# Ecological site R052XN168MT
# Silty-Steep (SiStp) 10-14" p.z.

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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, 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 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 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 the 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 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 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 in the fact that 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 Shrubland

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: Xeromorphic Woodland, Scrub and Herb Vegetation Class (3)
• Subclass: Cool Semi-Desert Scrub and Grassland Subclass (3.B)
• Formation: Cool Semi-Desert Scrub and Grassland Formation (3.B.1)
• Division: Cool Semi-Desert Scrub and Grassland Division (3.B.1.Ne)
• Macrogroup: Artemisia tridentata - Artemisia tripartita ssp. tripartita - Purshia tridentata Steppe and Shrubland Macrogroup (3.B.1.Ne.3)
• Group: Artemisia tridentata - Artemisia tripartita - Purshia tridentata Big Sagebrush Steppe and Shrubland Group (3.B.1.Ne.3.b)
• Alliance: Artemisia tridentata ssp. wyomingensis Mesic Steppe and Shrubland Alliance
• Association: Artemisia tridentata ssp. wyomingensis / Pascopyrum smithii Shrub Grassland

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)

## Ecological site concept

It occurs on hillslopes, till plains, and bluffs where slopes are 15 percent or greater. This site is typically found on linear or concave backslopes.

The distinguishing characteristics of this site are moderately steep to very steep slopes, a relatively well developed soil profile, and less than 5 percent calcium carbonate (lime) concentration in the upper 5 inches of soil. Soils are typically moderately deep to very deep (greater than 20 inches to bedrock) and derived from glacial till. They commonly have a mollic epipedon. Soil surface horizons fall within the fine-loamy textural family and contain 18 to 35 percent clay. Underlying horizons typically, but not always, have an argillic horizon that contains 18 to 45 clay, depending on the soil series. In general, growing conditions are relatively favorable on this site and species diversity is commonly high. Production is slightly less than on similar soils on gentler slopes due to increased runoff

potential. Characteristic vegetation is bluebunch wheatgrass (Pseudoroegneria spicata), needle and thread (Hesperostipa comata), western wheatgrass (Pascopyrum smithii), and winterfat (Krascheninnikovia lanata).

## Associated sites

| | |
|---|---|
| R052XN163MT | **Sandy (Sy) 10-14" p.z.**<br>Is not located on steep slopes, different species composition and soil texture. |
| R052XN161MT | **Silty (Si) 10-14" p.z.**<br>Slopes <15%; more forage production;different species composition. |
| R052XN166MT | **Overflow (Ov) 10-14" p.z.**<br>Receives additional run-in moisture from surrounding landscape; different species composition, higher productivity. |
| R052XN178MT | **Shallow (Sw) 10-14" p.z.**<br>Soil depth less than or equal to 20 inches to a restrictive layer; less forage production. |

## Similar sites

| | |
|---|---|
| R053AE058MT | **Loamy Steep (Lostp) (Legacy) RRU 53AE**<br>Little bluestem more persistent in HCPC. Still have bluebunch wheatgrass, but not as prevalent. |
| R052XN164MT | **Clayey-Steep (CyStp) 10-14" p.z.**<br>Similar landscape position; different species composition and soil texture. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | (1) *Krascheninnikovia lanata* |
| Herbaceous | (1) *Pseudoroegneria spicata*<br>(2) *Hesperostipa comata* |

## Physiographic features

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

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Till plain<br>(2) Hill<br>(3) Hillslope |
| Runoff class | Medium to very high |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 2,000–3,500 ft |
| Slope | 15–60% |
| Aspect | Aspect is not a significant factor |

**Table 3. Representative physiographic features (actual ranges)**

| | |
|---|---|
| Runoff class | Not specified |
| Flooding frequency | Not specified |
| Ponding frequency | Not specified |
| Elevation | 1,875–3,800 ft |
| Slope | 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 |

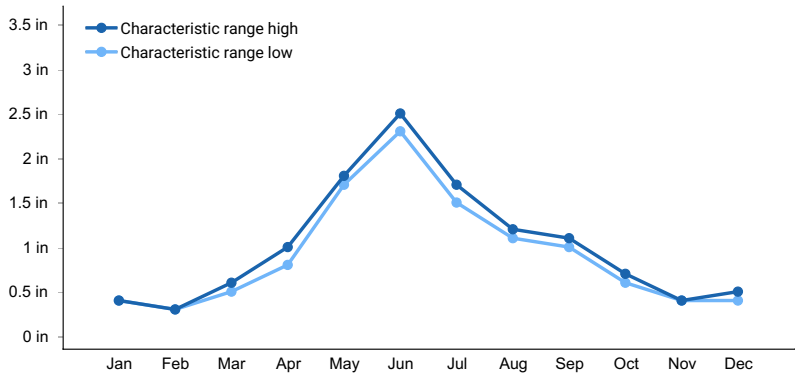



**Figure 1. Monthly precipitation range**

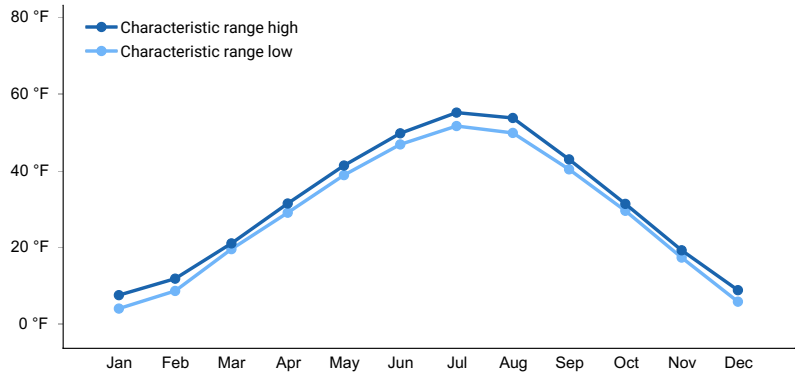



**Figure 2. Monthly minimum temperature range**

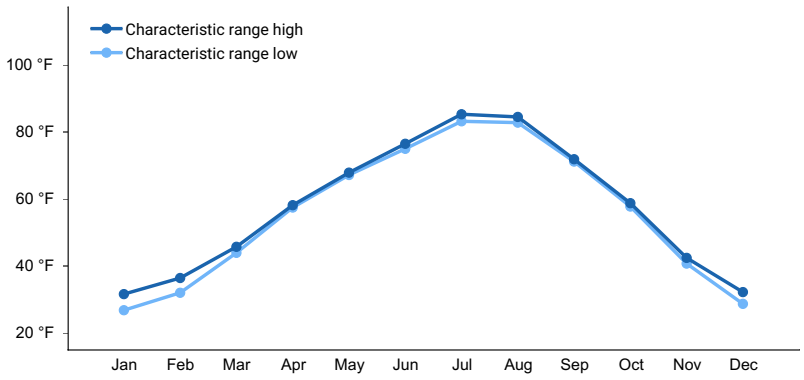



**Figure 3. Monthly maximum temperature range**

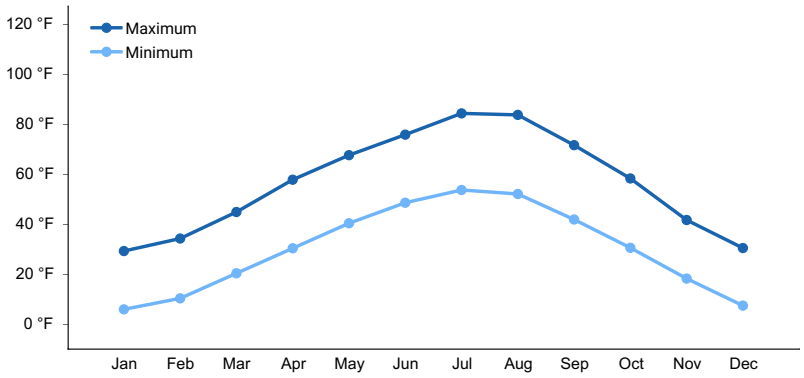



**Figure 4. Monthly average minimum and maximum temperature**

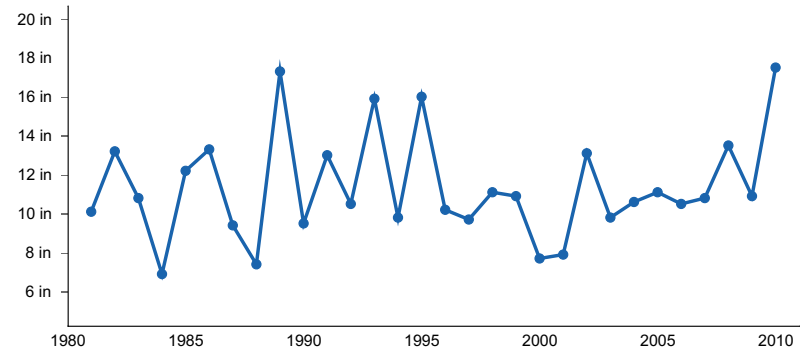



**Figure 5. Annual precipitation pattern**

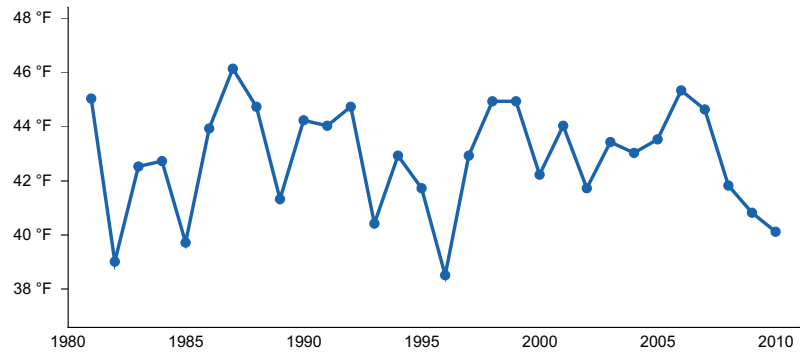



**Figure 6. Annual average temperature pattern**

## 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

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

**Table 5. Representative soil features**

| | |
|---|---|
| Parent material | (1) Till<br>(2) Glaciofluvial deposits |
| Surface texture | (1) Gravelly loam<br>(2) Gravelly silt loam<br>(3) Gravelly clay loam |
| Family particle size | (1) Fine-loamy |
| Drainage class | Well drained |
| Permeability class | Moderate |
| Soil depth | 20–78 in |
| Surface fragment cover <=3" | 0–35% |
| Surface fragment cover >3" | 0–5% |
| Available water capacity<br>(Depth not specified) | 4–7 in |
| Calcium carbonate equivalent<br>(Depth not specified) | 0–15% |
| Electrical conductivity<br>(Depth not specified) | 0–4 mmhos/cm |
| Sodium adsorption ratio<br>(Depth not specified) | 0–8 |
| Soil reaction (1:1 water)<br>(Depth not specified) | 7.4–8.4 |
| Subsurface fragment volume <=3"<br>(Depth not specified) | 0–10% |
| Subsurface fragment volume >3"<br>(Depth not specified) | 0–5% |

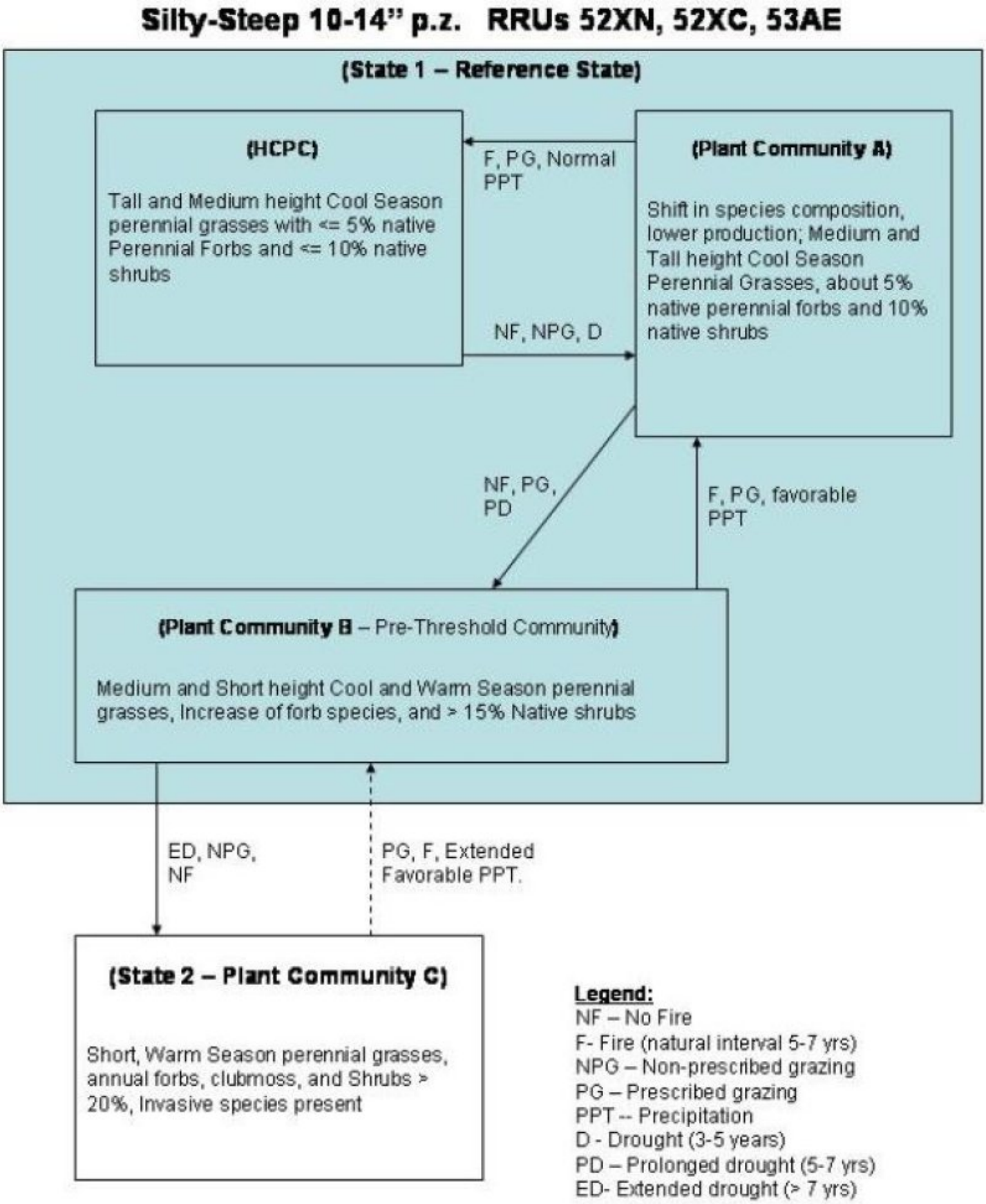
## Ecological dynamics

This ecological site developed under Northern Great Plains climatic conditions, the natural influence of herbivory and a fire frequency of 5-7 years (Frost 1998). Plant community interpretations are based on the Historic Climax Plant Community (HCPC).
Changes in the HCPC are brought about by frequency, timing and intensity of past grazing use, series of dry or wet

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

State and Transition Diagram
Traditional theories of plant succession leading to a single climax community are inadequate for understanding the complex successional pathways of this ecological site in the glaciated plains (Stringham et al. 2003). This ecological site is more aptly described using state-and-transition vegetation dynamics in a non-linear framework. A "state" is an alternative, persistent vegetation community that is not simply reversible in the linear successional framework. States are depicted as seral stages, while pathways between states are "transitions." The latter can be transient or persisting (crosses a threshold). Transitions may be triggered by climatic events, fire, grazing, farming, etc.
Three important plant communities and associated successional pathways for the Reference state (State 1), and the transitions across a threshold to State 2 are illustrated below for the Silty-Steep 10-14" p.z. site in the Glaciated Plains.

## State and transition model




**State 1**
**Reference State**

**Community 1.1**
**Historic Climax Plant Community (HCPC) Tall- and medium-height cool-season perennial grasses with less than or equal to 5 percent native perennial forbs and less than or equal to 10**

## percent native shrubs

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

**Table 6. Annual production by plant type**

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

**Table 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 | 55-65% |

| | |
|---|---|
| Surface fragments >0.25" and <=3" | 0-3% |
| Surface fragments >3" | 0-2% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 10-15% |

**Table 8. Soil surface cover**

| | |
|---|---|
| Tree basal cover | 0% |
| Shrub/vine/liana basal cover | 5-10% |
| Grass/grasslike basal cover | 20-25% |
| Forb basal cover | 1-5% |
| Non-vascular plants | 0% |
| Biological crusts | 0% |
| Litter | 0% |
| Surface fragments >0.25" and <=3" | 0% |
| Surface fragments >3" | 0% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 0% |

**Table 9. Canopy structure (% cover)**

| Height Above Ground (Ft) | Tree | Shrub/Vine | Grass/ Grasslike | Forb |
|---|---|---|---|---|
| <0.5 | – | 0-20% | 0-10% | 0-40% |
| >0.5 <= 1 | – | 0-40% | 0-40% | 0-50% |
| >1 <= 2 | – | 0-30% | 0-40% | 0-8% |
| >2 <= 4.5 | – | 0-10% | 0-10% | 0-2% |
| >4.5 <= 13 | – | – | – | – |
| >13 <= 40 | – | – | – | – |
| >40 <= 80 | – | – | – | – |
| >80 <= 120 | – | – | – | – |
| >120 | – | – | – | – |

## Community 1.2
## Plant Community A Shift in species composition, lower production, medium- and tall-height cool-season perennial grasses, about 5 percent native perennial forbs, and 10 percent native shrubs

Shift in species composition, lower production, medium- and tall-height cool-season perennial grasses, about 5 percent native perennial forbs, and 10 percent native shrubs Total plant production averages about 1,000 lbs/ac in this Plant Community, or about 80% of the production in the HCPC. The decrease in production results from a shift in species composition. Needle and thread, threadleaf sedge, blue grama and plains reedgrasss increased at the expense of the tall, more palatable grasses (bluebunch wheatgrass, green needlegrass, and western/thickspike wheatgrasses). In comparison to the HCPC, production of blue grama, prairie junegrass, plains reedgrass, threadleaf sedge and other short grasses increased. They now account for about 20% of the total annual production. Exact response by these species varies with the kind of disturbance (drought, grazing, etc.) and with precipitation (amount and timing). Total production of native forbs remains at about 5% of annual production of the

site. However, the palatable species (prairie clovers, American vetch and dotted gayfeather) decrease in abundance (relative to the HCPC). The open niches allow hairy goldenaster, bastard toadflax, prairie thermopsis, etc. to become more abundant. Shrubs continue to account for about 10% of the total production. However, species such as fringed sagewort and silver sagebrush increase (relative to the HCPC). Similarity index values from 55-75% are associated with this community. In contrast to the HCPC, range conservationists have moderate concerns regarding lower successional plants, lower infiltration rates and potentially higher runoff rates, plant functional/structural group shifts, and decreasing amount of litter.

### Community 1.3
### Plant Community B - Pre-threshold Community Medium- and short-height cool- and warm-season perennial grasses, annual forbs, clubmoss, and shrubs greater than 20 percent, invasive species present

Medium- and short-height cool- and warm-season perennial grasses, annual forbs, clubmoss, and shrubs greater than 20 percent, invasive species present Plant Community B is dominated by needle and thread, blue grama, plains reedgrass, prairie junegrass and upland sedges. However, individual plants of bluebunch wheatgrass, green needlegrass, and western/thickspike wheatgrass remain in the Community. The short grass and grass-like plants make up about 30% of the total production. Total vegetative production declines to about 800 lbs/ac in a normal year. Hairy goldenaster, scarlet globemallow, scurfpeas and other warm season forbs increase at the expense of the prairie clovers and American vetch. Forbs account for about 10% total annual production. Fringed sagewort, a half-shrub increases at the expense of winterfat. Silver sagebrush and rose also increase on some sites. Shrubs account for about 15% of the total plant production. SI values for this community vary from 35-55%. Litter provides cover for about 30% of the ground, while bare ground increases to about 25%. Rills, water flow patterns and litter movement are evident on the site. The tall cool season grasses have poor vigor, with little seed production. Most of the seedlings and young plants appear to represent short grasses and warm season forbs. Lower successional plant species and some invasive species are a significant part of the community. Japanese brome and cheatgrass are usually present wherever rodents or other disturbances create an open niche. Plant Community B is fairly resilient, but it is not highly resistant to disturbance. It is the “pre-threshold” community. Therefore, it is critical that this community be recognized and strategies implemented to prevent further regression. Community B can readily regress to a lower state, from which succession back to the HCPC community or Plant Community A would be restricted.

### Pathway 1.1A
### Community 1.1 to 1.2

No fire, non-prescribed grazing, drought (3 to 5 years) Successional pathways from the HCPC are influenced by frequency, timing and intensity of grazing, precipitation patterns, fire, insect infestations, noxious weed colonization and recruitment, etc. As communities regress from HCPC, medium and short grasses increase at the expense of mid and tall cool season grasses. The medium and short grasses consist of cool (prairie junegrass, upland sedges, and sandberg bluegrass) and warm season grasses (blue grama and plains reedgrass) and grasslike plants.

### Pathway 1.2A
### Community 1.2 to 1.1

Fire (natural interval 5 to 7 years), prescribed grazing, normal precipitation Plant Community A is resilient. Successional processes can readily return Plant Community A to the HCPC during normal precipitation cycles. Succession is facilitated by prescribed grazing, the incorporation of the natural fire regime into the system, etc.

### Pathway 1.2B
### Community 1.2 to 1.3

No fire, prescribed grazing, prolonged drought (5 to 7 years) Plant community A is resistant. However, prolonged drought, non-prescribed grazing, and the removal of fire from the system will result in retrogression to Community B. The causative factors of regression are usually apparent with careful observation.

### Pathway 1.3A
### Community 1.3 to 1.2

Fire (natural interval 5 to 7 years), prescribed grazing, favorable precipitation Favorable precipitation and prescribed grazing are normally required for succession to higher successional communities (Community A or HCPC). Management strategies should focus on grazing deferment to increase vigor and seed production of desirable plants, and to increase litter cover. Increasing litter is extremely critical because of the steep slopes.

## State 2
## Degraded State

### Community 2.1
### Plant Community C Short, warm-season perennial grasses, annual forbs, clubmoss, and shrubs greater than 20 percent, invasive species present

Short, warm-season perennial grasses, annual forbs, clubmoss, and shrubs greater than 20 percent, invasive species present State 2 Plant Community C is dominated by blue grama, prairie junegrass, sandberg bluegrass, prairie sandreed, other short grasses, and clubmoss. However, a few individual western wheatgrass, bluebunch wheatgrass, etc. plants seem to persist longer than they do on surrounding ecological sites. The ability of these palatable plants to persist on the Silty-Steep 10-14” p.z site is probably a reflection of lighter grazing use. Cattle prefer grazing areas with less than 15% slope, and those areas adjacent to livestock water developments. Red threeawn, Japanese brome and cheatgrass often invade this Community. Wooly plantain, hoods phlox, hairy goldenaster and bastard toadflax are common forbs. Fringed sagewort usually increases. Silver sagebrush and rose may also increase. The most palatable shrubs are nearly absent. SI values of less than 25% are associated with State 2. Surface runoff and soil erosion are a serious concern on the Silty-Steep 10-14” p.z. site. The decrease in plant cover and litter increases the susceptibility to erosion. Less vegetative growth is available for transfer to litter, and nutrient cycling is delayed or impeded. As bare ground increases, infiltration decreases and/or surface runoff and soil evaporation increases. Because ecological processes of the site are no longer balanced and sustained, shallow rooted, warm season species continue to gain a competitive advantage over the deep rooted, cool season species. The biotic integrity of the site is degraded. In comparison to the State 1 communities, State 2 is less efficient in capturing solar energy and converting it to carbohydrates for plant growth. Total vegetative production averages about 400 lbs/ac. The absence of tall and mid cool season perennial grasses, plus the shift from cool season plants to warm season plants, indicates that the structural and functional processes of this site have been disrupted. However, if the soil surface is stable and does not erode, site potential may not be significantly impaired.

### Transition T1A
### State 1 to 2

Extended drought (greater than 7 years), non-prescribed grazing, no fire Plant Community B will regress to a lower state with any combination of extended drought, non-prescribed grazing and unfavorable climatic patterns. This transition from Community B to State 2 represents a threshold, or a point in space and time at which one or more of the primary ecological processes responsible for maintaining the sustained equilibrium of the state degrades beyond the point of self-repair.

### Restoration pathway R2A
### State 2 to 1

Prescribed grazing, fire (natural interval 5 to 7 years), extended favorable precipitation Plant community succession across a threshold to a higher state is ecologically difficult in most ecosystems. A significant input of energy is often required for succession to occur. In instances of prolonged favorable climatic conditions combined with proper management, the significant input of energy that is normally required to move this site across the threshold (from State 2 to State 1) may not be needed. Because of the steep slopes, mechanical treatments and range seeding are not recommended. Ranchers should be aware of the limitations of this site. Rather than trying to change nature, managers must learn to live within the environmental boundaries of this site. Prescribed grazing management should be a requirement for this site.

## Additional community tables

**Table 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** | | | 600–1320 | |
| | bluebunch wheatgrass | PSSP6 | *Pseudoroegneria spicata* | 300–720 | – |
| | needle and thread | HECO26 | *Hesperostipa comata* | 120–240 | – |
| | green needlegrass | NAVI4 | *Nassella viridula* | 90–180 | – |
| | porcupinegrass | HESP11 | *Hesperostipa spartea* | 90–180 | – |
| 1 | **Rhizomatous Wheatgrasses** | | | 180–360 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 90–180 | – |
| | tufted wheatgrass | ELMA7 | *Elymus macrourus* | 90–180 | – |
| 3 | **Warm-season Grasses** | | | 90–300 | |
| | plains muhly | MUCU3 | *Muhlenbergia cuspidata* | 90–180 | – |
| | little bluestem | SCSC | *Schizachyrium scoparium* | 0–120 | – |
| 4 | **Miscellaneous Grasses** | | | 0–120 | |
| | threadleaf sedge | CAFI | *Carex filifolia* | 0–60 | – |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–60 | – |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 0–60 | – |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 0–60 | – |
| | plains reedgrass | CAMO | *Calamagrostis montanensis* | 0–60 | – |
| | Grass, native | 2GN | *Grass, native* | 0–60 | – |
| **Forb** | | | | | |
| 5 | **Dominant Forbs** | | | 24–120 | |
| | dotted blazing star | LIPU | *Liatris punctata* | 12–60 | – |
| | American vetch | VIAM | *Vicia americana* | 12–60 | – |
| 2 | **Clovers** | | | 24–120 | |
| | purple prairie clover | DAPU5 | *Dalea purpurea* | 12–60 | – |
| | white prairie clover | DACA7 | *Dalea candida* | 12–60 | – |
| 7 | **Miscellaneous Forbs** | | | 0–60 | |
| | Missouri goldenrod | SOMI2 | *Solidago missouriensis* | 0–60 | – |
| | aster | ASTER | *Aster* | 0–60 | – |
| | scarlet globemallow | SPCO | *Sphaeralcea coccinea* | 0–60 | – |
| | scurfpea | PSORA2 | *Psoralidium* | 0–60 | – |
| | hairy false goldenaster | HEVI4 | *Heterotheca villosa* | 0–60 | – |
| | upright prairie coneflower | RACO3 | *Ratibida columnifera* | 0–60 | – |
| | prairie thermopsis | THRH | *Thermopsis rhombifolia* | 0–60 | – |
| | pussytoes | ANTEN | *Antennaria* | 0–60 | – |
| | bastard toadflax | COUM | *Comandra umbellata* | 0–60 | – |
| | milkvetch | ASTRA | *Astragalus* | 0–60 | – |
| | beardtongue | PENST | *Penstemon* | 0–60 | – |
| | spiny phlox | PHHO | *Phlox hoodii* | 0–60 | – |
| | buckwheat | ERIOG | *Eriogonum* | 0–60 | – |
| | Forb, native | 2FN | *Forb, native* | 0–60 | – |
| | lesser spikemoss | SEDE2 | *Selaginella densa* | 0–1 | – |
| | plains pricklypear | OPPO | *Opuntia polyacantha* | 0–1 | – |

| | | | | | |
|---|---|---|---|---|---|
| | plains pricklypear | OPPO | *Opuntia polyacantha* | 0–1 | |
| **Shrub/Vine** | | | | | |
| 8 | **Dominant Shrubs** | | | 15–60 | |
| | winterfat | KRLA2 | *Krascheninnikovia lanata* | 15–60 | – |
| 9 | **Miscellaneous Shrubs** | | | 0–120 | |
| | snowberry | SYMPH | *Symphoricarpos* | 0–60 | – |
| | rose | ROSA5 | *Rosa* | 0–60 | – |
| | rubber rabbitbrush | ERNA10 | *Ericameria nauseosa* | 0–60 | – |
| | silver sagebrush | ARCA13 | *Artemisia cana* | 0–60 | – |
| | prairie sagewort | ARFR4 | *Artemisia frigida* | 0–60 | – |
| | creeping juniper | JUHO2 | *Juniperus horizontalis* | 0–60 | – |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 0–60 | – |
| | broom snakeweed | GUSA2 | *Gutierrezia sarothrae* | 0–1 | – |
| | plains pricklypear | OPPO | *Opuntia polyacantha* | 0–1 | – |

## Animal community

Livestock Management
This site evolved with trampling, defoliation (ungulates, grasshoppers and jackrabbits, and other herbivores), fire and drought. Its plant communities are moderately resistant to disturbances which may alter ecological processes. They are also moderately resilient. Following perturbations such as drought, which allows blue grama and other increasers to increase at the expense of the mid and tall grasses, succession occurs with subsequent rainfall. Thus, the HCPC, or Communities A and B may be present at any given time in State 1. During “average” years, the site has the potential to produce 1200 lbs of forage per acre.
Forage production shows far greater variations in response to changes in annual precipitation than to different grazing intensities (Heitschmidt et al 2005) However, proper stocking rates and prescribed grazing is needed to ensure that the site remains in a high seral or HCPC state. Without proper grazing management the mid-to-tall grass community will regress to a blue grama, prairie junegrass, dense clubmoss community. In comparison to the high seral state, suggested stocking rates on sites in the early seral state represent a 4-fold reduction. Experience indicates that prescribed grazing prevents further deterioration in State 2. Furthermore, significant plant succession may occur within a reasonable time frame. Very few livestock losses are reported from poisonous plants.
Similarity index values of 35-55% characterized most of the Silty-Steep 10-14” p.z. sites inventoried on the Fort Peck and Fort Belknap Reservations in 2001-2004. SI values of less than 25% were not encountered. In contrast, SI’s of less than 25% were frequently associated with adjacent Silty 10-14” p.z. sites. Similar observations occur on other ranches in the Glaciated Plains. In contrast to adjacent Silty 10-14” p.z. site (often near water) where very few highly palatable cool season grasses remain because of repeated, frequent grazing events, a fairly diverse mix of desirable, cool season plants often grow on the Silty-Steep 10-14” p.z. site. The higher range health rating of this site probably results from less livestock grazing. Utilization of plants growing on slopes and on sites more distant from water developments is normally less than it is for plants growing on lower, more gently sloping terrain that is situated near watering facilities.
This site is suitable for livestock grazing from May through October. The grass-dominant plant community is better suited for cattle, rather than sheep grazing.
However, sheep are better adapted to grazing the steep slopes, especially if watering facilities are relatively distant. Therefore, a mix of cattle and sheep usage often merits consideration.

Wildlife Interpretations
State 1 of the Silty-Steep 10-14” p.z. ecological site includes the HCPC and two additional communities. This state provides forage for mule deer during most of the year. However, the overall forage potential is limited by the relatively low production and diversity of forbs and shrubs. Low shrub cover also limits the potential of the site for thermal and escape cover. Most deer use occurs along the edges of the site where it borders deciduous wooded draws, badland sites, etc.
Species diversity and cover associated with the HCPC or other communities in the Reference State also provide habitat for sharp-tailed grouse and other upland birds. Most wildlife usage occurs along the “ecotones” between the Silty-Steep 10-14” p.z. site and wooded draws. The relative absence of big sagebrush limits the potential of this site

for sage grouse habitat. The few sage grouse that exist in the Glaciated Plains are associated with silver sagebrush.
Species diversity and litter also provide favorable habitats for deer mice, rabbits and other small mammals. Golden eagles, redtail and ferruginous hawks are often circling over the landscape searching for prey.
Communities that are in State 2 are much less suitable for big game, upland birds and most species of small mammals. Prairie dogs usually are not a problem on Silty-Steep 10-14” p.z. sites because slopes are greater than 15%. Prairie dogs prefer slopes of 1-10%.

Plant Preferences by Animal Kind
Refer to NRCS Field Office Technical Guide, Section IIE, General Information, for tables displaying plant preferences by livestock and wildlife.

## Hydrological functions

Soils associated with this ecological site are in Hydrologic Soil Groups B and C. Infiltration rates are generally moderate. The runoff potential is medium to very high, varying with slope and ground cover.
Good hydrologic conditions exist on Silty-Steep 10-14” p.z. sites that are either in a high seral state or at the HCPC (State 1). Canopy cover (grass, forbs and shrubs) is greater than 90% in these communities, which is conducive to high infiltration rates and minimizes runoff and erosion.
Communities in early seral states (State 2) are generally considered to be in poor hydrologic condition. Concerns are valid. The excessive amount of bare ground results from inadequate plant cover and litter. Therefore, infiltration decreases and surface runoff increases. The desirable tall and mid-grasses are unable to effectively utilize available moisture. Water and wind erosion are major concerns on Silty-Steep 10-14” p.z. sites. Prescribed grazing management is needed to restore vigor of the higher-successional plants and to replenish or maintain about 50% litter to protect the soil resource.

## Recreational uses

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

## Wood products

This site has no significant value for wood products.

## Other information

The Silty-Steep 10-14” p.z. ecological site in the northern Glaciated Plains is resistant to perturbations. However, the site loses its resiliency when the plant community regresses from State 1 to State 2. Reproductive capability of the higher successional plants and annual production declines as the site moves toward the threshold separating State 1 from State 2. Annual production in early seral states is less than 1/4 of the potential at HCPC. Thus, litter and the number of structural/functional groups are adversely affected.

## Inventory data references

Data Source Number of Records Sample Period State County
SCS-Range-417 2 (#513, #514) 1991--1992 MT Phillips
ECS-1
Modified Double Sampling 18 2001-2004 MT Blaine, Roosevelt, Sheridan,
Phillips, Valley
USDA-SCS-MT. 1981. Technical Range Site Description

## Other references

Branson, F. A., and R. F. Miller. 1981. Effects of increased precipitation and grazing management on Northeastern Montana rangelands. J. Range Manage. 34: 3-10.

Dyksterhuis, E. J. 1949. Condition and management of rangeland based on quantitative ecology. J. Range Manage.2:104-115.
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.
Heitschmidt, R. K., K. D. Klement, and M. R. Haferkamp. 2005. Interactive effects of drought and grazing on Northern Great Plains rangelands. Rangeland Ecol. Manage. 58: 11-19.
Stringham, T. K., W. C. Krueger, and P. L. Shaver. 2003. State and transition modeling: an ecological process approach. J. Range Manage. 56:106-113.
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 Silty-Steep 10-14” p.z. ecological site description replaces earlier dated versions of Silty-Steep 10-14” p.z., Thin Silty 10-14” p.z. and Thin Hilly 10-14” p.z. descriptions in Rangeland Resource Unit 52XN. This 2005 revision incorporates the State and Transition Model theory, additional data on site productivity, and an improved understanding of many rangeland health indicators.
The USDA-SCS-MT Technical Range Site Description (August 1981), which this site description partially replaces, reports that total annual production averages about 1200 lbs/ac on the Thin Hilly 10-14” p.z. ecological site. Production varies from 850 lbs/ac in an unfavorable year to 1450 lbs in a favorable year. The Thin Hilly site was based on the concept that slope was the key factor characterizing the site, soil texture and other factors were considered less important. Because the earlier approach did not provide the site specific information required for management of some landscapes, the current effort of separating the Thin Hilly site into Silty-Steep 10-14” p.z., Clayey-Steep 10-14” p.z., and Sandy-Steep 10-14” p.z. ecological sites is justified.
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
Rick Bandy, Area RSS, Great Falls, 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) | Siddoway/Bandy |

| | |
|---|---|
| Contact for lead author | Great Falls Area Office, Great Falls, MT<br><br>Reference site used? No |
| Date | 04/19/2005 |
| Approved by | Kirt Walstad |
| Approval date | |
| Composition (Indicators 10 and 12) based on | Annual Production |

## Indicators

1. **Number and extent of rills:** Slopes most common on this site are between 15–45% and with at least 90% of the soil surface well-covered, rills, if evident will be rare, but may occur in bare areas after extreme convection storms – rills in this case would be narrow and less than 5 feet in length.

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2. **Presence of water flow patterns:** Will be rare, generally, on this site, but with the steeper slopes, and up to 10% bare ground, there may be areas which show accumulations of litter due to water movement, especially after severe storms.

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3. **Number and height of erosional pedestals or terracettes:** Wind and water erosion will be rare on this site, but with the steeper slopes there may be rare plants that could have pedestals which could be 0.5 inch in height.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground should be 10% or less on this site.

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5. **Number of gullies and erosion associated with gullies:** Gully erosion will not be evident on this site.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Appearance or evidence of these erosional features on the landscape would not be present on this site.

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7. **Amount of litter movement (describe size and distance expected to travel):** Because the site is dominated by the taller bunchgrasses, litter size will reflect the height and diameter of the reproductive culms and leaves of these grasses as well as the lesser dominate mid-size grasses.

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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):** Resistance to erosion will be high with soil stability values of 5 or 6 under plant canopies; areas of bare soil on this site may have values between 1 and 4 if not under plant canopy

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface structure is granular; A horizon depth is 1 – 3”.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Dominance of taller, deep rooted bunchgrasses will maximize infiltration and minimize runoff throughout the site

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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):** Will not be present generally, but there may be areas that have “healed” from former bison trails and wallows as well as more current livestock trails which could have a compaction layer below the soil surface.

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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: Cool season, taller grasses (Bluebunch wheatgrass) >> cool season mid-grasses (Needleandthread) = cool season rhizomatous grasses (Western wheatgrass) > cool season short grasses (Sandberg bluegrass) = perennial forbs > warm season shortgrass (Blue grama) = shrubs.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Will be low for all functional groups in a given year. Prolonged droughts which last more than 3 years may show increases in mortality and decadence for all plant groups.

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14. **Average percent litter cover (%) and depth ( in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 850 - 1450 #/acre. This would be the expected production for the reference state during adequate moisture years. 1200 pounds would be the expected production in a 12 inch precipitation zone.

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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:** Dense clubmoss, blue grama, Red threeawn, Japanese brome, a variety of annual or biennial weedy forbs, fringed sagewort, broom snakeweed, prickly pear cactus, cheatgrass.

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17. **Perennial plant reproductive capability:** During adequate moisture years bunchgrasses will generally produce seeds, however the cool season rhizomatous grasses may not necessarily produce seed even with adequate moisture.

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