

Ecological site R052XC205MT

Clayey (Cy)

10-14" p.z.

Last updated: 4/14/2025

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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.

MLRA notes

Major Land Resource Area (MLRA): 052X–Brown Glaciated Plains

The Brown Glaciated Plains, MLRA 52, is an expansive and agriculturally and ecologically significant area. It consists of around 14.5 million acres and stretches across 350 miles from east to west, encompassing portions of 15 counties in north-central Montana. This region represents the southwestern limit of the Laurentide Ice Sheet and is considered to be the driest and westernmost area within the vast network of glacially derived prairie pothole landforms of the northern Great Plains. Elevation ranges from 2,000 feet (610 meters) to 4,600 feet (1,400 meters). Soils are primarily Mollisols, but Entisols, Inceptisols, Alfisols and Vertisols are also common. Till from continental glaciation is the predominant parent material, but alluvium and bedrock are also common. Till deposits are typically less than 50 feet thick, and in some areas glacially deformed bedrock occurs at or near the soil surface (Soller, 2001). Underlying sedimentary bedrock largely consisting of Cretaceous shale, sandstone, and mudstone (Vuke et al., 2007) is commonly exposed on hillslopes, particularly along drainageways. Significant alluvial deposits occur along glacial outwash channels and major drainages, including portions of the Missouri, Teton, Marias, Milk, and Frenchman Rivers. Large glacial lakes, particularly in the western half of the MLRA, deposited clayey and silty lacustrine sediments (Fullerton et al., 2013). Much of the western portion of this MLRA was glaciated towards the end of the Wisconsin age, with the maximum glacial extent occurring approximately 20,000 years ago (Fullerton et al., 2004). The result is a geologically young landscape that is predominantly a level till plain interspersed with lake plains and dominated by soils in the Mollisol and Vertisol orders. These soils are very productive and generally are well suited to dryland farming. Much of this area is aridic-ustic. Crop-fallow dryland wheat farming is the predominant land use. Areas of rangeland typically are on steep hillslopes along drainages. The rangeland, much of which is native mixed grass prairie, increases in abundance in the eastern half of the MLRA. The Wisconsin-age till in the north-central part of this area typically formed large disintegration moraines with steep slopes and numerous poorly drained potholes. A large portion of Wisconsin-age till occurring on level terrain that would typically be optimal for farming has large amounts of less-suitable sodium-affected Natrustalfs. Significant portions of Blaine, Phillips, and Valley Counties were glaciated approximately 150,000 years ago during the Illinoian age. Due to erosion and dissection of the landscape, many of these areas have steeper slopes and more exposed bedrock than areas glaciated during the Wisconsin age (Fullerton and Colton, 1986). While much of the rangeland in the aridic-ustic portion of MLRA 52 is classified as belonging to the "dry grassland" climatic zone, sites in portions of southern MLRA 52 may belong to the "dry shrubland" climatic zone. The dry shrubland zone represents the northernmost extent of the big sagebrush (*Artemisia tridentata*) steppe on the Great Plains. As similar soils occur in both southern and northern portions of the MLRA, it is currently hypothesized that climate is the primary driving factor affecting big sagebrush distribution in this area. However, the precise factors are not yet fully understood. Sizeable tracts of largely unbroken rangeland in the eastern half of the MLRA and adjacent southern Saskatchewan are home to the Northern Montana population of greater sage-grouse (*Centrocercus urophasianus*), and large portions of this area are considered to be a Priority Area for Conservation (PAC) by the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service, 2013). This population is unique among sage grouse populations because many individuals overwinter in the big sagebrush steppe (dry shrubland) in the southern portion of the MLRA and then migrate to the northern portion of the MLRA, which lacks big sagebrush (dry grassland), to live the rest of the year (Smith, 2013). Areas of the till plain near the Bearpaw and Highwood Mountains as well as the Sweetgrass Hills and Rocky Mountain foothills are at higher elevations, receive higher amounts of precipitation, and have a typic-ustic moisture regime. These areas have significantly more rangeland production than the drier aridic-ustic portions of the MLRA and have enough moisture to produce crops annually rather than just bi-annually, as in the drier areas. Ecological sites in this higher precipitation area are classified as the moist grassland climatic zone.

Classification relationships

NRCS Soil Geography Hierarchy • Land Resource Region: Northern Great Plains • Major Land Resource Area (MLRA): 052 Brown Glaciated Plains • Climate Zone: Dry Grassland National Hierarchical Framework of Ecological Units (Cleland et al., 1997; McNab et al., 2007) • Domain: Dry • Division: Temperate Steppe • Province: Great Plains-Palouse Dry Steppe Province 331 • Section: Northwestern Glaciated Plains 331D • Subsection: Montana Glaciated Plains 331Dh • Landtype association/Landtype phase: N/A National Vegetation Classification Standard (Federal Geographic Data Committee, 2008) • Class: Mesomorphic Shrub and Herb Vegetation Class (2) •

Subclass: Temperate and Boreal Grassland and Shrubland Subclass (2.B) • Formation: Temperate Grassland, Meadow, and Shrubland Formation (2.B.2) • Division: Great Plains Grassland and Shrubland Division (2.b.2.Nb) • Macrogroup: *Hesperostipa comata* – *Pascopyrum smithii* – *Festuca hallii* Grassland Macrogroup (2.B.2.Nb.2) • Group: *Pascopyrum smithii* – *Hesperostipa comata* – *Schizachyrium scoparium* – *Bouteloua* spp. Mixedgrass Prairie Group (2.B.2.Nb.2.c) • Alliance: *Pascopyrum smithii* – *Nassella viridula* Northwestern Great Plains Herbaceous Alliance • Association: *Pascopyrum smithii* – *Bouteloua gracilis* – *Carex filifolia* Herbaceous Vegetation EPA Ecoregions • Level 1: Great Plains (9) • Level 2: West-Central Semi-Arid Prairies (9.3) • Level 3: Northwestern Glaciated Plains (42) • Level 4: North Central Brown Glaciated Plains (42o) & Glaciated Northern Grasslands (42j)

Ecological site concept

It occurs on till plains, lake plains, and low hills where slopes are less than 15 percent. This site can be found on any slope shape, but concave or linear is most common. The distinguishing characteristic of this ecological site is that it contains greater than 35 percent, but not more than 45 percent, clay in the upper 4 inches of soil. Soils for this ecological site are typically moderately deep to very deep (more than 20 inches to bedrock) and derived from shale residuum, clayey till, or glaciofluvial deposits. Soil surface textures (0 to 4 inches) are typically clay, clay loam, silty clay, or silty clay loam, and the soils typically have an ochric epipedon. This site is typically nonacid, with pH values greater than 5.6 throughout the soil profile. Characteristic vegetation is western wheatgrass (*Pascopyrum smithii*), green needlegrass (*Nassella viridula*), and Wyoming big sagebrush (*Artemisia tridentata* subsp. *Wyomingensis*).

Associated sites

R052XC207MT	Overflow (Ov) 10-14" p.z. Receives additional run-in moisture from surrounding landscape; different species composition, higher productivity.
R052XC214MT	Shallow (Sw) 10-14" p.z. Soil depth less than or equal to 20 inches to a restrictive layer; less forage production.
R052XC217MT	Silty (Si) 10-14" p.z. Similar landscape position; different species composition and soil texture.
R052XC212MT	Sandy (Sy) 10-14" p.z. Similar landscape position, different species composition and soil texture.

Similar sites

R052XN162MT	Clayey (Cy) 10-14" p.z. Significant increase in total annual production of bluebunch wheatgrass. Decrease in other wheatgrasses and/or needlegrass.
R053AE061MT	Clayey (Cy) (Legacy) RRU 53AE Decrease in total annual production of bluebunch wheatgrass. Increase in other wheatgrasses and/or needlegrass.

Table 1. Dominant plant species

Tree	Not specified
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Shrub	(1) <i>Krascheninnikovia lanata</i> (2) <i>Atriplex nuttallii</i>
Herbaceous	(1) <i>Nassella viridula</i> (2) <i>Elymus lanceolatus ssp. lanceolatus</i>

Physiographic features

This site usually consists of deep soils on flood plains and fans, and moderately deep soils on uplands. Slopes vary from 1 to 15 percent, but are usually less than 8 percent. Elevations generally range from 2,000 to 3,500 feet, with potential to occur outside of this range..

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Alluvial fan (3) Terrace
Runoff class	Medium
Flooding frequency	None
Ponding frequency	None
Elevation	570 – 1,220 m
Slope	0 – 20 %
Water table depth	180 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

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

Minimum Maximum

Frost-free period (days): 85 to 123

32 degrees Fahrenheit, 90% Probability = Minimum

50% Probability = Maximum

Freeze-free period (days): 116 to 142

28 degrees Fahrenheit, 90% Probability = Minimum

50% Probability = Maximum

Mean annual precipitation (inches): 10 to 14

Table 3 Representative climatic features

Frost-free period (characteristic range)	90-120 days
Freeze-free period (characteristic range)	120-140 days
Precipitation total (characteristic range)	250-360 mm
Frost-free period (average)	90 days
Freeze-free period (average)	130 days
Precipitation total (average)	310 mm

- (1) CHESTER [USC00241692], Chester, MT
- (2) GLASGOW [USW00094008], Glasgow, MT
- (3) HAVRE CITY CO AP [USW00094012], Havre, MT
- (4) SHELBY [USC00247500], Shelby, MT

Influencing water features

This site is not influenced by water from streams.

Wetland description

This site is not influenced by water from wetlands.

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 6.6 to 8.4. This site is characterized by the following soil components: Abor, Lohler, Marias, Bacovey, and Marvan.

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Till (3) Residuum – shale
Surface texture	(1) Clay loam (2) Silty clay loam (3) Silty clay

Family particle size	(1) Fine (2) Very-fine
Drainage class	Moderately well drained to well drained
Permeability class	Very slow
Soil depth	50 – 180 cm
Available water capacity (Depth not specified)	10.16 – 15.24 cm
Electrical conductivity (Depth not specified)	Not specified
Sodium adsorption ratio (Depth not specified)	Not specified
Soil reaction (1:1 water) (Depth not specified)	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 to 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 percent, respectively to total annual production. Total vegetative production averages 1300 pounds per acre in normal years, 1800 pounds per acre during favorable years, and 900 pounds per acre 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	Dominant Grasses			437-1065	
	green needlegrass	NAVI4	<i>Nassella viridula</i>	437-729	–
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	0-336	–
1	Rhizomatous Wheatgrasses			437-729	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	219-364	–
	tufted wheatgrass	ELMA7	<i>Elymus macrourus</i>	219-364	–
3	Other Grasses			15-146	
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	15-73	–
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	15-73	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	15-73	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	15-73	–
	plains reedgrass	CAMO	<i>Calamagrostis montanensis</i>	15-73	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	15-73	–
	Grass, native	2GN	<i>Grass, native</i>	15-73	–
Forb					
4	Primary Forbs			15-73	
	dotted blazing star	LIPU	<i>Liatris punctata</i>	15-73	–
	American vetch	VIAM	<i>Vicia americana</i>	15-73	–
3	Clovers			29-146	
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	15-73	–
	white prairie clover	DACA7	<i>Dalea candida</i>	15-73	–
6	Other Forbs			0-112	
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	0-73	–
	common yarrow	ACMI2	<i>Achillea millefolium</i>	0-73	–
	aster	ASTER	<i>Aster</i>	0-73	–

	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	0-73	–
	scurfpea	PSORA2	<i>Psoraleidium</i>	0-73	–
	hairy false goldenaster	HEVI4	<i>Heterotheca villosa</i>	0-73	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0-73	–
	prairie thermopsis	THRH	<i>Thermopsis rhombifolia</i>	0-73	–
	pussytoes	ANTEN	<i>Antennaria</i>	0-73	–
	bastard toadflax	COUM	<i>Comandra umbellata</i>	0-73	–
	white milkwort	POAL4	<i>Polygala alba</i>	0-73	–
	milkvetch	ASTRA	<i>Astragalus</i>	0-73	–
	groundplum milkvetch	ASCR2	<i>Astragalus crassicaarpus</i>	0-73	–
	beardtongue	PENST	<i>Penstemon</i>	0-73	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0-73	–
	buckwheat	ERIOG	<i>Eriogonum</i>	0-73	–
	Forb, native	2FN	<i>Forb, native</i>	0-73	–
	lesser spikemoss	SEDE2	<i>Selaginella densa</i>	0-1	–
Shrub/Vine					
7	Dominant Shrubs			15-73	
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	15-73	–
	Nuttall's saltbush	ATNU2	<i>Atriplex nuttallii</i>	15-73	–
8	Other Shrubs			0-45	
	rubber rabbitbrush	ERNA10	<i>Ericameria nauseosa</i>	0-73	–
	silver sagebrush	ARCA13	<i>Artemisia cana</i>	0-73	–
	snowberry	SYMPH	<i>Symphoricarpos</i>	0-73	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	0-73	–
	rose	ROSA5	<i>Rosa</i>	0-73	–
	creeping juniper	JUHO2	<i>Juniperus horizontalis</i>	0-73	–
	Shrub, other	2S	<i>Shrub, other</i>	0-73	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0-1	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0-1	–
	brittle pricklypear	OPFR	<i>Opuntia fragilis</i>	0-1	–

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 7. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 9. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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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 to 1800 pounds 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 per AUM in the HCPC to about 10 acres per 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 percent 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

Inventory data references

Inventory Data References Data Source Number of Records Sample Period State County SCS-Range-417 3 (1991-1992) MT Phillips ECS-1 Modified Double Sampling 19 2001-2004 MT Blaine, Roosevelt, Sheridan, Phillips Valley Site Description Revision(s) This 2005 revision replaces the following technical range site description in Section II-E-8 of the NRCS Field Office Technical Guide: Clayey 10-14" p.z. – Western Glaciated Plains (RRU 52XC), dated August 1981. This 2005 revision incorporates the State and Transition Model theory, additional data on site productivity, and an improved understanding of many rangeland health indicators. Site Description Approval This ecological site description is approved with the understanding that it is no more than another step in our continual effort to update the NRCS ecological database. In order to facilitate the process, NRCS field personnel are encouraged to forward existing information and/or new data that can be used to improve the utility of this site description. Please forward the information and data to the State Rangeland Management Specialist.

Other references

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Contributors

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Approval

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Acknowledgments

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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.

Author(s)/participant(s)	Loretta Metz, Maxine Rasmussen, Jon Siddoway
Contact for lead author	Area Rangeland Management Specialist, Glasgow Area Office, MT Reference Site used? NO
Date	05/03/2005
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 1 foot) and continuous across the landscape.
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3. **Number and height of erosional pedestals or terracettes:** Pedestals or terracettes are nonexistent in HCPC. If in plant community A, careful examination on slopes > 8% yield occasional pedestals approximately ¼ inch above the soil surface. If in plant community B, pedestals 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:** None.
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6. **Extent of wind scoured, blowouts and/or depositional areas:** None.
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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, and 3-4 in plant interspaces.
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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" thick. 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 perennial 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):** None.
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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:

Sub-dominant:

Other:

Additional: HCPC: Tall and mid-stature bunchgrasses & mid-stature, cool season rhizomatous grasses& short stature, warm season rhizomatous grasses& forbs & shrubs. Plant community A: Tall and mid-stature bunchgrasses & mid-stature, cool season rhizomatous grasses& short stature, warm season rhizomatous grasses & shrubs & forbs. Plant community B: Short warm season perennial grasses & few mid-stature warm and cool season perennial grasses & forbs & shrubs.

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 in Plant Community B may be very few.
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