

# Ecological site R046XS115MT Very Shallow (VSw) RRU 46-S 13-19 PZ

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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.

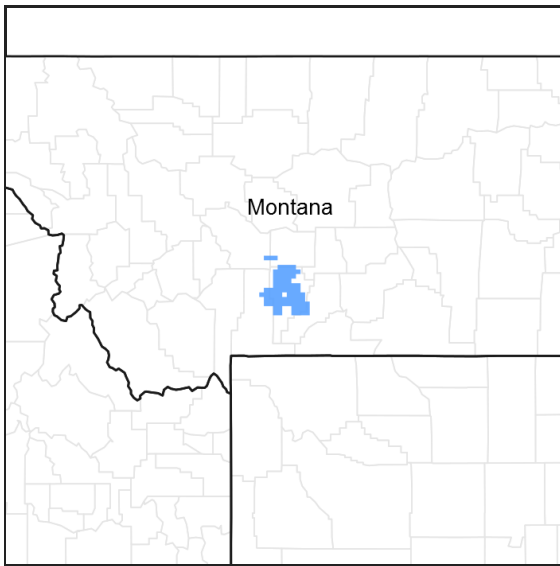


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

## Associated sites

|             |   |
|-------------|---|
| R046XS104MT | <b>Silty (Si) RRU 46-S 13-19 PZ</b>         |
| R046XS114MT | <b>Shallow (Sw) RRU 46-S 13-19 PZ</b>       |
| R046XS619MT | <b>Shallow Clay (SwC) RRU 46-S 13-16 PZ</b> |

## Similar sites

|             |  |
|-------------|--|
| R046XS116MT | <b>Gravelly (Gr) RRU 46-S 13-19 PZ</b><br>The Gravel site differs mainly in depth or texture.  |
| R046XS114MT | <b>Shallow (Sw) RRU 46-S 13-19 PZ</b><br>The Shallow site differs by having a deeper soil profile over the root restricting layer, and having significantly more production. |

Table 1. Dominant plant species

|            |                                    |
|------------|------------------------------------|
| Tree       | Not specified                      |
| Shrub      | Not specified                      |
| Herbaceous | (1) <i>Pseudoroegneria spicata</i> |

## Physiographic features

This ecological site can occur on most upland positions including ridgetops, escarpments and shoulders of hills. It often occurs in complex with other ecological sites. This site occurs on slopes ranging from nearly level to very steep. It occurs on all exposures, and aspect sometimes becomes significant on steeper slopes. Variations in plant community composition and production can result due to aspect. Outcroppings of bedrock are characteristic and the amount tends to increase as slopes increase.

**Table 2. Representative physiographic features**

|                    |                                    |
|--------------------|------------------------------------|
| Landforms          | (1) Ridge<br>(2) Hill              |
| Flooding frequency | None                               |
| Ponding frequency  | None                               |
| Slope              | 2–70%                              |
| Water table depth  | 152 cm                             |
| Aspect             | Aspect is not a significant factor |

## Climatic features

See Climatic Data Sheet for more details (Section II of the Field Office Technical Guide) or reference the following climatic web site: <http://www.wrcc.sage.dri.edu/>.

**Table 3. Representative climatic features**

|  |              |
|--|--------------|
| Frost-free period (characteristic range)   | 49-96 days   |
| Freeze-free period (characteristic range)  | 105-122 days |
| Precipitation total (characteristic range) | 356-457 mm   |
| Frost-free period (actual range)           | 47-99 days   |
| Freeze-free period (actual range)          | 104-125 days |
| Precipitation total (actual range)         | 330-457 mm   |
| Frost-free period (average)                | 76 days      |
| Freeze-free period (average)               | 114 days     |
| Precipitation total (average)              | 406 mm       |

## Climate stations used

- (1) JOLIET [USC00244506], Joliet, MT
- (2) COLUMBUS [USC00241938], Columbus, MT
- (3) BIG TIMBER [USC00240780], Big Timber, MT
- (4) MELVILLE 4 W [USC00245603], Big Timber, MT
- (5) MARTINSDALE 3 NNW [USC00245387], Martinsdale, MT
- (6) NYE 2 [USC00246190], Fishtail, MT

## Influencing water features

No influencing water features.

## Soil features

These soils form on alluvium, residuum, and colluvium. They are typically less than 10 inches deep to hard rock or soft beds of decomposed siltstone, sandstone, or shale. Soils that characterize this ecological site can include deep

fragmental soils. Few roots penetrate deeper than 10 inches. Surface textures are variable. Cracks in the bedrock may allow deeper root penetration and have taller grasses, shrubs, or stunted trees. These soils are very droughty, having a total water holding capacity of 2 inches or less.

**Table 4. Representative soil features**

|  |   |
|--|---|
| Surface texture  | (1) Channery loam<br>(2) Very channery sandy loam<br>(3) Gravelly silt loam |
| Drainage class   | Excessively drained   |
| Permeability class                                       | Moderate to rapid   |
| Soil depth   | 25 cm   |
| Surface fragment cover <=3"                              | 0–3%  |
| Surface fragment cover >3"                               | 0–1%  |
| Available water capacity<br>(0-101.6cm)                  | 5.08 cm   |
| Electrical conductivity<br>(0-101.6cm)                   | 0 mmhos/cm  |
| Soil reaction (1:1 water)<br>(0-101.6cm)                 | 6.6–8.4   |
| Subsurface fragment volume <=3"<br>(Depth not specified) | 15–70%  |
| Subsurface fragment volume >3"<br>(Depth not specified)  | 0–10%   |

## Ecological dynamics

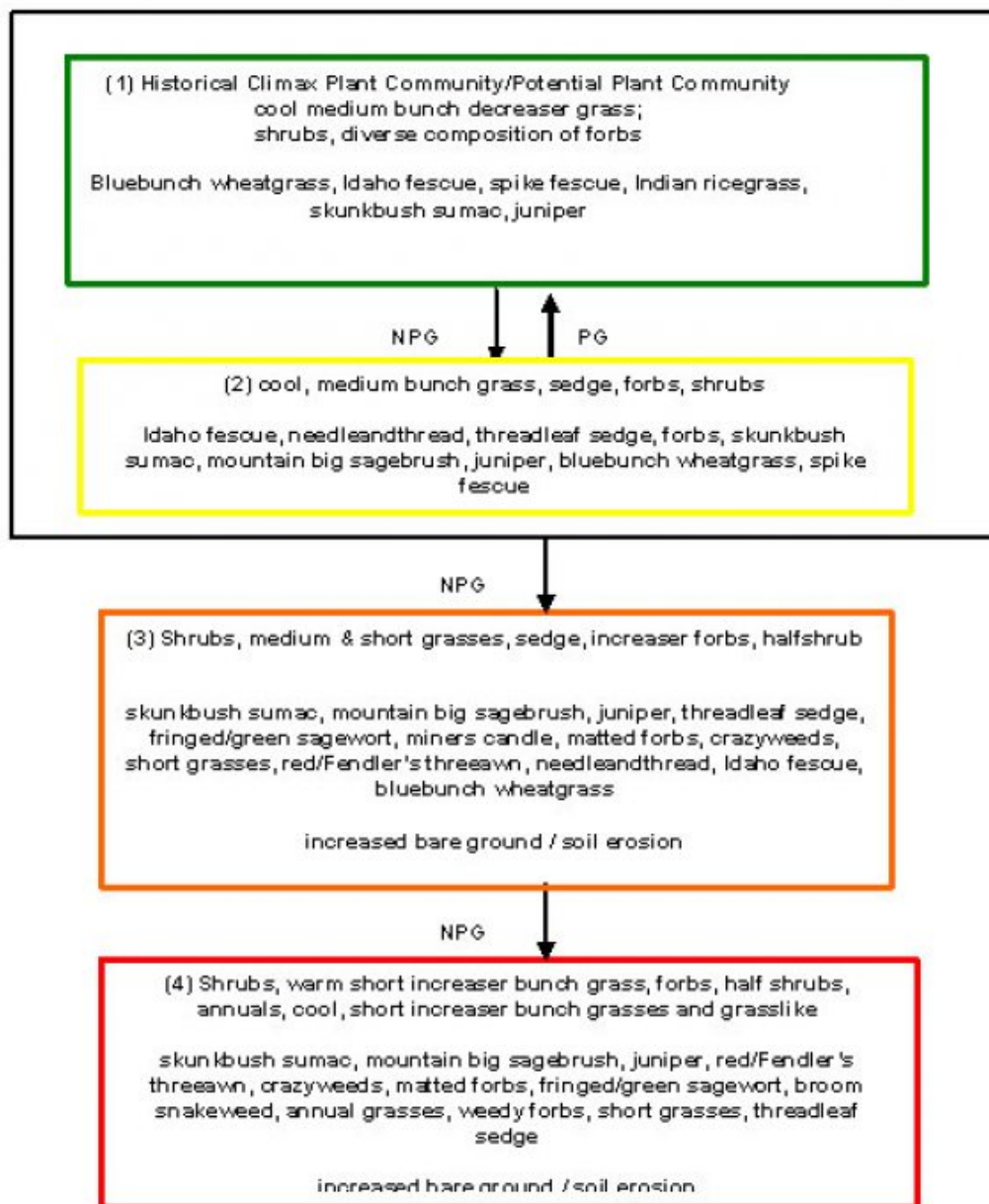
This site developed under Northern Rocky Mountain foothills climatic conditions, which included the natural influence of large herbivores and occasional fire. The plant community upon which interpretations are primarily based is the Historic Climax Plant Community (HCPC). This community is described as a reference to understand the original potential of this site, and is not always considered to be the management goal for every acre of rangeland. The following descriptions should enable the landowner or manager to better understand which plant communities occupy their land, and assist with setting goals for vegetation management. It can also be useful to understand the environmental and economic values of each plant community.

This site is considered slightly resilient to disturbance as it has significant soil limitations for plant growth. Changes may occur to the Historic Climax Plant Community due to management actions and/or climatic conditions. Under continued adverse impacts, a moderate decline in vegetative vigor and composition will occur. Under favorable vegetative management treatments, this site can more readily return to the Historic Climax Plant Community (HCPC).

Continual adverse impacts to the site over a period of years results in a departure from the HCPC, with a decrease of the taller, more palatable species such as bluebunch wheatgrass, little bluestem, Indian ricegrass, and plains muhly, and an increase in Idaho fescue, sedges, needleandthread, forbs, juniper, and green sagewort.

Plants that are not a part of the climax community that are most likely to invade are annual grasses and forbs. Noxious weeds that are likely to invade are spotted knapweed, dalmation toadflax, sulphur cinquefoil, and leafy spurge.

## State and transition model



Smaller boxes within a larger box indicate that these communities will normally shift among themselves with slight variations in precipitation and other disturbances. Moving outside the larger box indicates the community has crossed a threshold (heavier line) and will require intensive treatment to return to Community 1 or 2. Dotted lines indicate a reduced probability for success. Yellow boxes indicate caution that the community may be in danger of crossing a threshold. Orange boxes represent communities that have crossed over thresholds from the HCPC and may be difficult to restore with grazing management alone. Red boxes represent communities that have severely shifted away from the HCPC and probably cannot be restored without mechanical inputs.

NOTE: Not all species present in the community are listed in this table. Species listed are representative of the plant functional groups that occur in the community.

PG = Prescribed Grazing: Use of a planned grazing strategy to balance animal forage demand with available forage resources. Timing, duration, and frequency of grazing are controlled and some type of grazing rotation is applied to allow for plant recovery following grazing.

NPG = Non-Prescribed Grazing: Grazing which has taken place that does not control the factors as listed above, or animal forage demand is more than the available forage supply.

Figure 8. State and Transition Model

**State 1**  
**Tall Bunchgrasses, Shrubs, Forbs**

**Community 1.1**  
**Tall Bunchgrasses, Shrubs, Forbs**

This is the interpretive plant community and is considered to be the Historic Climax Plant Community (HCPC) for this site. This plant community contains a high diversity of tall and medium height, cool and warm season grasses and grasslikes (bluebunch wheatgrass, Idaho fescue, spike fescue, and Indian ricegrass), and short grasses and sedges (Sandberg bluegrass, prairie junegrass, threadleaf and needleleaf sedge). There are abundant forbs (prairie clovers) which occur in smaller percentages. Shrubs such as skunkbush sumac and juniper can also be common. This plant community is well adapted to the Northern Rocky Mountain foothills climatic conditions. The diversity in plant species allows for drought tolerance. Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation, and temperature). This plant community is well suited to managed livestock grazing and provides diverse habitat for many wildlife species. Plants on this site have strong, healthy root systems that allow production to increase significantly with favorable moisture conditions. This plant community provides for soil stability and a properly functioning hydrologic cycle. Abundant plant litter is available for soil building and moisture retention. Plant litter is properly distributed with very little movement off-site and natural plant mortality is very low. The soils associated with this site provide a limited soil-water-plant relationship.

**Table 5. Annual production by plant type**

| Plant Type      | Low<br>(Kg/Hectare) | Representative Value<br>(Kg/Hectare) | High<br>(Kg/Hectare) |
|-----------------|---------------------|--------------------------------------|----------------------|
| Grass/Grasslike | 620                 | 714                                  | 792                  |
| Shrub/Vine      | 45                  | 102                                  | 170                  |
| Forb            | 45                  | 102                                  | 170                  |
| <b>Total</b>    | <b>710</b>          | <b>918</b>                           | <b>1132</b>          |

**Table 6. Ground cover**

|                                   |        |
|-----------------------------------|--------|
| Tree foliar cover                 | 0%     |
| Shrub/vine/liana foliar cover     | 15-25% |
| Grass/grasslike foliar cover      | 15-20% |
| Forb foliar cover                 | 1-5%   |
| Non-vascular plants               | 0-1%   |
| Biological crusts                 | 0%     |
| Litter                            | 0%     |
| Surface fragments >0.25" and <=3" | 0%     |
| Surface fragments >3"             | 0%     |
| Bedrock                           | 0%     |
| Water                             | 0%     |
| Bare ground                       | 0%     |

**Table 7. Soil surface cover**

|                                   |        |
|-----------------------------------|--------|
| Tree basal cover                  | 0%     |
| Shrub/vine/liana basal cover      | 1-5%   |
| Grass/grasslike basal cover       | 5-10%  |
| Forb basal cover                  | 1-4%   |
| Non-vascular plants               | 0-1%   |
| Biological crusts                 | 0%     |
| Litter                            | 10-15% |
| Surface fragments >0.25" and <=3" | 0%     |
| Surface fragments >3"             | 10-15% |

|             |        |
|-------------|--------|
| Bedrock     | 0%     |
| Water       | 0%     |
| Bare ground | 40-50% |

## **State 2**

### **Medium and Short Grasses, Sedge, Forbs, Shrubs**

#### **Community 2.1**

##### **Medium and Short Grasses, Sedge, Forbs, Shrubs**

Early stages of degradation, including non-prescribed grazing, will tend to change the HCPC to a community dominated by medium and short grasses and sedges such as Idaho fescue, needleandthread (mainly 15 inches MAP or less), prairie junegrass, Sandberg bluegrass, plains reedgrass, and threadleaf sedge. Shrubs such as skunkbush sumac and juniper will tend to be more abundant. Most of the taller, more palatable grasses (bluebunch wheatgrass, spike fescue, Indian ricegrass) will still be present but in smaller amounts. Palatable and nutritious forbs will be replaced by less desirable and more aggressive species. Biomass production and litter become slightly reduced on the site with Community 2, as the taller grasses become replaced by shorter ones. Evapotranspiration tends to increase, moisture retention is reduced, and soil surface temperatures increase. Some natural ecological processes will be altered. This plant community provides for moderate soil stability. Increased amounts of bare ground can result in undesirable species invading. Common invaders can include spotted knapweed, leafy spurge, dalmation toadflax, and sulphur cinquefoil. This plant community will readily respond to improved grazing management, but a significant amount of time can be necessary to move it toward a higher successional stage and a more productive plant community similar to community 1.

## **State 3**

### **Shrubs, medium & short grasses, sedge, increaser forbs, threeawns, clubmoss**

#### **Community 3.1**

##### **Shrubs, medium & short grasses, sedge, increaser forbs, threeawns, clubmoss**

Should the heavy disturbance continue, the site will become dominated by species such as skunkbush sumac, juniper, threadleaf sedge, fringed or green sagewort, short grasses such as prairie junegrass and Sandberg bluegrass, Idaho fescue, needleandthread, and increaser forbs such as miner's candle, and crazyweeds. There may still be remnant amounts of some of the late-seral species such as bluebunch wheatgrass and Indian ricegrass present. The taller grasses will occur only occasionally, often within juniper plants. Palatable forbs will be mostly absent. Mountain big sagebrush may become common in some locations. There is often an increase in the amount of bare ground that can result in significant loss of the very limited amount of topsoil that's present. Plant community 3 is usually less productive than 1 or 2. The lack of litter and short plant heights result in higher soil temperatures, poor water infiltration rates, and higher evapotranspiration rates, thus eventually favoring species that are more adapted to drier conditions. These communities have lost many of the attributes of a healthy rangeland, including good infiltration, minimal erosion and runoff, nutrient cycling and energy flow. This plant community is the result of long-term, heavy, continuous grazing and/or annual, early spring seasonal grazing. Repeated spring grazing depletes stored carbohydrates, resulting in weakening and eventual death of the cool season tall and medium grasses. This plant community can occur throughout the pasture, on spot grazed areas, and around water sources where season-long grazing patterns occur. This community will respond positively to improved grazing management, but significant economic inputs and a significant amount of time are usually required to move this plant community toward a higher successional stage and a more productive plant community.

## **State 4**

### **Shrubs, Threeawns, Forbs, Half shrubs, Annuals, Short Grasses and, clubmoss**

#### **Community 4.1**

##### **Shrubs, Threeawns, Forbs, Half shrubs, Annuals, Short Grasses and, clubmoss**

Further deterioration of community 3 results in a plant community dominated by the shrubs skunkbush sumac and

juniper, and undesirable plants such as red threeawn, fringed sagewort, broom snakeweed, weedy forbs (e.g., pussytoes and thistles), annuals such as cheatgrass and Japanese bromes, threadleaf sedge, and yucca. Many increaser short grasses such as prairie junegrass, plains reedgrass, and Sandberg bluegrass will be abundant. Frequently, a remnant population of climax species such as bluebunch wheatgrass will occur. Mountain big sagebrush may become abundant in some locations. Plains prickly pear cactus may also become common. The increase in the amount of bare ground may continue, resulting in significant loss of the very limited amount of topsoil that's present, leaving a surface similar to "desert pavement". Plant community 4 produces less usable forage than the others described. The continuation of the downward trend and degradation of this site has resulted in higher soil surface temperatures, reduced water infiltration, and higher evapotranspiration. This has resulted in plant species that are more adapted to drier conditions, such as blue grama and cactus. The thick canopy cover of big sagebrush often results in precipitation being intercepted, thus not reaching the soil. Most of the attributes of a healthy rangeland, including good infiltration, minimal erosion and runoff, nutrient cycling and energy flow, have been lost. This community can respond positively to improved grazing management but it will take additional inputs and a significant amount of time to move it towards communities similar in production and composition to the others that have been described. However, because of the very shallow soils (and sometimes, steeper slopes) associated with this ecological site, practices such as mechanical treatment or seeding are generally not feasible nor recommended.

## Additional community tables

Table 8. Community 1.1 plant community composition

| Group                  | Common Name                   | Symbol | Scientific Name                           | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|------------------------|-------------------------------|--------|---|--------------------------------|------------------|
| <b>Shrub/Vine</b>      |                               |        |   |                                |                  |
| 0                      | <b>Shrubs and Half-shrubs</b> |        |   | 45–170                         |                  |
|                        | Shrub, broadleaf              | 2SB    | <i>Shrub, broadleaf</i>                   | 0–56                           | –                |
|                        | prairie sagewort              | ARFR4  | <i>Artemisia frigida</i>                  | 0–56                           | –                |
|                        | mountain big sagebrush        | ARTRV  | <i>Artemisia tridentata ssp. vaseyana</i> | 0–56                           | –                |
|                        | juniper                       | JUNIP  | <i>Juniperus</i>                          | 0–56                           | –                |
|                        | skunkbush sumac               | RHTR   | <i>Rhus trilobata</i>                     | 0–56                           | –                |
|                        | soapweed yucca                | YUGL   | <i>Yucca glauca</i>                       | 0–56                           | –                |
|                        | plains pricklypear            | OPPO   | <i>Opuntia polyacantha</i>                | 0–1                            | –                |
|                        | broom snakeweed               | GUSA2  | <i>Gutierrezia sarothrae</i>              | 0–1                            | –                |
| <b>Grass/Grasslike</b> |                               |        |   |                                |                  |
| 0                      | <b>Grasses and Sedges</b>     |        |   | 620–792                        |                  |
|                        | bluebunch wheatgrass          | PSSP6  | <i>Pseudoroegneria spicata</i>            | 443–735                        | –                |
|                        | Idaho fescue                  | FEID   | <i>Festuca idahoensis</i>                 | 0–170                          | –                |
|                        | needle and thread             | HECOC8 | <i>Hesperostipa comata ssp. comata</i>    | 0–113                          | –                |
|                        | Indian ricegrass              | ACHY   | <i>Achnatherum hymenoides</i>             | 0–113                          | –                |
|                        | spike fescue                  | LEKI2  | <i>Leucopoa kingii</i>                    | 0–113                          | –                |
|                        | plains muhly                  | MUCU3  | <i>Muhlenbergia cuspidata</i>             | 0–56                           | –                |
|                        | Cusick's bluegrass            | POCU3  | <i>Poa cusickii</i>                       | 0–56                           | –                |
|                        | Sandberg bluegrass            | POSE   | <i>Poa secunda</i>                        | 45–56                          | –                |
|                        | prairie Junegrass             | KOMA   | <i>Koeleria macrantha</i>                 | 45–56                          | –                |
|                        | Grass, perennial              | 2GP    | <i>Grass, perennial</i>                   | 0–56                           | –                |
|                        | needleleaf sedge              | CADU6  | <i>Carex duriuscula</i>                   | 0–56                           | –                |
|                        | threadleaf sedge              | CAFI   | <i>Carex filifolia</i>                    | 0–56                           | –                |
|                        | plains reedgrass              | CAMO   | <i>Calamagrostis montanensis</i>          | 45–56                          | –                |
|                        | thickspike wheatgrass         | ELLAL  | <i>Elymus lanceolatus ssp.</i>            | 0–28                           | –                |

|             |                         |         |   |        |   |
|-------------|-------------------------|---------|---|--------|---|
|             |                         |         | <i>lanceolatus</i>                        |        |   |
|             | western wheatgrass      | PASM    | <i>Pascopyrum smithii</i>                 | 0–28   | – |
|             | purple threeawn         | ARPU9   | <i>Aristida purpurea</i>                  | 0–1    | – |
|             | Fendler's threeawn      | ARPUF   | <i>Aristida purpurea var. fendleriana</i> | 0–1    | – |
| <b>Forb</b> |                         |         |   |        |   |
| 0           | <b>Forbs</b>            |         |   | 45–170 |   |
|             | beardtongue             | PENST   | <i>Penstemon</i>                          | 0–56   | – |
|             | spiny phlox             | PHHO    | <i>Phlox hoodii</i>                       | 0–56   | – |
|             | scurfpea                | PSORA2  | <i>Psoraleidium</i>                       | 0–56   | – |
|             | stonecrop               | SEDUM   | <i>Sedum</i>                              | 0–56   | – |
|             | Forb, perennial         | 2FP     | <i>Forb, perennial</i>                    | 0–56   | – |
|             | pussytoes               | ANTEN   | <i>Antennaria</i>                         | 0–56   | – |
|             | tarragon                | ARDR4   | <i>Artemisia dracunculus</i>              | 9–56   | – |
|             | Hoffmann's rockcress    | ARHO    | <i>Arabis hoffmannii</i>                  | 9–56   | – |
|             | aster                   | ASTER   | <i>Aster</i>                              | 0–56   | – |
|             | miner's candle          | CRVI4   | <i>Cryptantha virgata</i>                 | 9–56   | – |
|             | buckwheat               | ERIOG   | <i>Eriogonum</i>                          | 0–56   | – |
|             | haplopappus             | HAPLO11 | <i>Haplopappus</i>                        | 0–56   | – |
|             | hairy false goldenaster | HEVI4   | <i>Heterotheca villosa</i>                | 0–56   | – |
|             | bitter root             | LERE7   | <i>Lewisia rediviva</i>                   | 9–56   | – |
|             | leafy wildparsley       | MUDI    | <i>Musineon divaricatum</i>               | 0–56   | – |
|             | locoweed                | OXYTR   | <i>Oxytropis</i>                          | 0–1    | – |
|             | larkspur                | DELPH   | <i>Delphinium</i>                         | 0–1    | – |

## Animal community

Livestock Grazing Interpretations: Managed livestock grazing is suitable on this site as it has the potential to produce a very limited amount of high quality forage. Grazing must be managed carefully on this site to be sure livestock drift onto the better, more productive sites is not excessive. Management objectives should include maintenance or improvement of the plant community. Shorter grazing periods and adequate re-growth after grazing are recommended for plant maintenance and recovery. Heavy stocking and season-long use of this site can be detrimental and will alter the plant community composition and production over time.

Using shorter grazing periods and providing for adequate re-growth after grazing are recommended for plant maintenance, health, and recovery. Continual over stocking and season-long use of this site can be detrimental and will alter the plant composition and production over time. The result will be plant communities that resemble numbers 3 and 4, depending on how long this grazing management is used as well as other circumstances such as weather conditions and fire frequency. Repeated heavy early spring grazing, especially during stem elongation (generally mid May through mid June), can also have detrimental affects on the taller, key forage species.

Whenever Plant Community 2 (medium and short grasses) occurs, grazing management strategies that will prevent further degradation need to be implemented. This community is still stable, productive, and healthy provided it receives proper management. It will respond fairly quickly to improved grazing management, including increased growing season rest of key forage plants. Grazing management alone can usually move this back towards the potential / historic climax community,.

Plant Communities 3 and 4 have a high percentage of aggressive, less-desirable species. Once these have become established, it is significantly more difficult using grazing management alone to restore the site to one that resembles the HCPC. It becomes critical at this point to implement a grazing strategy that will restore the stability and health of the site. Additional growing season rest, or rest for an entire year(s) is often the only alternative for re-



establishment of the desired species, and restoration of the stability and health of this site.

**Calculating Safe Stocking Rates:** Proper stocking rates should be incorporated into a grazing management strategy that protects the resource, maintains or improves rangeland health, and is consistent with management objectives. Safe stocking rates will be based on useable forage production, and should consider ecological condition and trend of the site, and past grazing use history.

Calculations used to determine a safe stocking rate are based on the amount of useable forage available, taking into account the harvest efficiency of the animal and the grazing strategy to be implemented. Average annual production must be measured or estimated to properly assess useable forage production and stocking rates.

Stocking rates are calculated from average forage production values using a 25% Harvest Efficiency factor for preferred and desirable plants, and 10% Harvest Efficiency for less desirable species. AUM calculations are based on 915 pounds (air-dry) per animal unit month (AUM) for a 1,000-pound cow with calf up to 4 months. No adjustments have been made for site grazability factors, such as steep slopes, site inaccessibility, or distance to drinking water.

The following is an example of how to calculate the recommended stocking rate. This example does not use production estimates from this specific ecological site. You will need to adjust the annual production values and run the calculations using total annual production values from the ecological sites encountered on each individual ranch/pasture. Before making specific recommendations, an on-site evaluation must be made.

Example of total annual production amounts by type of year:

Favorable years = 2200 lbs/acre

Normal years = 1480 lbs/acre

Unfavorable years = 1200 lbs/acre

It is recommended that on slopes of 30% or less, stocking rate should be derived from the total annual production pounds minus 500 pounds for residual dry matter and 25% harvest efficiency. On slopes over 30%, stocking rate is derived from total annual production pounds minus 800 pounds for residual dry matter and 25% harvest efficiency. Refer to the NRCS National Range and Pasture Handbook for a list of Animal Unit Equivalents.

Sample Calculations using Favorable Year production amounts:

< 30% slopes:  $AUM/AC = [(2200-500)(0.25)]/915$  lbs/month for one AU = 0.46 AUM/AC  
 $AC/AUM = (1.0 AU)/(0.46AUM/AC) = 2.2 AC/AUM$

> 30% slopes:  $AUM/AC = [(2200-800)(0.25)]/915$  lbs/month for one AU = 0.38 AUM/AC  
 $AC/AUM = (1.0 AU)/(0.38 AU/AC) = 2.6 AC/AUM$

NOTE: 915 lbs/month for one Animal Unit is used as the baseline for maintenance requirements. This equates to 30 lbs/day of air-dry forage (1200 lb cow at 2.5% of body weight).

## Hydrological functions

The soils associated with this ecological site are generally in Hydrologic Soil Group A. The infiltration rates for these soils are highly variable, requiring an on-site evaluation. The runoff potential for this site is low to moderate, depending on slope and ground cover/health. Runoff curve numbers generally range from 54 to 73.

The hydrologic condition of this site has a significant affect on runoff. The hydrologic condition considers the effects of cover, including litter, and management on infiltration. Good hydrologic condition indicates that the site usually has a lower runoff potential.

Sites in low similarity (Plant Communities 3 and 4) are generally considered to be in less than good hydrologic condition. Sites in low similarity may have a high percentage of cover, but from shallow rooted species (e.g., threadleaf sedge). The deep root systems of the potential vegetation will help maintain or increase infiltration rates

and reduce runoff.

Erosion is minor for sites in high similarity. Rills and gullies should not be present. Water flow patterns, if present, will be barely observable. Plant pedestals are essentially non-existent. Plant litter remains in place and is not moved by erosion. Soil surfaces should not be compacted or crusted.

For arid and semi-arid rangelands, good hydrologic conditions exist if cover (grass, litter, and brush canopy) is greater than 70%. Fair conditions exist when cover is between 30 and 70%, and poor conditions exist when cover is less than 30%. (Reference: Engineering Field Manual, Chapter 2 and Montana Supplement 4).

## Recreational uses

This site provides some recreational opportunities for hiking, horseback riding, big game and upland bird hunting. The forbs have flowers that appeal to photographers. This site provides valuable open space and visual aesthetics. Caution should be used during wet weather periods.

## Wood products

None.

## Contributors

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## Approval

Kirt Walstad, 7/19/2023

## Rangeland health reference sheet

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

|   |                         |
|---|-------------------------|
| Author(s)/participant(s)                    | G. Petersen             |
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| Date  | 03/01/2020              |
| Approved by                                 | Kirt Walstad            |
| Approval date                               |                         |
| Composition (Indicators 10 and 12) based on | Annual Production       |

## Indicators

1. **Number and extent of rills:** Rills are rarely present in the reference condition, if present will be short and inconspicuous on the steeper, South facing slopes.
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2. **Presence of water flow patterns:** Water flow patterns are not present in the reference condition, but may be present on the steeper, south facing slopes when runoff exceeds infiltration. These patterns will be short and infrequent across gentle slopes and increasingly more common on extremely steep slopes.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals are rarely evident in the reference condition. If present, they will be on slopes greater than 25% and associated with waterflow patterns.

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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 is less than 30%. It consists of small, randomly scattered patches.

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5. **Number of gullies and erosion associated with gullies:** Gullies are not present in the reference condition.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Wind scoured, or depositional areas are not evident in the reference condition.

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7. **Amount of litter movement (describe size and distance expected to travel):** Litter movement is not evident in the reference condition.

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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):** The average soil stability rating is 4-6 under plant canopies and 4-5 in interspaces. The A horizon is 3-4 inches thick. Root mat and biotic crusts may exist.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil Structure at the surface is typically weak to moderate fine granular. A Horizon should be 3-4 inches thick with color, when wet, typically ranging in Value of 5 or less and Chroma of 3 or less. Local geology may affect color, it is important to reference the Official Series Description (OSD) for characteristic range. <https://soilseries.sc.egov.usda.gov/osdname.aspx>

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Infiltration of the Very Shallow ecological site is moderate. The site is well drained. An even distribution of mid stature grasses (75-80%), cool season bunchgrasses (10-15%) along with rhizomatous grass (5-10%), forbs (5-10%), and shrubs (0-5%)

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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):** A compaction layer is not present in the reference condition.

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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: Mid-statured, perennial bunchgrasses (Primarily bluebunch wheatgrass, green needlegrass, spike fescue)

Sub-dominant: shortgrass grasses/grasslikes (needle and thread, Idaho fescue, prairie Junegrass) > forbs = rhizomatous grasses ≥ Shrubs > tall shrubs/trees

Other:

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Mortality in herbaceous species is not evident. Species with bunch growth forms may have some natural mortality in centers is 3% or less.
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14. **Average percent litter cover (%) and depth ( in):** Total litter cover ranges from 15-35%. Most litter is irregularly distributed on the soil surface and is not at a measurable depth.
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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Average annual production is 950. Low: 850 High 1050. Production varies based on effective precipitation and natural variability of soil properties for this ecological site.
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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:** Potential invasive (including noxious) species (native and non-native). Invasive species on this ecological site include (but not limited to) salsify, whitetop, Canada thistle, annual brome spp., spotted knapweed, leafy spurge, crested wheatgrass, dandelion  
Native species such as Rocky Mountain juniper, limber pine, ponderosa pine, Douglas fir, lupine, broom snakeweed, Sandberg bluegrass, etc. when their populations are significant enough to affect ecological function, indicate site condition departure.
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17. **Perennial plant reproductive capability:** In the reference condition, all plants are vigorous enough for reproduction either by seed or rhizomes in order to balance natural mortality with species recruitment.
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