvan.

Table 4. Representative soil features

Surface texture	(1) Clay loam (2) Silty clay loam (3) Silty clay
Drainage class	Moderately well drained to well drained
Permeability class	Very slow
Soil depth	50 – 180 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified

Available water capacity (0-101.6cm)	10.16 – 15.24 cm
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	6.1 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	0 – 10 %
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

This ecological site developed under Northern Great Plains climatic conditions, geological parent materials, fire, biotic factors, and under the natural influence of herbivory. Research consistently shows that precipitation is the principle 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). Fires were ignited by lightning and by early Americans whom were striving to manipulate their environment. Periodic burns would have favored grasses over shrubs, adversely impacted dense clubmoss, attracted herbivory into an area, and altered nutrient cycling and the hydrologic cycle.

The resultant historic climax plant community (HCPC) is the basis for plant community interpretations. The HCPC was determined by evaluating relic areas, and other areas protected from excessive disturbance. The HCPC is comprised of a mixture of tall and medium height cool and warm season grasses, native forbs and native shrubs. About 80% of the annual production is from grasses and grasslike plants, most of which are produced during the cool season. Forbs and shrubs contribute 15% and 5%, respectively to total annual production. Total vegetative production averages 1300 lbs/ac in normal years, 1800 lbs/ac during favorable years, and 900 lbs/ac during unfavorable years.

This ecological site is highly resistant and resilient to disturbance as it has only minor soil limitations for plant growth. Departures from HCPC generally result from management actions, drought, colonization and recruitment of noxious weeds, and a change in the natural fire regime. Under continued adverse impacts, vegetative vigor declines and the HCPC species are gradually out-competed by lower-successional species. This shift in species composition is most evident as the deep-rooted cool season perennial grasses (such as green needlegrass and western/thickspike wheatgrasses) are replaced by short warm season grasses (blue grama, sandberg bluegrass), fringed sagewort (a half-shrub), and forbs including western wallflower, scarlet globemallow, western yarrow and biscuitroot. The dominance of these short grasses, non-nitrogenous-fixing forbs, and warm season half-shrubs disrupts ecological processes, impairs the biotic integrity of the site, and restricts the system’s ability to recover to higher seral states. Thus, the site loses much of its resiliency.

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 (Briske et al 2005). This 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 are triggered by climatic events, fire, grazing, farming, burning, etc.

Three important 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 Plant Community B (State #1) to Plant Community C (State #2), and a transition from State #1 to State #3 are also illustrated. Ecological processes are discussed in the plant community descriptions which follow the diagram.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	**Native perennial grasses**			1-953	
	green needlegrass	NAVI4	*Nassella viridula*	437-729	–
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	1-224	–
2	**Native perennial grasses**			437-729	
	tufted wheatgrass	ELMA7	*Elymus macrourus*	219-364	–
	western wheatgrass	PASM	*Pascopyrum smithii*	219-364	–
3	**Native perennial grasses and grasslikes**			15-146	
	Grass, perennial	2GP	*Grass, perennial*	15-45	–
	blue grama	BOGR2	*Bouteloua gracilis*	15-45	–
	needleleaf sedge	CADU6	*Carex duriuscula*	15-45	–
	threadleaf sedge	CAFI	*Carex filifolia*	15-45	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	15-45	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	15-45	–
	Sandberg bluegrass	POSE	*Poa secunda*	15-45	–
Forb					
4	**Native perennial forbs**			29-146	
	dotted blazing star	LIPU	*Liatris punctata*	15-73	–
	American vetch	VIAM	*Vicia americana*	15-73	–
5	**Native perennial forbs**			29-146	
	white prairie clover	DACA7	*Dalea candida*	15-73	–
	purple prairie clover	DAPU5	*Dalea purpurea*	15-73	–
6	**Native perennial forbs**			1-45	
	Forb, perennial	2FP	*Forb, perennial*	1-28	–
	common yarrow	ACMI2	*Achillea millefolium*	1-28	–
	pussytoes	ANTEN	*Antennaria*	1-28	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	1-28	–
	aster	ASTER	*Aster*	1-28	–
	milkvetch	ASTRA	*Astragalus*	1-28	–
	bastard toadflax	COUM	*Comandra umbellata*	1-28	–
	buckwheat	ERIOG	*Eriogonum*	1-28	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	1-28	–
	beardtongue	PENST	*Penstemon*	1-28	–

	spiny phlox	PHHO	*Phlox hoodii*	1-28	–
	white milkwort	POAL4	*Polygala alba*	1-28	–
	scurfpea	PSORA2	*Psoralidium*	1-28	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	1-28	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	1-28	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	1-28	–
	prairie thermopsis	THRH	*Thermopsis rhombifolia*	1-28	–
	lesser spikemoss	SEDE2	*Selaginella densa*	0-1	–
Shrub/Vine					
7	**Native shrubs and half-shrubs**			29-73	
	Nuttall's saltbush	ATNU2	*Atriplex nuttallii*	15-73	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	15-73	–
8	**Native shrubs and half-shrubs**			1-45	
	Shrub, broadleaf	2SB	*Shrub, broadleaf*	1-17	–
	silver sagebrush	ARCA13	*Artemisia cana*	1-17	–
	prairie sagewort	ARFR4	*Artemisia frigida*	1-17	–
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	1-17	–
	creeping juniper	JUHO2	*Juniperus horizontalis*	1-17	–
	rose	ROSA5	*Rosa*	1-17	–
	snowberry	SYMPH	*Symphoricarpos*	1-17	–
9	**Native shrubs and half-shrubs**			0-1	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0-1	–
	brittle pricklypear	OPFR	*Opuntia fragilis*	0-1	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0-1	–

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 9. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Animal community

Livestock Management This site evolved with trampling, defoliation (grasshoppers, jackrabbits, deer, elk, bison, antelope, prairie dogs and other herbivores), fire and drought. The site is highly resistant and resilient to disturbances which may alter its ecological processes. Following perturbations such as drought, which allows blue grama and other short grasses to increase at the expense of the mid and tall grasses, succession occurs during years of favorable precipitation. The site has the potential to produce 900-1800 lbs of forage per acre. Under typical grazing practices, very few livestock losses are reported from poisonous plants. Forage production shows far greater variations in response to changes in annual precipitation than to different grazing intensities (Branson, 1985). However, proper stocking rates and a planned grazing system are 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 an early seral state (blue grama, prairie junegrass, sandberg bluegrass, hoods phlox, wooly plantain, and annual bromes). Suggested stocking rates decrease from about 2.8 acres/AUM in the HCPC to about 10 acres/AUM in the early seral state (State #2). Plant succession in communities that are inhabited with prairie dogs is unlikely until the prairie dogs are controlled. This site is usually grazed by livestock from May through October. Some ranchers utilize the Clayey 10-14" p.z. ecological site for fall and early winter grazing. However, storms are a threat. It is recommended that livestock either have access to

adjacent wooded draws, or provide a good animal trail leading to headquarters for protection in winter and during storm events. Because of the predominant wheatgrass composition, the site is better-suited for cattle, rather than sheep grazing. Wildlife Interpretations The Clayey 10-14” p.z. ecological site that is in the reference state (State #1) provides forage for mule deer and antelope 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 on the site occurs along the edges where it borders woody draws, badland range sites, etc. The species diversity and cover associated with the HCPC and with other communities in State #1 provides habitat for sharp-tailed grouse and other upland birds. Much of the use occurs along the ecotones between the Clayey 10-14” p.z. site and wooded draws where deciduous tree and shrub cover increase. 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 usually 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. Sites that are characterized by communities in mid to early seral stages are less suitable for big game, upland birds and small mammals. However, they are more suitable for prairie dogs. Prairie dog towns also have potential for use by burrowing owls, upland plovers, and other wildlife species.

Hydrological functions

Soils series in the Clayey 10-14” p.z. fall into the C and D hydrologic groups. Runoff potential varies from low to high, depending on slope, ground cover, and rangeland health. Infiltration rates also vary with environmental conditions. Good hydrologic conditions exist on this site when it is in State #1. Canopy cover (grass, forbs and shrubs) is greater than 90% in these communities. Plant cover and litter are adequate to optimize infiltration and minimize runoff and erosion. Sites in early or low seral state (State #2) are generally considered to be in poor hydrologic condition.

Recreational uses

Hunters are probably the most common recreational user of Clayey 10-14” p.z. ecological sites. The site is also used by hikers and photographers.

Wood products

None

Other products

None

Other information

None

Inventory data references

SCS-Range-417 3 1991-1992 MT Phillips ECS-1 Modified Double Samplings 19 2001-2004 MT Blaine, Roosevelt, Sheridan, Phillips, Valley

Other references

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Approval

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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	
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. If in plant community A, careful examination will yield slight evidence of rills that are less than ½ inch deep, linear, but short in length. If 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 observable in HCPC. If in plant community A, careful examination will yield short discontinuous water flow patterns. If 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):** Less than 5-10% of the soil surface should be bare in HCPC. Bare ground should be less than 2" in diameter. If in plant community A, 10-20% of the soil surface can be exposed. If in plant community B, >20% of the soil surface can be exposed.

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

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7. **Amount of litter movement (describe size and distance expected to travel):** Litter movement is not expected with HCPC. If in plant community A, careful examination will yield some fine litter movement for a short distance. If in plant community B, litter, both fine and coarse, movement is visible, especially on slopes > 8%, but the distance moved is less than 1 foot.

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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 5 or 6 under plant canopy.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The light brownish gray clay surface layer is 5-7" deep. The surface texture ranges from clay loam, silty clay, silty clay loam and clay. Soil organic matter is usually 1-2% with a high of 3% and a low of 0.5%.

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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, 90-95% plant canopy and 80-85% 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 slow. If in plant community A, 50-80% plant canopy and 20-35% basal cover with moderate gaps between plants will intensify raindrop impact and increase overland flow, causing decreased time for infiltration. If in plant community B, 10-40% plant canopy and 10-20% basal cover with sizeable gaps between plants, amplifies 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: HCPC: Tall and mid-stature, cool season bunch grasses > mid-stature, cool season rhizomatous grasses> short stature, warm season rhizomatous grasses> forbs >shrubs. Plant community A: Tall and mid-stature, cool season bunch grasses > mid-stature, cool season rhizomatous grasses> short stature, warm season rhizomatous > shrubs > forbs.

Sub-dominant: Plant community B: Short warm season perennial grasses > few mid-stature warm and cool season perennial grasses>forbs>shrubs.

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 10-20% and depth is reduced to 0.5 inch. Litter decreases to less than 20% in Plant community B and is less than ½ inch deep.**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production): 900 - 1800 #/acre from Plant community B to HCPC in the State 1 reference community.**

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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, prairie junegrass, needleleaf sedge, curly cup gumweed, Sandberg bluegrass, fringed sagewort, plains prickly pear, broom snakeweed, leafy spurge.**

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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.**
