USDA Natural Resources Conservation Service

Ecological site R052XC218MT
Subirrigated (Sb) 10-14" p.z.

Last updated: 1/24/2024
Accessed: 05/06/2024

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 approximately 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 the till is sedimentary bedrock largely consisting of Cretaceous shale, sandstone, and mudstone (Vuke et al., 2007). The bedrock 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, and the maximum glacial extent occurred 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 mixedgrass 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 the type of 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 Illinoisan 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 climatic zone represents the northernmost extent of the big sagebrush (Artemisia tridentata) steppe on the Great Plains. Because 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 fully understood at this time.

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: N/A

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: Shrub and Herb Wetland Subclass (2.C)
• Formation: Temperate to Polar Freshwater Marsh, Wet Meadow and Shrubland Formation (2.C.4)
• Division: Salix interior / Juncus spp. - Eupatorium perfoliatum Wet Meadow and Shrubland Division (2.C.4.Nd)
• Macrogroup: Spartina pectinata - Typha spp. - Schoenoplectus spp. Great Plains Marsh, Wet Meadow, Shrubland and Playa Macrogroup (2.C.4.Nd.5)
• Group: Spartina pectinata - Calamagrostis stricta - Carex spp. Great Plains Wet Prairie, Wet Meadow and Seepage Fen Group (2.C.4.Nd.5.b)
• Alliance: Spartina pectinata Great Plains Wet Meadow Alliance
• Association: Spartina pectinata - Carex spp. Wet Meadow 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) and Glaciated Northern Grasslands (42j)

Montana Riparian and Wetland Sites (Hansen et. al, 1995)
• Spartina pectinata Habitat Type and Symphoricarpos occidentalis Community Type

Ecological site concept

This ecological site generally occurs as a minor component in floodplain map units. Subirrigated is an ecological site of limited extent occurring sporadically throughout MLRA 52. It occurs on floodplains and stream terraces where a seasonal water table is present at a depth of 24 to 40 inches below the soil surface, especially during peak runoff periods. In some cases, the site may also receive additional moisture from flooding and stream overflow.

The distinguishing characteristics of this site are that it is located on floodplains and that it receives additional

moisture from groundwater. Soils for this ecological site are typically very deep (more than 60 inches) and derived from alluvium. Soil textures in the upper 4 inches are typically loam, silt loam, or silty clay loam. The soils typically have a mollic epipedon and are commonly stratified (USDA-NRCS, 2016) due to deposition of sediment from multiple flood events. Characteristic vegetation is prairie cordgrass (Spartina pectinata), western wheatgrass (Pascopyrum smithii), and sedges (Carex spp.). Shrubs may include chokecherry (Prunus virginiana), snowberry (Symphoricarpos spp.), and Wood's rose (Rosa woodsii).

Associated sites

R052XC205MT	**Clayey (Cy) 10-14" p.z.** Different landscape position; different species composition and soil texture.
R052XC212MT	**Sandy (Sy) 10-14" p.z.** Different landscape position, different species composition and soil texture.
R052XC209MT	**Saline Overflow (SOv) 10-14" p.z.** Similar landscape position, receives additional run-in moisture from surrounding landscape; different species composition, saline or sodic affected, lower productivity.
R052XC214MT	**Shallow (Sw) 10-14" p.z.** Soil depth 10-20 inches; 20 inches to a restrictive layer; less forage production, different landscape position.
R052XC207MT	**Overflow (Ov) 10-14" p.z.** Site receives extra moisture, but it is not in floodplain, no permanent water table at less than 42 inches.

Similar sites

R052XN169MT	**Subirrigated (Sb) 10-14" p.z.** No switchgrass or big bluestem present in HCPC.
R053AE070MT	**Subirrigated (Sb) (Legacy) RRU 53AE** Switchgrass and big bluestem are present in HCPC.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Prunus virginiana* (2) *Salix*
Herbaceous	(1) *Spartina pectinata* (2) *Deschampsia cespitosa*

Physiographic features

This site usually occurs on terraces and floodplain steppes, near springs or seeps, or other areas having a seasonal water table close enough to the surface to influence plant composition and production. These areas are rarely flooded or non-flooded. "Rare" indicates there is a 0- 5% chance of flooding in any year. The site has a seasonal water table at 24" – 42". Slopes vary from 0-2% and occur on all exposures. Elevations generally range from 2,000 to 3,100 feet.

Table 2. Representative physiographic features

Landforms	(1) Terrace (2) Hillside (3) Flood plain
Runoff class	Negligible to low
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to rare
Ponding frequency	None

Elevation	2,000–3,100 ft
Slope	0–2%
Water table depth	24–42 in
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding duration	Not specified
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	1,875–3,500 ft
Slope	Not specified
Water table depth	Not specified

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 4. Representative climatic features

Frost-free period (characteristic range)	85-123 days
Freeze-free period (characteristic range)	116-142 days
Precipitation total (characteristic range)	10-14 in
Frost-free period (average)	94 days
Freeze-free period (average)	125 days
Precipitation total (average)	12 in

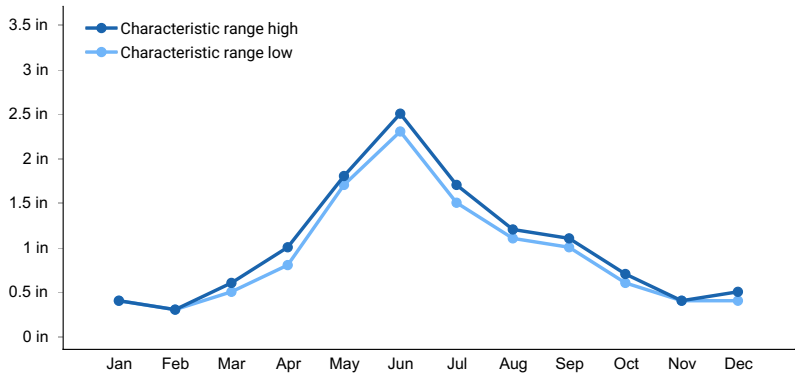


Figure 1. Monthly precipitation range

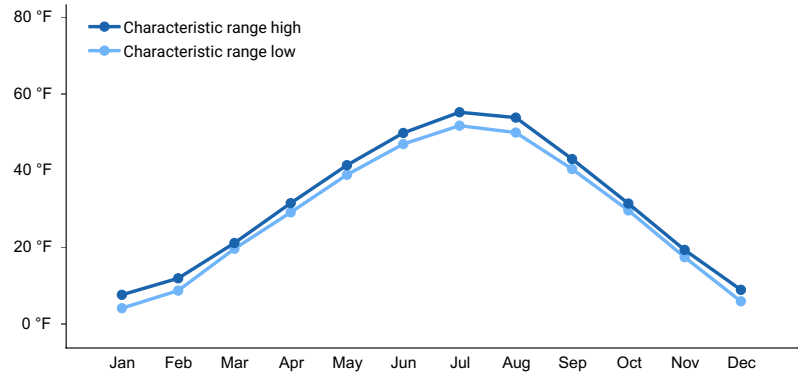


Figure 2. Monthly minimum temperature range

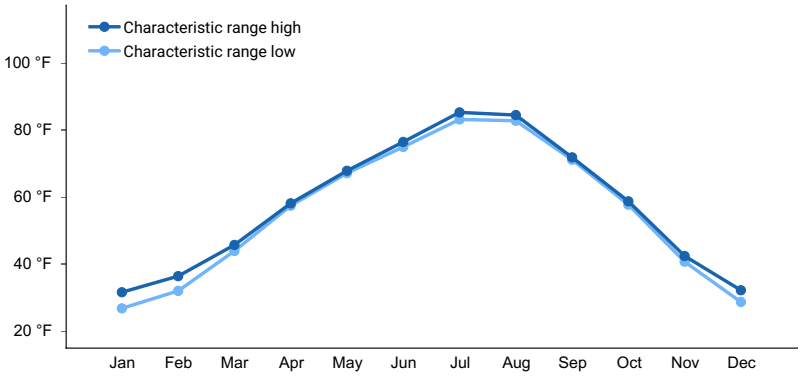


Figure 3. Monthly maximum temperature range

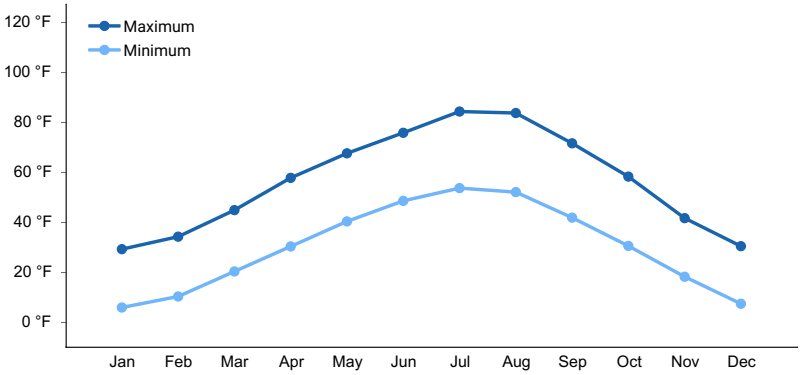


Figure 4. Monthly average minimum and maximum temperature

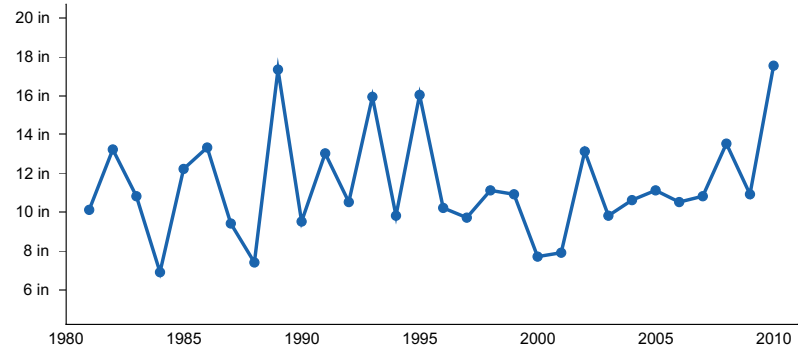


Figure 5. Annual precipitation pattern

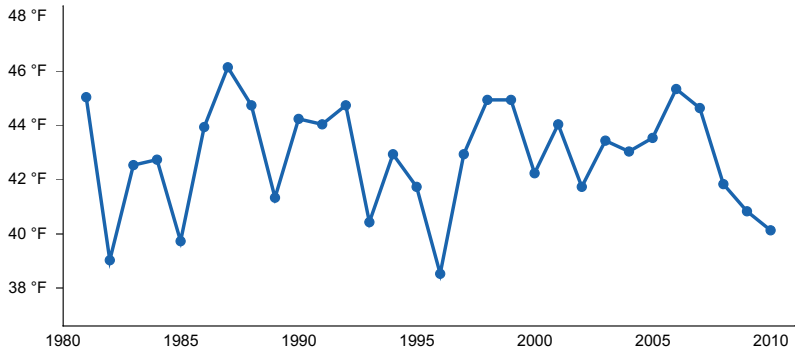


Figure 6. Annual average temperature pattern

Climate stations used

- (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

Soils are deep to very deep with a seasonal water table within about three feet of the surface. These soils are non-hydric. Soils are somewhat poorly drained, and more than 72 inches deep. Permeability varies from moderately slow to slow. The surface layer of these soils vary from 3-12 inches in depth and are typically a loam, silt loam, clay loam, or sandy loam. Textures of underlying layers also vary since these are alluvial soils, having been deposited by flowing water. Soil ph varies from 6.6-8.4. The following soil components characterize this site: Bearlake, Gallatin and Novary.

Table 5. Representative soil features

Parent material	(1) Alluvium–igneous, metamorphic and sedimentary rock
Surface texture	(1) Loam (2) Sandy loam (3) Clay loam
Drainage class	Somewhat poorly drained
Permeability class	Very slow to moderately slow
Soil depth	40–78 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	5–7 in
Calcium carbonate equivalent (Depth not specified)	0–10%
Electrical conductivity (Depth not specified)	0–2 mmhos/cm

Sodium adsorption ratio (Depth not specified)	0–8
Soil reaction (1:1 water) (Depth not specified)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–1%
Subsurface fragment volume >3" (Depth not specified)	0–1%

Ecological dynamics

This ecological site developed under Northern Great Plains climatic conditions. At the time that North America was settled by Europeans, the Glaciated Plains was the home of nomadic tribes and large numbers of bison, prairie dogs, elk, pronghorn, bighorn sheep and deer. These herbivores have been present on the plains since the retreat of the Pleistocene glaciers and greatly influenced the mixed grass prairie ecosystem. Much of the landscape burned at intervals of 5-7 years, either as a result of lightning or environmental manipulations by the Native Americans (Frost 1998).

Plant community interpretations are based on the Historic Climax Plant Community (HCPC). The HCPC is the plant community that is best adapted to the unique combination of factors associated with this ecological site. It was in a natural dynamic equilibrium with the historic biotic, abiotic, and climatic factors at the time of European immigration and settlement. This site is highly resilient to disturbance.

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, prairie dogs, noxious weed invasions, etc. Continual adverse impacts to the site over a period of years results in a departure from the HCPC. As the HCPC regresses to lower seral stages, the deep-rooted perennial grasses are replaced by the introduced bluegrasses (Kentucky and Canada) and lower successional species (Baltic rush, sedges, foxtail barley, curlydock, and annual forbs). The dominance of these short grasses, low successional warm season forbs and half-shrubs, and invasive species 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.

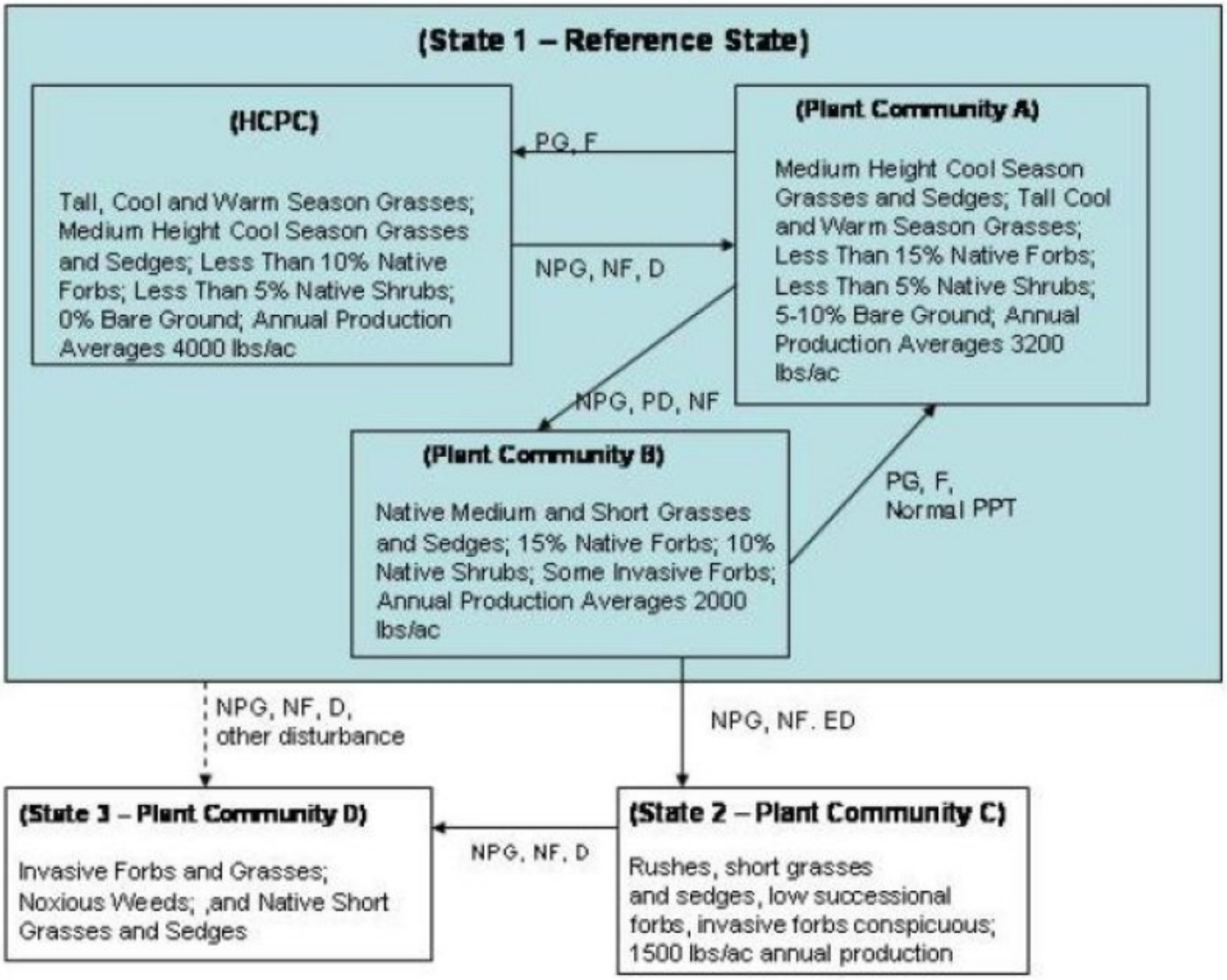
State and Transition Diagram

Traditional theories of plant succession leading to a single climax community are inadequate for understanding the complex successional pathways of Subirrigated 10-14” p.z. ecological sites in the central Glaciated Plains. The 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 (Stringham 2003). 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 associated successional pathways for the Reference state (State 1) are illustrated below for the Subirrigated 10-14” p.z. ecological site in the Glaciated Plains. The diagram also depicts a transition from Plant Community B to State 2 (Community C) and a possible transition from the Reference State to State 3 (Community D).

State and transition model

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



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

State 1
Reference State

Community 1.1
Historic Climax Plant Community (HCPC) Tall, cool- and warm-season grasses, medium-height cool-season grasses and sedges, less than 5 percent native shrubs, 0 percent bare

ground

Tall, cool- and warm-season grasses, medium-height cool-season grasses and sedges, less than 5 percent native shrubs, 0 percent bare ground, annual production averages 4000 lbs/ac. The interpretive plant community for this site is the Historic Climax Plant Community (HCPC). Warm and cool season tall and mid-grasses (such as prairie cordgrass, western wheatgrass, slender wheatgrass, bearded wheatgrass, mat muhly, tall reedgrasses, and tufted hairgrass) dominate the HCPC. These grasses represent about 80% of the total annual plant production in the community. Short grasses, sedges and rushes make up another 5% of the total annual production. Dotted blazing-star, meadow hawksbeard, lance-leaf goldenweed, goldenrods, maximilian sunflower, cinquefoil, and blue-eyed grass are important forbs. Total forb production normally represents less than 10% of the total annual production. Buffaloberry, willows, chokecherry, snowberry, shrubby cinquefoil, and rose are important shrubs. Overall, shrubs account for about 10% of the annual plant production. Historic NRCS data indicate that total annual production on this site varies from 5000 lbs/ac in favorable years to 3500 lbs/ac in unfavorable years. Annual production averages 4000 lbs/ac. This site was rarely sampled in the range inventory (in 2001 and 2004) on the Fort Peck and Fort Belknap Indian Reservations. Therefore, the production estimate for the HCPC could not be refined with more recent data. Average annual production is expected to be slightly higher or lower, respectively on more mesic and xeric portions of the central Glaciated Plains. This plant community is well adapted to the climatic conditions of the glaciated plains and to the presence of a permanent water table. The diversity of plant species helps make the site resistant to environmental changes. The functional and structural diversity of plant species (perennials, cool and warm season grasses, sedges, 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. Continued adverse disturbances reduce the competitiveness of perennial plants, and precipitate the replacement of high successional species with lower successional grasses, forbs, shrubs, and annual species. With proper grazing management and a “natural” fire regime, more species found at HCPC will replace these lower successional species within a few years. Litter is in contact with 55% of the soil surface. Plant litter remains in place and is not moved by erosional forces. Less than 1% of the soil surface should be bare, or unprotected by litter, rock, moss, and plant canopy. Rills should not be present and water flow patterns should be barely observable. The major plant species composition and production by dry weight are shown for the HCPC in the following table. Total annual production has been derived from several sources, and has been adjusted to represent a typical annual moisture cycle.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2975	3400	4250
Forb	350	400	500
Shrub/Vine	175	200	250
Total	**3500**	**4000**	**5000**

Table 7. 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"	0-1%
Surface fragments >3"	0-1%
Bedrock	0%
Water	0-1%
Bare ground	0-1%

Table 8. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	1-5%
Grass/grasslike basal cover	35-45%
Forb basal cover	5-10%
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 9. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-10%	0-10%
>0.5 <= 1	–	0-25%	0-10%	0-30%
>1 <= 2	–	0-30%	0-40%	0-40%
>2 <= 4.5	–	0-30%	0-35%	0-20%
>4.5 <= 13	–	0-10%	0-5%	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.2
Plant Community A Medium-height cool-season grasses and sedges, tall cool- and warm-season grasses, less than 15 percent native forbs, less than 5 percent native shrubs, 5 to 10 percent bare ground.

Medium-height cool-season grasses and sedges, tall cool- and warm-season grasses, less than 15 percent native forbs, less than 5 percent native shrubs, 5 to 10 percent bare ground, annual production averages 3200 lbs/ac. Total plant production averages about 3200 lbs/ac in this Plant Community. Annual production of the tall, more palatable grasses (tufted hairgrass, prairie cordgrass and narrow-spiked reedgrass) declines by about 20%. In response, western wheatgrass, mat muhly, and lower successional sedges have increased. Exact response by these lower successional species varies with the kind and intensity of disturbance (drought, grazing, etc.) and with precipitation (amount and timing). Production of native forbs increases relative to the HCPC and now accounts for more than 10% of the total production. Dotted blazing-star and Maximilian sunflower decrease in abundance while meadow hawksbeard, prairie thermopsis, and cinquefoil increase. Shrubs account for about 5% of the total annual production. Species such as snowberry, rose and shrubby cinquefoil increase at the expense of chokecherry and willows. Litter cover decreases to 50% and bare ground increases to about 5%. In contrast to the HCPC, range conservationists have slight to moderate concerns regarding lower infiltration rates and potentially higher runoff rates, plant functional/structural group shifts, and decreasing amount of litter. There shouldn’t be any, or only a trace of invasive plants present. The tall cool season grasses have poor vigor, with reduced seed production. Most of the seedlings and young plants appear to represent short grasses and warm season forbs.

Community 1.3
Plant Community B Native medium and short-grasses and sedges, 15 percent native forbs, 10 percent native shrubs, some invasive forbs.

Native medium and short-grasses and sedges, 15 percent native forbs, 10 percent native shrubs, some invasive forbs, annual production averages 2000 lbs/ac. Mid and short grasses and grasslike plants dominate this Community. A few western wheatgrass, tufted hairgrass plants persist with reduced vigor in the community. Mat muhly, sedges and Baltic rush are common species. Grasses and grass-like plants contribute 75% of total annual production. Arrowgrass, white-prairie aster, cudweed sagewort, cinquefoil, prairie thermopsis, and other native low successional forbs make up about 15% of the total annual production. Dandelions, salsify, Canada thistle, and other invasive forbs may be present in this community. Total vegetative production declines to about 2000 lbs/ac in a normal year. Litter provides cover for about 40% of the ground, while bare ground increases to about 10%. Rills, water flow patterns and litter movement are evident on the site.

Pathway 1.1A
Community 1.1 to 1.2

Non-prescribed grazing, no fire, drought Successional pathways from the HCPC are influenced by frequency, timing and intensity of grazing, precipitation patterns, fire, insect infestations, noxious weed invasions, etc. As communities regress from HCPC, medium and short grasses increase at the expense of mid and tall, cool season grasses. Total annual production decreases.

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing, fire (natural interval 5 to 7 years) Plant Community A is highly resistant to disturbance. It is also resilient. With prescribed grazing, the high successional species are able to replace the lower-successional species and also expand into the bare areas.

Pathway 1.2B
Community 1.2 to 1.3

Non-prescribed grazing, prolonged drought (5 to 7 years), no fire Non-prescribed grazing, prolonged or extended drought, and the prolonged elimination of the natural fire regime from the system results in regression to Plant Community B. The effects of poor grazing management are readily apparent with careful observation. However, the influence of fire is more difficult to verify. It is believed that these sites burned naturally at 5 – 7 year intervals (Frost 1998). Without fire and/or grazing, litter accumulation becomes excessive and adversely impacts plant vigor, seedling establishment, and nutrient cycling.

Pathway 1.3A
Community 1.3 to 1.2

Prescribed grazing, fire (natural interval 5 to 7 years), normal precipitation Plant Community B should be recognized as the pre-threshold community. It is generally resilient but it is not highly resistant to stress. Under prescribed grazing this Community can return to Community A through succession.

State 2
Degraded State

Community 2.1
Plant Community C Rushes, short grasses and sedges, low successional forbs, invasive forbs conspicuous.

Rushes, short grasses and sedges, low successional forbs, invasive forbs conspicuous, 1500 lbs/ac annual production. Baltic rush, western wheatgrass, clustered field sedge, ticklegrass, mat muhly, Kentucky bluegrass, meadow barley and other short grasses and grass-like plants dominate this Community. HCPC dominant species such as prairie cordgrass, switchgrass and tufted hairgrass may persist as individual plants. Normally there is

minimal regeneration of these species. Wooly plantain, cudweed sagewort, arrowgrass, cinquefoil, dandelion, and western yarrow are common forbs. These low successional forbs contribute about 20% of the annual production. In comparison to the HCPC, fringed sagewort, snowberry and rose tend to increase and may contribute about 10% of the total annual production. Soil erosion is not a serious problem because of the cover provided by the short native grasses and the rhizomatous grasses. However, the loss of the tall cool season bunchgrasses, results in a simplification of the compositional and structural plant communities. The hydrologic cycle (capture, storage and redistribution of precipitation), energy flow, and nutrient cycles are believed to be adversely impacted. Total vegetative production averages about 1500 lbs/ac. In contrast to the HCPC, range conservationists express moderate concerns about plant community composition, functional/structural groups, litter, annual production, and invasive plants. Each of the primary processes: 1) hydrology (the capture, storage and redistribution of precipitation), 2) energy capture (conversion of sunlight to plant and animal matter), and 3) nutrient cycling (the cycle of nutrients through the physical and biotic components of the environment) has been degraded beyond the point of self-repair within a reasonable length of time. For example, when tall, high producing, cool season grasses are replaced by short grasses (Kentucky bluegrass, mat muhly and Baltic rush), the ability of the plant community to maximize the conversion of solar energy to plant biomass and efficiently utilize available precipitation is impaired. Less solar energy is captured and converted to carbohydrates for plant growth. Plant growth declines, and there are less plant canopy and less litter to protect the soil. 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. Thus, the transitions from Plant Community B in State #1 to either Communities C (State 2) or D (State 3) represent thresholds. Thresholds are defined as 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 3
Invaded State

Community 3.1
Plant Community D Invasive forbs and grasses, noxious weeds, and native short grasses and sedges.

Invasive forbs and grasses, noxious weeds, and native short grasses and sedges. This plant community is dominated by invasive forbs, Kentucky and Canada bluegrasses, and noxious weeds. Some native short grasses and sedges remain in the Community.

Transition T1A
State 1 to 2

No prescribed grazing, no fire, extended drought (greater than 7 years) Plant Community B should be recognized as the pre-threshold community. It is generally resilient but it is not highly resistant to stress. Under prescribed grazing this Community can return to Community A through succession. However, it will regress under the influence of NPG to lower successional Plant Community C (State 2). However, it is theorized that the pathways for this transition originate from within the Reference State, and not necessarily from Community B.

Transition T1B
State 1 to 3

No prescribed grazing, no fire, drought, other disturbance Regression also occurs to Community D (State 3). However, it is theorized that the pathways for this transition originate from within the Reference State, and not necessarily from Community B.

Restoration pathway R2A
State 2 to 1

Succession from Community C to Community B is not likely without significant input of energy into the system. Many of the rhizomatous species are resistant to fire and grazing. Therefore, it is not logical for nutrient cycling and other ecological processes to be restored after a single fire or immediately following the implementation of

prescribed grazing.

Transition T2A
State 2 to 3

No prescribed grazing, no fire, drought Plant community C is not a precise assemblage of species that remain constant from place to place or from year to year. Variability is apparent in productivity and occurrence of individual species. Changes in climate, fire patterns and frequency, and grazing all play a role in determining which plant species express dominance. Plant community C can regress into Community D with non-prescribed grazing and/or the absence of a natural fire regime.

Restoration pathway R3A
State 3 to 2

The noxious weeds and introduced rhizomatous grasses are competitive. Succession to Plant Community C is not likely to occur without a proactive management of a significant input of energy into the natural system. Practical experience indicates that Garrison Creeping Foxtail (GCF) can be introduced into this community by feeding livestock GCF on the site, or by scattering seed and allowing livestock to trample it into the soil. Within a few years, the GCF often dominates the community. The seasonal water table and extensive below ground biomass that characterizes this restricts the use of conventional tillage. Research suggests that desirable species can be seeded into the site with a no-till drill following the application of Roundup R to control undesirable plants. In most situations, these agronomic approaches are usually economically and ecologically prohibitive.

Additional community tables

Table 10. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-season Grasses**			800–1800	
	tufted hairgrass	DECE	*Deschampsia cespitosa*	600–1200	–
	slimstem reedgrass	CAST36	*Calamagrostis stricta*	200–600	–
2	**Warm-season Grasses**			400–2450	
	prairie cordgrass	SPPE	*Spartina pectinata*	400–1200	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–400	–
	rough bentgrass	AGSC5	*Agrostis scabra*	0–400	–
	switchgrass	PAVI2	*Panicum virgatum*	0–300	–
	big bluestem	ANGE	*Andropogon gerardii*	0–150	–
3	**Wheatgrasses**			600–1400	
	western wheatgrass	PASM	*Pascopyrum smithii*	400–800	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	200–600	–
4	**Miscellaneous Grasses**			600–1200	
	sedge	CAREX	*Carex*	200–400	–
	bulrush	SCIRP	*Scirpus*	200–400	–
	Grass, native	2GN	*Grass, native*	200–400	–
Forb					
5	**Dominant Forbs**			80–400	
	dotted blazing star	LIPU	*Liatris punctata*	40–200	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	40–200	–
6	**Miscellaneous Forbs**			0–400	
	lanceleaf goldenweed	PYLA	*Pyrrocoma lanceolata*	0–200	–
	fiddleleaf hawksbeard	CRRU3	*Crepis runcinata*	0–200	–
	prairie thermopsis	THRH	*Thermopsis rhombifolia*	0–200	–
	arrowgrass	TRIGL	*Triglochin*	0–200	–
	Forb, native	2FN	*Forb, native*	0–200	–
Shrub/Vine					
7	**Dominant Shrubs**			80–400	
	chokecherry	PRVI	*Prunus virginiana*	40–200	–
	willow	SALIX	*Salix*	40–200	–
8	**Miscellaneous Shrubs**			0–200	
	shrubby cinquefoil	DAFR6	*Dasiphora fruticosa*	0–200	–
	snowberry	SYMPH	*Symphoricarpos*	0–200	–
	rose	ROSA5	*Rosa*	0–200	–
	buffaloberry	SHEPH	*Shepherdia*	0–200	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–200	–

Animal community

Livestock Management

This site evolved with trampling, defoliation (ungulates, grasshoppers and jackrabbits, and other herbivores), fire and drought. In comparison to upland ecological sites, water is relatively more accessible to grazing animals on this site. Therefore, it is theorized that this site evolved with more animal impact than did the normal upland ecological

sites. This site has the potential to produce an abundance of high quality forage. Total annual production varies from 3500 – 5000 lbs/ac.
The Subirrigated 10-14” p.z. site is normally highly resistant to disturbances which may alter its ecological processes. However, grazing early in the season when the upper part of the soil is wet can cause compaction and hummocks. Proper stocking rates, along with adequate recovery periods following grazing events, are needed to ensure that this site remains in a high seral or HCPC state. Following perturbations such as drought or poor grazing management, which allows mat muhly and other low successional species to increase at the expense of the mid and tall grasses, succession occurs with subsequent rainfall and prescribed grazing.
Forage production is greatly reduced in Plant communities C and D. Once these communities occupy this site, the presence of non-native grasses and undesirable plants significantly impede succession. Species such as Kentucky bluegrass, leafy spurge and Canada thistle are difficult to remove from the site.
Arrowgrass, death camas, and horsetail are poisonous plants that often occur on this site. However, livestock losses are unusual unless the range is overstocked and livestock are forced to consume the poisonous plants.
This site is suitable for livestock grazing from May through October. Because of topographic position, proximity to water, and species composition (grasses comprise about 85% of the production) the site is better-suited for cattle, rather than sheep grazing.

Wildlife Interpretations
The Subirrigated 10-14” p.z. ecological site has high biodiversity in the Glaciated Plains. High forage yields and the diversity of shrubs, grasses and forbs provide food and cover for resident and migratory wildlife species. The narrow irregular, meandering drainage patterns serve as a corridor allowing big game and other species to move between upland habitats.
State 1 supports the highest abundance of insects, invertebrates, amphibians, reptiles, upland game birds and small mammals. It also provides forage for mule deer and antelope during most of the year.
States 2 and 3 are much less suitable for big game, upland birds and most species of small mammals. The simplification of the plant community reduces the number of wildlife habitat niches. Because of less plant growth and litter, soil surface temperatures rise and soil moisture decreases. As the site becomes more xeric the insect and invertebrate population becomes less diverse, and there are less cover and food resources for upland birds, and mammals.

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 negligible to low, varying with landscape and ground cover.
Good hydrologic conditions exist on overflow sites that are either in a high seral state or are at HCPC (State 1). Canopy cover (grasses, forbs and shrubs) is greater than 100% in these communities, which is conducive to high infiltration rates and minimal runoff and erosion.
Communities in the early seral state (Communities B & C) are generally considered to be in poor hydrologic condition. Concerns are valid, not because of the amount of bare ground, but because the short grasses have replaced the tall high yielding species. Thus, there is much less opportunity

Recreational uses

Hunters are probably the most common recreational user of this ecological site. The site is also used by hikers and photographers and birdwatchers.

Wood products

This site has no significant value for wood products.

Other information

At high seral states, the Subirrigated 10-14” p.z. site in the central 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 desirable plants declines and annual production decreases as the site moves toward the threshold separating State 1 from State 2. Production in the latter state is less than 50% of the potential at HCPC. Thus, litter and the number of structural/functional groups are adversely affected.

Inventory data references

Data Source Number of Records Sample Period State County
SCS-Range-417
ECS-1
Modified Double Sampling 1 2001 MT Valley
USDA-SCS-MT. 1981. Technical Range Site Description

Other references

Frost, Cecil C. 1998. Presettlement fire frequency regimes of the United States: a first approximation. Pages 70-81 in Teresa L. Pruden and Leonard A. Brennan (eds.). Fire in ecosystem management: shifting the paradigm from suppression to prescription. Tall Timbers Fire Ecology Conference Proceedings, No. 20. Tall Timbers Research Station, Tallahassee, Fl.
Heidel, B. S.,V. Cooper, and C. Jean. Plant species of special concern and plant associations of Sheridan County, Montana. Report to the U.S. Fish and Wildlife Service. Montana Natural Heritage Program, Helena. 22pp. plus appendices.
Stringham, T. k., W. C. Krueger, and P. L. Shaver. 2003. State and transition modeling: an ecological process approach. J. Range Manage. 56(2):106-113.
USDI BLM USGS and USDA NRCS. 2000. Interpreting indicators of rangeland health. Tech. Ref. 1734-6.

Contributors

Kirt Walstad

Approval

Kirt Walstad, 1/24/2024

Acknowledgments

Site Description Revisions
The 2005 Subirrigated 10-14” p.z. ecological site description replaces earlier dated versions of Subirrigated 10-14” p.z. description in Rangeland Resource Unit 52XC. This 2005 revision incorporates the State and Transition Model theory, additional data on site productivity, and an improved understanding of many rangeland health indicators.
Site Description Approval
This ecological site description is approved with the understanding that it is no more than another step in our continual effort to update the NRCS technical guide. In order to facilitate the process, NRCS field personnel are encouraged to forward existing information and/or new data that can be used to improve the utility of this site description. Please forward the information and data to the State Rangeland Management Specialist.
Authors Date Approval Date
Dr. John Lacey 02/28/2005 Loretta J. Metz 03/19/2005
Maxine Rasmussen, Area RMS, Glasgow, MT
Jon Siddoway, Area RMS, Great Falls, MT
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Greg Snell, Area RSS, Glasgow, MT

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	05/04/2005
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None.

2. **Presence of water flow patterns:** None.

3. **Number and height of erosional pedestals or terracettes:** None.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground would essentially be nonexistent in HCPC. Bare ground should be less than 2” in diameter. If in plant community A, less than 5% of the soil surface can be exposed. In plant community B, 10% bare ground may be exposed.

5. **Number of gullies and erosion associated with gullies:** None.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None.

7. **Amount of litter movement (describe size and distance expected to travel):** None.

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 canopies, and 2 to 4 in plant interspaces.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The surface layer varies from 0.1” to 12” thick. The color is usually dark brown. Surface textures include loam, silt loam, clay loam, or sandy loam. Soil organic matter ranges from 2-6%.

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 moderate to very slow. If in plant community A, 90-95% plant canopy and 70-80% basal cover with small gaps between plants will still reduce raindrop impact and decrease overland flow. If in plant community B, 40-70% plant canopy and 50-75% basal cover with moderate gaps between plants, intensifies raindrop impact and increases overland flow.

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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, warm season rhizomatous grasses > mid-stature, cool season rhizomatous grasses > mid-stature cool season bunch grasses > forbs >shrubs. Plant community A: Mid-stature, cool season rhizomatous grasses> mid-stature cool season bunch grasses > tall, cool season bunch grasses > forbs > shrubs. Plant community B: Mid-stature, cool season rhizomatous grasses > mid-stature cool season bunch grasses > sedges and rushes > forbs > shrubs.

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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, all plants 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.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 3800 - 5000 #/acre from Plant community A 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:** Smooth bromegrass, Kentucky bluegrass, Canada bluegrass, Baltic rush, leafy spurge and Canada thistle.

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17. **Perennial plant reproductive capability:** All species are capable of reproducing in HCPC. In Plant community A, plant seedlings will be weighed in favor of marginal and undesirable species. Replacement of desirable species will be very few.
