USDA Natural Resources
Conservation Service

# Ecological site EX043B23C113
# Granitic Loamy (GLy) Absaroka Subalpine Zone

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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): 043B–Central Rocky Mountains

Major Land Resource Unit (MLRA) 43B: Central Rocky Mountains

43B – Central Rocky Mountains – The Central Rocky Mountains extends from northern Montana to southern extent of Wyoming and from Idaho to central Wyoming. The southern extent of 43B is comprised of a combination of metamorphic, igneous, and sedimentary mountains and foothills. Climatic changes across this extent are broad and create several unique breaks in the landscape.

Further information regarding MLRAs, refer to: United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.
Available electronically at: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_053624#handbook.

## LRU notes

Land Resource Unit (LRU) 43B23C: Absaroka Subalpine Zone

Based on the shifts in geology, precipitation patterns and other climatic factors, as well as elevation and vegetation, the Absaroka Range was divided into LRU 23. Further division of this LRU is necessary due to the gradient moving from the foothills to the summit, as well as aspect shifts (north/east face versus south/west face). Subset C is the high elevation zone noted for dense timber interspersed with open parks and longer persisting snowpack (within timberline). Precipitation can range from 18 to 20 plus inches and is more noted for the duration of snow cover and shorter growing season. To verify or identify Subset C (the referenced subset for this ecological site), refer to the Wyoming LRU matrix key contained within the Ecological Site Key.

This LRU/Subset occurs on the eastern divide of the Absaroka Range. This LRU starts north of Clark, WY and runs to the Thermopolis, WY area. Once the Absaroka Range merges with the Owl Creek and Wind River Ranges, the climatic patterns and elevational changes shifts the plant community and creates a break in the LRU/Subset.

The extent of soils currently correlated to this ecological site does not fit within the digitized boundary. Many of the noted soils are provisional and will be reviewed and corrected in mapping update projects. Other map units are correlated as small inclusions within other MLRA's/LRU's based on elevation, landform, and biological references.

Moisture Regime: Typic Ustic
Temperature Regime: Cryic
Dominant Cover: Rangeland – Sagebrush Steppe (major species is Mountain Big Sagebrush)
Representative Value (RV) Effective Precipitation: 20+ inches (508 mm)
RV Frost-Free Days: 31-65 days

## Classification relationships

Relationship to Other Established Classification Systems:

National Vegetation Classification System (NVC):
2 Shrub & Herb Vegetation
2.B Temperate & Boreal Grassland & Shrubland
2.B.2 Temporate Grassland & Shrubland
2.B.2.Na Western North American Grassland & Shrubland
M048 Central Rocky Mountain Montane-Foothill Grassland & Shrubland
G267 Central Rocky Mountain Montane Grassland
A3965 Central Rocky Mountain Subalpine Dry Idaho Fescue Grassland
CEGL001611 – Festuca idahoensis – Carex obtusata Grassland or
CEGL001612 – Festuca idahoensis – Danthonia intermedia Grassland

Ecoregions (EPA):
2 Shrub & Herb Vegetation Class
2.B Temperate & Boreal Grassland & Shrubland Subclass
2.B.2 Temperate Grassland & Shrubland Formation
2.B.2.Na Western North American Grassland & Shrubland Division
M048 Central Rocky Mountain Montane-Foothill Grassland & Shrubland Macro-group
G273 Central Rocky Mountain Lower Montane, Foothill & Valley Grassland Group

Ecoregions (EPA):
Level I: 6 North Western Forested Mountains
Level II: 6.2 Western Cordillera
Level III: 6.2.10 Middle Rockies
Level IV: 6.2.17ao – Absaroka Volcanic Subalpine Zone
6.2.17i – Absaroka – Gallatin Volcanic Mountains

## Ecological site concept

• Site receives no additional water.
• Slope is <20%
• Soils are:
o Derived from granitic parent material (weathered/mixed)
o Textures range from very fine sandy loam to clay loam in top 4” (10 cm) of mineral soil surface
o Clay content is or = 32% in top 4” (10 cm) of mineral soil surface
o Each following subsurface horizon has a clay content of <35% by weighted ave. in the particle size control section
o Moderately deep to very deep (20-78+ in. (50-200+ cm)
o <3% stone and boulder cover and <20% cobble and gravel cover
o Not skeletal (<35% rock fragments) within 20” (51 cm) of mineral soil surface
o None to Slightly effervescent throughout top 20” (51 cm) of mineral soil surface
o Non-saline, sodic, or saline-sodic

The Granitic Loamy ecological site concept is based on minimal (none to slight) influence from salts, carbonates, gypsum or other chemistry within the top 20 inches (51 cm) of the mineral soil surface. Increased precipitation and cool soil temperatures allows soluble salts and calcium carbonates to move lower in the profile with the increased potential for deeper percolation of water, in comparison to the mesic/frigid counterparts. The main site characteristic is a moderate to very deep soil profile with moderate textures of 18-35% clays, it remains within the sandy loam and clay loam textural classes. The soil surface 4 inches may be lighter in texture but the percent clay by weighted average within the particle size control section (overall profile from either the start of an argillic horizon for 50 cm’s or from 25-100 cm’s), is the deciding variable.

Granitic Loamy is found in association with ecological sites comprised of shallow and very shallow soils which generally have a significantly lower production, higher rate of King-Spike fescue, and bare ground, and an increase in pincushion and low-growing forbs. Skeletal soils are common in these complexes as well and will be similar in

plant composition, with a shift to more bunch grasses, lower production as a response to lower vigor in plants, and a slightly reduced plant canopy as a response of higher rock fragments.

Originally the Loamy 20”+ precipitation zone, High Mountains, covered all of mountain ranges that are part of the central Rocky Mountains, including sedimentary, volcanic, and granitic soils. The concept, previously, was too broad in nature, supporting a division of the ecological sites according to LRU’s, to better match climatic, geomorphologic and geologic differences. Although the concept is similar, plant production and community composition will shift between LRU’s and dominant parent materials.

## Associated sites

| | |
|---|---|
| R043BY162WY | **Shallow Loamy High Mountains**<br>Shallow Loamy sites are generally located on the break of slopes, on or surrounding rock outcrops before it transitions into more gently rolling landforms with deeper soils. Similar plant communities with more pincushion forbs and a higher percentage of King spike fescue, but a marked reduction in production and increased bare ground. |
| R043BY130WY | **Overflow High Mountains**<br>Overflow sites are found in concave areas that have concentrated flows within a loamy or other similar sites. This site is characterized by increased shrubby cinquefoil, snowberry, and forbs. The upland concave nature with increased capture of overland flows increases productivity above a Loamy site and the transition to more water dependent species is an easy key on the landscape. |
| R043BY108WY | **Coarse Upland High Mountains**<br>Course Upland sites occur as isolated pockets to extensive complexes along a landform with granitic loamy. A shift in the abundance of sedges, rushes, and ground covering forbs occurs along the transition between the two sites. |

## Similar sites

| | |
|---|---|
| R043BY322WY | **Loamy (Ly) 15-19” Foothills and Mountains East Precipitation Zone**<br>This site is the 15-19 |
| R043BY222WY | **Loamy Foothills and Mountains West**<br>This site is the 15-19 |
| R043BY122WY | **Loamy High Mountains**<br>This site is the basis for the current site development, however, the site is narrowed to the characteristics specific to the granitic soils within the Bighorn Mountains, where the original range site was broader based covering all loamy textured soils on the Absaroka, Owl Creek, Bridger, and Wind River Range. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | (1) *Artemisia tridentata ssp. vaseyana* |
| Herbaceous | (1) *Festuca idahoensis*<br>(2) *Danthonia intermedia* |

## Legacy ID

R043BX713WY

## Physiographic features

The Granitic Loamy ecological site generally occurs on slopes ranging from near level to 20%. The landform features are a combination of residuum, alluvial, and colluvium materials derived from glacial, landslide, and tectonic movement in degrading granitic rock. Hillslopes or mountain slopes, landslides, mountain valleys along narrow drainages (marked as drainage ways) are identified landforms where this site exists. Some level of variability is allowed within the description to incorporate variability of deposition and scour of snow, as well as wind desiccation. In the investigative process, this group of landforms was described as follows: Rocky Mountain Systems Division □ Middle Rocky Mountains Province □ with a landscape classified as Mountains or Mountain

Range (Geomorphic Description System v. 4.2). The Bighorn Mountains has a characteristic rolling summit or plateau with hills and valleys cutting across. This feature allows for large parks or open areas.

As part of the research process, a closer examination of surface and bedrock geology was completed to help explain or determine specific landforms. From the USGS Surficial Geology GIS layer, the surface geology for this ecological site includes:
• Glacial deposits
• Landslide
• Bedrock and glaciated bedrock
• Residuum with alluvium
• Grus

Each of which are mixed with one or more of the following scattered deposits: slopewash, residuum, grus, alluvium, colluvium, (Tertiary) landslides, glacial, periglacial, and/or bedrock outcrops.

The content of rock fragments throughout the profile or depth to rock (bedrock or paralithic material) are the key factors for identifying the Granitic Loamy site. Many of these landforms are erosional and have both deep and shallow soils. The depth of the granitic deposits or extent of weathering combined with erosional influence from timbered or surrounding areas will affect the mosaic of ecological sites. Variability in depth and weathering can make it difficult when on the landscape to identify clearly which site is dominant for a specific point along a transitional gradient.

Depth to water table is stated to occur below 78 inches (200 cm) for the calendar year. This site is also characterized by no additional moisture capture; it will occur or be associated with isolated pockets where snowmelt or surface moisture collects briefly creating an overflow site. Shallow drains or concave areas may express a more robust plant community and could be correlated as an overflow; however, within valley floors or “bowls” on the landscape, sag ponds or small wetland depressions may occur in close proximity to a loamy site if there is a restrictive layer or a spring that occurs in an isolated geologic pocket.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Mountain range > Mountain slope<br>(2) Mountain range > Alluvial fan<br>(3) Mountain range > Landslide |
| Runoff class | Negligible to low |
| Elevation | 2,377–3,612 m |
| Slope | 0–20% |
| Aspect | W, NW, N, NE, E, SE, S, SW |

## Climatic features

Annual precipitation and modeled relative effective annual precipitation range from 18 to 35 inches (457 – 889 mm). The normal precipitation pattern is evenly distributed through the year and averages over 20 inches. Annual snowfall averages 150 to 200 inches annually. Wide fluctuations may occur in yearly precipitation and result in more dry years than those with more than normal precipitation.

Because of the varied topography, the wind will vary considerably for different parts of the area. Prevailing winds are from the southwest, and strong winds are less frequent than over other areas of Wyoming. Occasional storms, however, can bring brief periods of high winds with gusts exceeding 50 mph.

Temperatures show a wide range between summer and winter and between daily maximums and minimums, due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in winter and bring rapid rises in temperature. High winds are generally blocked by high mountains but occur in conjunction with thunderstorms, which are common in late summer. Growth of native cool-season plants begins about June 1, but can be as late as July 15, and continues until the beginning of September.

For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/. Climate station representative of this precipitation zone include: “Cooke City 2W” and “Tower Falls”. The following graphs and charts are a collective sample representing the averaged normals and 30-year annual rainfall data for the selected weather stations from 1981 to 2010.

**Table 3. Representative climatic features**

| | |
|---|---|
| Frost-free period (characteristic range) | 1-2 days |
| Freeze-free period (characteristic range) | 23-47 days |
| Precipitation total (characteristic range) | 457-584 mm |
| Frost-free period (actual range) | 1-2 days |
| Freeze-free period (actual range) | 17-53 days |
| Precipitation total (actual range) | 432-610 mm |
| Frost-free period (average) | 2 days |
| Freeze-free period (average) | 35 days |
| Precipitation total (average) | 533 mm |

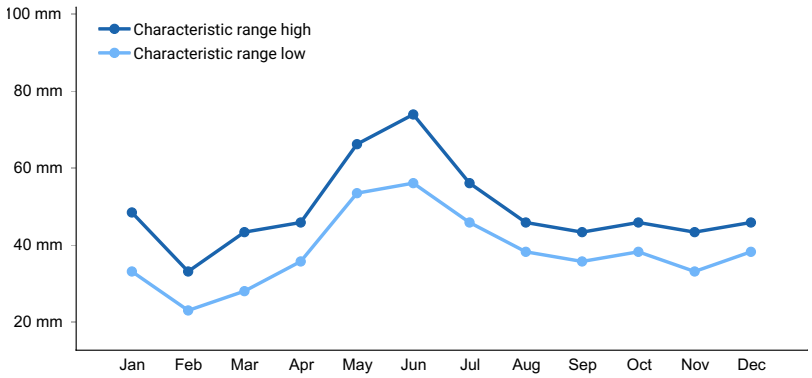



**Figure 1. Monthly precipitation range**

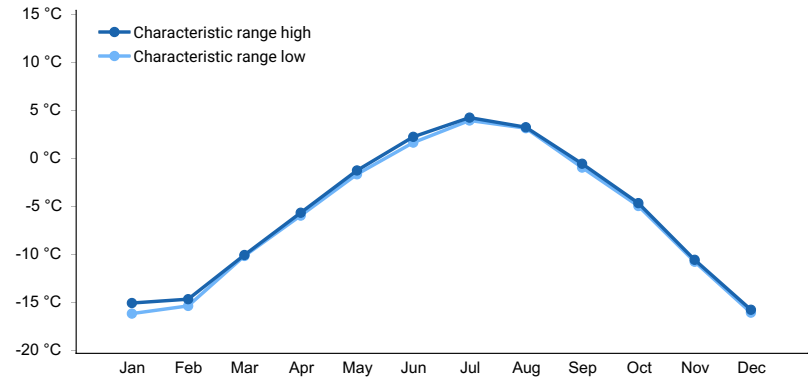



**Figure 2. Monthly minimum temperature range**

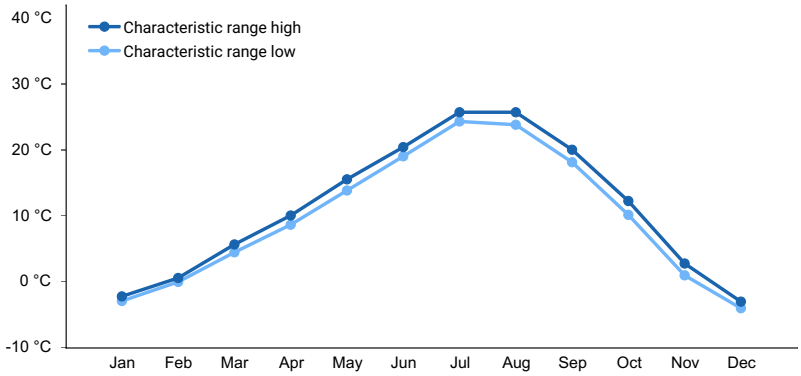



**Figure 3. Monthly maximum temperature range**

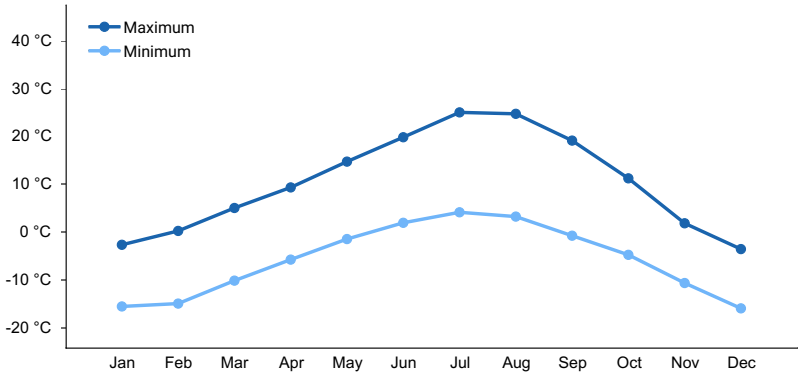



**Figure 4. Monthly average minimum and maximum temperature**

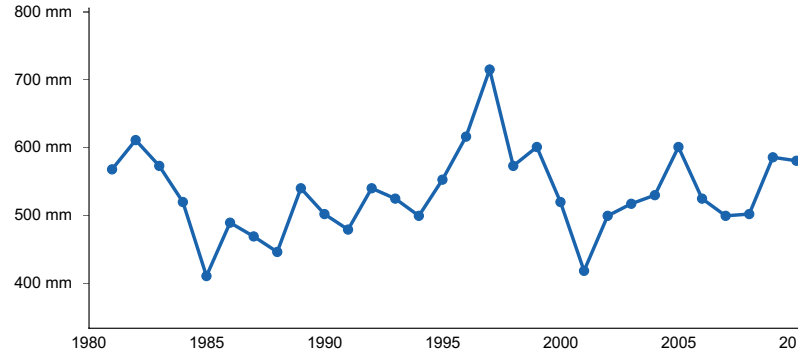



**Figure 5. Annual precipitation pattern**

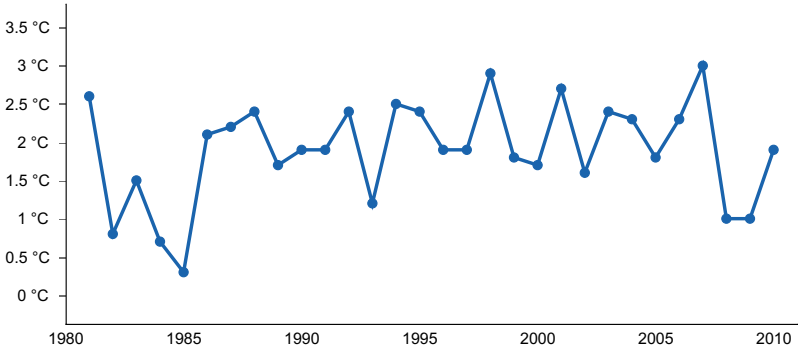



**Figure 6. Annual average temperature pattern**

## Climate stations used

- (1) TOWER FALLS [USC00489025], Yellowstone National Park, WY
- (2) COOKE CITY 2 W [USC00241995], Gardiner, MT

## Influencing water features

The characteristics of these upland soils have no influence from ground water (water table below 78 inches (200 cm)) and have minimal influence from surface water/overland flow. There may be isolated features that are affected by snow pack that persists longer than surrounding areas due to position on the landform (shaded/protected pockets). These sites tend to have a higher ratio of sedges, greener longer, and a higher incidence of shrubby cinquefoil cover.

## Soil features

The soils of this site are moderately deep to very deep (greater than 20 inches (51 cm) to bedrock), moderately well to well drained, and moderately slow to moderate permeability. The soil characteristics having the most influence on the plant community are parent material, depth, and texture.

The general soil profile has a sandy loam or loam cap over sandy clay loams and clay loams. These soils are moderately deep to very deep and may have decomposing granitic rock throughout the profile (increasing below 20 inches (51 cm)). Overall the pH, CCE, EC, and SAR are neutral or moderately acidic. The range of values characterizing this site are listed below. As deposition or alluvial materials from sedimentary parent material begins to increase or dominate a site, the site will transition from Granitic Loamy to the typical Loamy site.

The development of a significant cover of spikemoss has been seen with this soil, limiting seedling establishment, reducing infiltration and possibly increasing runoff. Hoof action and mechanical means have been used to reduce the cover and improve soil conditions. Results and plant responses will be discussed later in this document.

Many of the landforms where these soils occur have an alluvial influence leaving a surface layer of gravels and cobbles. Typically, this surface lag will be less than 10% cover, however some areas may have greater than 15% of gravels and a few cobbles. This layer does not extend very deep in the profile and has minimal influence on the plants.

Major soil series correlated to this site include: No series are currently correlated to this ecological site.

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Residuum–granite and gneiss<br>(2) Colluvium–granitoid<br>(3) Alluvium–igneous, metamorphic and sedimentary rock |
| Surface texture | (1) Gravelly loam<br>(2) Sandy clay loam<br>(3) Fine sandy loam |
| Family particle size | (1) Fine-loamy |
| Drainage class | Moderately well drained to well drained |
| Permeability class | Moderately slow to moderate |
| Soil depth | 51 cm |
| Surface fragment cover <=3" | 0–30% |
| Surface fragment cover >3" | 0–5% |
| Available water capacity (Depth not specified) | 6.35–15.24 cm |
| Calcium carbonate equivalent (Depth not specified) | 0–14% |
| Electrical conductivity (Depth not specified) | 0–2 mmhos/cm |
| Sodium adsorption ratio (Depth not specified) | 0–3 |

| | |
|---|---|
| Soil reaction (1:1 water) (Depth not specified) | 5–6.8 |
| Subsurface fragment volume <=3" (Depth not specified) | 0–30% |
| Subsurface fragment volume >3" (Depth not specified) | 0–15% |

## Ecological dynamics

Loamy soils originate from two distinct parent materials influencing the specific species, granitic and sedimentary. The community dominance will vary from one parent material to the other, with the most significant variation being the lack of mountain big sagebrush on sites derived from granitic (intrusive) parent materials. However, there is a shift in total species composition as well as the vigor and response of Idaho fescue between these two parent materials. Because of these variations, it was warranted to separate the loamy soils into granitic loamy ecological site and loamy ecological site (sedimentary materials). Potential vegetation for the Granitic Loamy ecological site is estimated at 75% grasses, 25% forbs, and no appreciable shrubs/woody plants.

Granitic loamy communities are dominated by perennial, Tall-stature cool-season bunchgrasses such as Columbia needlegrass and slender wheatgrass. Rhizomatous wheatgrasses and other mid-stature grasses such as Montana wheatgrass, Idaho fescue, cusick’s bluegrass, prairie junegrass, spike trisetum, Parry’s and timber oatgrass, bentgrass, Letterman needlegrass, mountain brome, and a variety of sedges are common. There is a wide variety of forbs that bloom at varying intervals through the summer creating seasons of color. Mountain and fringed sagewort are incidental woody species that may occur in the communities.

Mountain big sagebrush is absent on most Granitic Loamy sites. Remnant or isolated pockets with alluvial deposits of sedimentary materials may support some sagebrush. Shrubby cinquefoil, snowberry, rose, fringed sagewort and mountain sagewort can be found on these granitic soils, however they are infrequent and tend to occur in snow-catch positions of the landform. Exposed areas of granitic rock (rock outcrops) support forested cover, but as the depth of soil increases, less trees (Conifers) are found to persist on the site. The lack of sagebrush is relayed to the lower pH of the granitic parent material as well as the lack of moisture retention of the high grus soils. The loose nature of these soils have less hold for trees, and the dense timber stands are found on shallow or very shallow sites along the fractured, granitic geology.

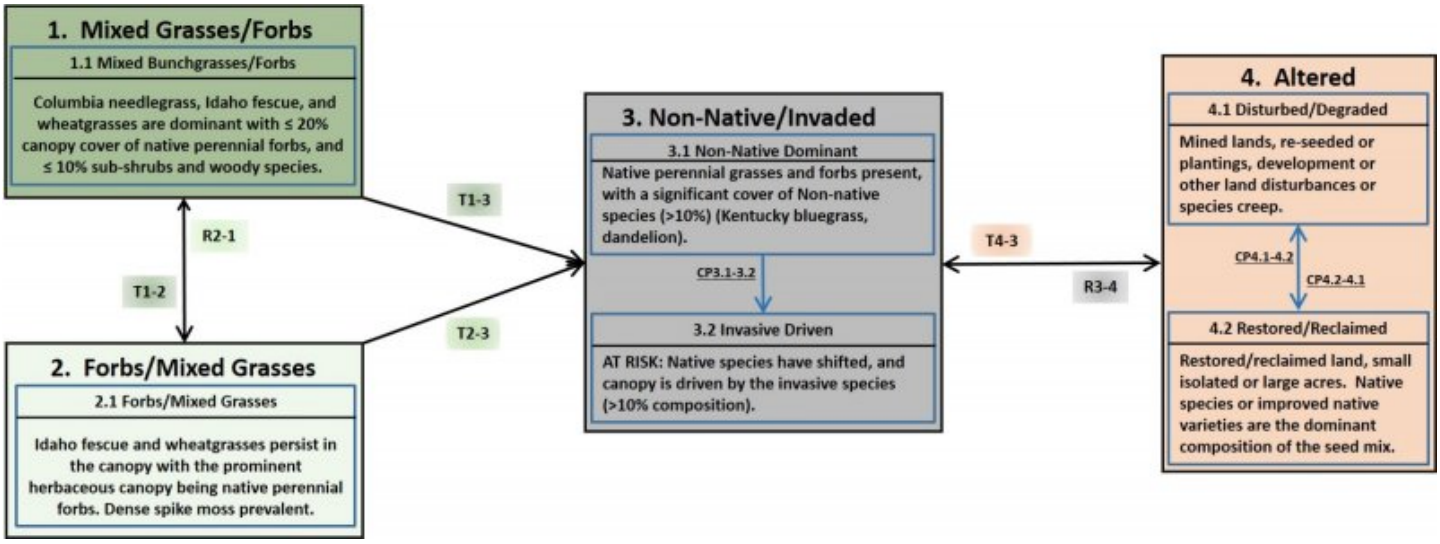
Deterioration of this site will occur as a response to frequent and severe grazing and/or drought. As the site declines, Columbia needlegrass, slender wheatgrass, and timber oatgrass decline; Idaho fescue and sedges will maintain in cover but lose production; while species such as fringed sagewort, forbs will increase. Kentucky bluegrass may invade, as well as dandelion.

The ecological states and community phases as well as they dynamic processes driving the transitions between these communities have been determined by studying this ecological site under all management scenarios, including those that do not include cattle grazing. Trends in plant communities going from heavily grazed areas to lightly grazed areas, seasonal use pastures, and historical accounts have been used.

The following State and Transition Model (STM) Diagram has five fundamental components: states, transitions, restoration pathways, community phases and community pathways. The state, designated by the bold box, is considered to be a set of parameters with thresholds defined by ecological processes. A State can be a single community phase or suite of community phases. The reference state is recognized as State 1. It describes the ecological potential and natural range of variability resulting from dynamic ecological processes occurring on the site. The designation of alternative states (State 2, etc) in STMs denotes changes in ecosystem properties that cross a certain threshold.

Transitions are represented by the arrows between states moving from a higher state to a lower state (State 1 - State 2) and are denoted in the legend as a “T” (T1-2). They describe the variables or events that contribute directly to loss of state resilience and result in shifts between states. Restoration pathways are represented by the arrows between states returning back from a lower state to a higher state (State 2 - State1 or better illustrated by State 1

## State and transition model




## State 1
## Mixed Grasses/Forbs

Mixed Bunchgrass/Forbs State (State 1 - Reference) evolved with grazing by large herbivores and is well suited for grazing by domestic livestock. Potential vegetation is estimated at 75% grasses or grass-like plants, 25% forbs, and no appreciable woody plants. Specific soil characteristics within the range of the site concept will result in a shift in the vigor and dominance of specific grass species, as well as the abundance of ground-covering forbs. In soils with a higher abundance of grus in the profile will have a higher ratio of mid-stature grasses than the modal concept for this site. There is also a higher occurrence of buckwheat and phlox species on these sites.

**Characteristics and indicators.** The community is characterized by the key species including: Columbia needlegrass, slender wheatgrass, needleleaf sedge, Idaho fescue, and bluebunch wheatgrass. Other grasses may include mutton and Cusick's bluegrass, bentgrasses, prairie junegrass, onespike and timber oatgrass, thickspike wheatgrass, mountain brome and spike trisetum. Forbs include: cutleaf anemone and pale mountain dandelion. Increaser species are: bluegrasses, old man's whiskers, rosy pussytoes, lupine, field chickweed, phlox and cinquefoil (herbaceous). Mountain and fringed sagewort have been found to occur in these communities but infrequently.

**Resilience management.** A shift that has been seen in this community is a variation between cattle grazing and sheep grazing over time. Those allotments reviewed with long-term sheep grazing had fewer forbs by production, but still maintained a strong diversity in the understory of a tall grass dominated system. As allotments with long-term cattle grazing were reviewed, the tall grasses persisted, but had a stronger undertone of more mid-stature grasses, and a higher prominence of all forbs within the community.

#### Dominant plant species

- Columbia needlegrass (*Achnatherum nelsonii*), grass
- timber oatgrass (*Danthonia intermedia*), grass
- Idaho fescue (*Festuca idahoensis*), grass

## Community 1.1
## Mixed Grasses/Forbs

The reference community (1.1) is declining in occurrence on the landscape. The introduction and creep of non-native species is a factor of change over time. Factors such as historic land uses (Sheep grazing to cattle grazing), to an overall increase of land use (increased access and recreational use), has allowed species such as smooth brome, common dandelion, Kentucky bluegrass, and others to become naturalized in the communities. Combined with the non-natives, the greater threat of invasive species has put the reference state and community at great risk. Granite based soils are generally lacking in the mountain big sagebrush component that is so prevelant on other sedimentary soils. These granitic soils do support low growing shrubs such as mountain sagewort and fringed

sagewort. Other shrubs incidental to these sites are shrubby cinquefoil, snowberry, and wood's rose. Idaho fescue is a dominant component on these soils, while Columbia needlegrass and rhizomatous wheatgrasses will be prevelant as well. A variety of upland sedge species occupy this site, and will vary from area to area. Dense spikemoss may be present in this reference community, but comprises less than 10% of the ground cover. There is still open soil for seed establishment and typical infiltration of water. The weathered and decomposing granitic base to these soils allows for rapid infiltration even with heavier textures, and erosion is not present on stable sites (such as reference). The total annual production (air-dry weight) of this state is about 2200 lbs./acre, but it can range from about 1500 lbs./acre in unfavorable years to about 2600 lbs./acre in above average years. This production is based on the historic records used to write the initial Loamy 20”+ High Mountains ecological site.

**Resilience management.** This plant community is extremely stable and well adapted to the Central Rocky Mountain climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community.

### Dominant plant species

- Columbia needlegrass (*Achnatherum nelsonii*), grass
- Idaho fescue (*Festuca idahoensis*), grass
- slender wheatgrass (*Elymus trachycaulus*), grass
- timber oatgrass (*Danthonia intermedia*), grass

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

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Grass/Grasslike | 1401 | 2074 | 2298 |
| Forb | 280 | 392 | 560 |
| Shrub/Vine | – | – | 56 |
| **Total** | **1681** | **2466** | **2914** |

**Table 6. Ground cover**

| | |
|---|---|
| Tree foliar cover | 0% |
| Shrub/vine/liana foliar cover | 0% |
| Grass/grasslike foliar cover | 50-75% |
| Forb foliar cover | 10-25% |
| Non-vascular plants | 0% |
| Biological crusts | 0-5% |
| Litter | 10-20% |
| Surface fragments >0.25" and <=3" | 0-15% |
| Surface fragments >3" | 0-15% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 5-10% |

**Table 7. Soil surface cover**

| | |
|---|---|
| Tree basal cover | 0% |
| Shrub/vine/liana basal cover | 0% |
| Grass/grasslike basal cover | 0% |
| Forb basal cover | 0% |
| Non-vascular plants | 0% |

| | |
|---|---|
| Biological crusts | 0-5% |
| Litter | 10-20% |
| Surface fragments >0.25" and <=3" | 0-15% |
| Surface fragments >3" | 0-15% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 5-10% |

**Table 8. Canopy structure (% cover)**

| Height Above Ground (M) | Tree | Shrub/Vine | Grass/ Grasslike | Forb |
|---|---|---|---|---|
| <0.15 | – | – | 1-5% | 5-10% |
| >0.15 <= 0.3 | – | – | 10-25% | 5-15% |
| >0.3 <= 0.6 | – | – | 5-50% | 0-3% |
| >0.6 <= 1.4 | – | – | 0-5% | 0-2% |
| >1.4 <= 4 | – | – | – | – |
| >4 <= 12 | – | – | – | – |
| >12 <= 24 | – | – | – | – |
| >24 <= 37 | – | – | – | – |
| >37 | – | – | – | – |

## State 2
## Forbs/Mixed Grasses

This state is prominent on granitic soils. Fringed sagewort and other low or dwarf shrubs found as a minor component in this community, but forbs and grasses are the dominant cover on the landscape. Grass species that remain are mid-stature bunchgrasses that still hold a significant composition in the community but are less conspicuous and lack the production and possibly palatability of other species.

**Characteristics and indicators.** Lupine, balsamroot, sandwarts and phlox are common components of this community with deathcamas, paintbrush and chickweed. Idaho fescue and timber and/or Parry's oatgrass are prominant, but are less vigorous or shorter in stature than in the reference community. An increase in Dense spikemoss is prevalent and can become a total ground cover in the interspaces of plants, restricting the propagation of new plants/species; which in turn lowers the resilience of this state.

**Resilience management.** Research has shown that attempts to understand and find management techniques for dense spikemoss have not provided an adequate solution. Trials within the Bighorn Mountains showed that after deep ripping a site, it was able to stabilize with significant vegetation and be a functional section of rangeland with improved production, but there are still significant remnants of the spikemoss that are evident in the trial. Disagreement on the cause and cure supported that this is a degraded state within the soil characteristics, that is a stable state to an extent, but that over time without some disturbance may loose all vigor and diversity. More research is warranted before any scientific statement can be made on the resiliency and management of a spikemoss driven community.

**Dominant plant species**

- Idaho fescue (*Festuca idahoensis*), grass
- timber oatgrass (*Danthonia intermedia*), grass
- Cusick's bluegrass (*Poa cusickii*), grass

## Community 2.1

## Forbs/Mixed Grasses

This plant community is the result of long-term season-long or severe grazing by livestock and large ungulates. A variety of forbs dominates the site, often exceeding 20-50% annual production and lowering grass/grass-like forage production. Bunchgrasses such as Idaho fescue, cusick's and sandberg bluegrass, a variety of sedges and mountain brome are a major component of the understory. The total annual production (air-dry weight) of this community phase is about 1950 lbs./acre, but it can range from about 1100 lbs./acre in unfavorable years to about 2750 lbs./acre in above average years.

**Resilience management.** This plant community is resistant to change and is relatively stable. The site is protected from excessive erosion by the understory of dense spikemoss. The biotic integrity of this plant community is usually intact, however forage value will decrease and wildlife values will shift with the loss of higher quality grass species. The watershed is functioning, the hydrology varies from relatively unaltered to severely impacted depending on the extent of spikemoss in the community, as well as the forbs and grasses that persist. The variability of forb bloom and prominence on the landscape will provide a longer maturity period of the forbs, however, the risk to livestock has increased due to the reduced grass composition. Larkspur, death camas and locoweed are common threats that will vary from year to year depending on climatic patterns.

### Dominant plant species

- Idaho fescue (*Festuca idahoensis*), grass
- Cusick's bluegrass (*Poa cusickii*), grass
- timber oatgrass (*Danthonia intermedia*), grass
- Letterman's needlegrass (*Achnatherum lettermanii*), grass

**Table 9. Annual production by plant type**

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Grass/Grasslike | 560 | 1317 | 1905 |
| Forb | 673 | 841 | 1121 |
| Shrub/Vine | – | 28 | 56 |
| **Total** | **1233** | **2186** | **3082** |

**Table 10. Ground cover**

| | |
|---|---|
| Tree foliar cover | 0% |
| Shrub/vine/liana foliar cover | 0-5% |
| Grass/grasslike foliar cover | 40-65% |
| Forb foliar cover | 10-15% |
| Non-vascular plants | 0% |
| Biological crusts | 15-30% |
| Litter | 5-10% |
| Surface fragments >0.25" and <=3" | 0-15% |
| Surface fragments >3" | 0-15% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 5-10% |

**Table 11. Soil surface cover**

| | |
|---|---|
| Tree basal cover | 0% |
| Shrub/vine/liana basal cover | 0% |
| Grass/grasslike basal cover | 0% |

| | |
|---|---|
| Forb basal cover | 0% |
| Non-vascular plants | 0% |
| Biological crusts | 15-30% |
| Litter | 5-10% |
| Surface fragments >0.25" and <=3" | 0-15% |
| Surface fragments >3" | 0-15% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 5-10% |

**Table 12. Canopy structure (% cover)**

| Height Above Ground (M) | Tree | Shrub/Vine | Grass/ Grasslike | Forb |
|---|---|---|---|---|
| <0.15 | – | 0-5% | 1-15% | 5-15% |
| >0.15 <= 0.3 | – | 0-1% | 10-30% | 5-25% |
| >0.3 <= 0.6 | – | – | 5-15% | 0-5% |
| >0.6 <= 1.4 | – | – | 0-1% | 0-2% |
| >1.4 <= 4 | – | – | – | – |
| >4 <= 12 | – | – | – | – |
| >12 <= 24 | – | – | – | – |
| >24 <= 37 | – | – | – | – |
| >37 | – | – | – | – |

## State 3
## Non-Native/Invaded

This state is not easily divided into two distinct communities, nor is it possible to determine a typical composition of any one community. Unlike sedimentary soils, the encroachment of woody species (juniper/spruce) into the parks is not prevalent. However, dandelion, smooth brome, and Kentucky bluegrass, as well as invasive species do have opportunity for movement into degraded communities. There are instances where it is difficult to identify these communities on the landscape, especially when the community has transitioned to a high composition of forbs. The occurrence of these communities can be a process of time or of disturbance. Historic studies have shown the presence of non-natives such as Kentucky bluegrass and dandelions in a significant stature as early as 1940's and 50's. Other species such as creeping meadow foxtail, timonthy, and smooth brome are becoming more prevalent. Although it has not been documented for the purpose of ESD's at this time, large scale populations of invasive species are starting to develop on segments of the foothills of the Bighorn mountains. On an allotment basis, there are large patches of invasive species that are appearing, these areas are included in this state as a secondary community.

**Characteristics and indicators.** A dominant component of this state is comprised of a non-native or an invasive species. Dominant component is defined for this state as a composition of 5% or greater by weight. As species composition crosses this threshold it becomes difficult to ignore the impact on the site and is not easily or feasibly eradicated from the site. Woodland (tree) encroachment is also a component of this state, but would have to comprise at least 15% by canopy cover.

**Resilience management.** In this state, it is understood that the key to management of the site is finding the balance between grazing to reduce or maintain the current level of non-native or invasive species while maintaining and improving the native composition. Treatment with herbicides, biologicals, or mechanical means may be necessary to maintain current levels. The site is resilient in the sense, that once the non-native and invasive species are present, they are not eradicable.

## Community 3.1
## Non-Native Encroachment

Transitioning from the Forbs/Mixed Grasses community (2.1) to the non-native community phase is the result of a culmination of factors including land use, proximity to transportation routes, wildlife and livestock movement, and general shift in vegetation. Minor impacts or major disturbances allow small or isolated patches of non-native species to establish. From there, succession over time, drought, or other natural or man-driven disturbances allows the spread and eventual dominance of species such as smooth brome, timothy, dandelions, Kentucky bluegrass, field pennycress and others. Many of these species, once established, cannot be eliminated from the system. Unlike their invader cousins, these species will co-exist with most native species. They provide a desirable forage and can be managed with targeted livestock grazing. Research from the 1950's using exclosures noted that dandelions did not seem to vary from grazed to non-grazed sites, and that they seemed to persist in undisturbed areas, reasoning that they were naturalized species. Although, many of these are naturalized, they are not native to the system and affect production and potential of a site if not managed. The total annual production (air-dry weight) of this state is about 2200 pounds per acre, but it can range from about 1250 lbs./acre in unfavorable years to about 3000 lbs./acre in above average years.

**Resilience management.** This community is at-risk of transitioning to the invaded state. The state overall is stable and protected from excessive erosion. The biotic integrity of this plant community is fractured, due to the increasing presence of non-native species. Forage value will decrease or the wildlife value will shift toward different species. Depending on the non-native species of threat in this community, will determine the departure from normal function on all levels. The watershed is functioning, but with the increase in woody species (conifers/junipers), the risk of fire could decrease the stability and watershed function of the site.

### Dominant plant species

- Idaho fescue (*Festuca idahoensis*), grass

**Table 13. Annual production by plant type**

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Grass/Grasslike | 1121 | 1905 | 2242 |
| Forb | 280 | 532 | 1065 |
| Shrub/Vine | – | 28 | 56 |
| **Total** | **1401** | **2465** | **3363** |

**Table 14. Ground cover**

| | |
|---|---|
| Tree foliar cover | 0% |
| Shrub/vine/liana foliar cover | 0-5% |
| Grass/grasslike foliar cover | 40-60% |
| Forb foliar cover | 10-20% |
| Non-vascular plants | 0% |
| Biological crusts | 10-30% |
| Litter | 5-20% |
| Surface fragments >0.25" and <=3" | 0-15% |
| Surface fragments >3" | 0-15% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 5-10% |

**Table 15. Soil surface cover**

| | |
|---|---|
| Tree basal cover | 0% |
| Shrub/vine/liana basal cover | 0% |
| Grass/grasslike basal cover | 0% |
| Forb basal cover | 0% |
| Non-vascular plants | 0% |
| Biological crusts | 10-30% |
| Litter | 5-20% |
| Surface fragments >0.25" and <=3" | 0-15% |
| Surface fragments >3" | 0-15% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 5-10% |

**Table 16. Canopy structure (% cover)**

| Height Above Ground (M) | Tree | Shrub/Vine | Grass/ Grasslike | Forb |
|---|---|---|---|---|
| <0.15 | – | 0-1% | 5-10% | 5-15% |
| >0.15 <= 0.3 | – | 0-1% | 10-30% | 10-25% |
| >0.3 <= 0.6 | – | – | 5-25% | 5-10% |
| >0.6 <= 1.4 | – | – | 0-5% | 0-5% |
| >1.4 <= 4 | – | – | – | – |
| >4 <= 12 | – | – | – | – |
| >12 <= 24 | – | – | – | – |
| >24 <= 37 | – | – | – | – |
| >37 | – | – | – | – |

## Community 3.2
## Invaded

The Invaded community phase has become an invader driven system. This community phase is characterized by a significant presence of non-native (> 25%) and/or invasive species (5% or greater) composition on the landscape, and are prominent on the site (referring to a wide scale composition, not one isolated patch in an isolated portion of the landscape). The diversity of species that are possible in this community and the wide array of growth forms, growth habits and plant characteristics make it difficult to determine or predict the limitations or risks of this site beyond those stated. The risks and limitations for this community will need to be addressed on an individual case basis. Production yields of the perennial grasses and forbs are reduced but the total production will maintain or may be slightly elevated due to the overall biomass and expanded growth potential of many of the annual or invasive species. A specific production range is not provided due to the variability of composition that will effect overall production.

**Resilience management.** When Invaded community phase has maintained a representative sample of native perennial grasses and forbs that are key to this particular ecological site. This community phase has, however, became an invader driven system. If native grasses can maintain at least a 15% composition, there is still a chance that the community can be improved, extent of improvement and costs required limit the economic feasibility. This plant community is prone to further invasion. Plant diversity is moderate, and plant vigor is diminished. Replacement capabilities are limited due to the reduced number of native grasses. Soil erosion is variable depending on the species of invasion and the litter accumulation thus associated.

## Pathway CP 3.1-3.2

### Community 3.1 to 3.2

The competition for limited resources is the driving factor for the transition to an invader driven system. As non-natives become prominent in the community, they are able to utilize resources quicker and slowly reduce the vigor and presence of most native grasses and forbs from the system. As invasive species are introduced into the system, they capitalize on small disturbed areas and open communities to establish and then spread. Drought stress, rodent activity, or grazing pressure will allow the invasive species to become dominant on the site, leaving only remnant populations of native perennial grasses.

## State 4
## Altered

Although more temperate in climate than the basin and foothills counter-parts, this high elevation site is arid in nature which has played a major role in the development and transitions in land use over time. Many landscapes were suppressed by fire management which has impacted forest health in general. While timber harvest has persisted on the landscape, the Bighorn Mountains provide a larger use as grazinglands. Historically, sheep were a major contributor on the range, but with time cattle are the most abundant user of this landscape. Farming (hayland) and general agricultural practices are not a threat to the higher elevations. However, development of summer working facilities, livestock handling facilities, quarries, recreational areas, trails, roads, and recreational camp sites have played a major role in transforming the landscape. Increased access to areas and more use by humans has fostered new challenges and disturbances to the open parks and sagebrush communities.

**Characteristics and indicators.** This state is characterized by active disturbance (erosion, development, shifts in use) or reclamation/restoration following a disturbance. This can include roads/access recovery post timber harvest, fire recovery, etc. The plant species and composition will vary with the age of the disturbance, the seed mixes used, or the post recovery characteristics.

**Resilience management.** Maintaining sites once reclaimed is dependent on access, the specific prescription used to treat the land and climatic factors during the establishment and succession of the community. Restoration or managing the disturb sites for natural recovery will vary depending on what successional species establish as well as the above mentioned variables. Site specific evaluations are needed to capture the resiliency and management needs of communities within this state.

### Community 4.1
### Disturbed/Degraded Lands

Disturbed or degraded lands are characterized by alteration of the soils to a degree that the functionality (erosional, depositional, hydrological or chemical) and potential of the site has been impacted. Site specific evaluations need to be completed to determine the level of effect. The method and severity of alternation, as well as the spatial extent of the disturbance will determine vegetation response and management needs. Linear disturbances, such as trails and roads, will hold a different risk than patchwork or polygonal disturbances, such as timber sites or parking areas. Small scale or isolated disturbances (spot fires, burrowing sites) can be just as significant of a risk as a large scale disturbance (mined-lands). The growth curve of this plant community will vary depending on the successional species that are able to establish in an area. Early successional community growth curves may be similar to the native community. For a more accurate growth curve, a site specific species inventory and documentation of the climatic tendencies should be collected.

**Resilience management.** The plant community is variable and depending on the age of the stand and the stage of successional tendencies that the location is in will determine how stable (resilient/resistant) the community is. Plant diversity of these successional communities is generally strong, but is usually lacking in the structural groups that are desired on the site. The limited nature of the granitic loamy plant community will make it difficult to determine the successional transition from a degraded community (2.1), but the variety and nature of the forbs dominating the site will be a determining factor (Russian thistle compared to lupine, or mustards compared to bladderpods and phlox. In areas of new or frequent disturbance, annual weedy species or early successional plants will be the dominant cover, providing a strong diversity, but has minimal structural cover for some wildlife. As the site matures or as the period between disturbances is lengthened, perennial or taller statured, stronger rooted species will increase providing protection and help to improve hydrologic process and general cover for grasses and other perennial forbs to begin to establish. This flexibility and the natural stature of no large woody shrubs within the community creates a

relatively stable level of biotic integrity. Soil erosion is dependent on the disturbance regime and the plant diversity of the community. The tendency for these communities to be high in dense spikemoss, limits erosion potential but will see an adverse effect to the water flow, infiltration, runoff, and pedestalling risk. Factors that are more prevalent or influential for these sites are surface roughness (tire tracks, hoof action, smoothed, denuded surfaces, trails that may focus the water).

### Community 4.2
### Reclaimed Lands

Shifts in reclamation practices over the last several decades have altered the success and stability of reclaiming a site. Crested wheatgrass and smooth brome were species used frequently for reclamation throughout Wyoming; many of these communities persist today. These stands are stable and generally persist as a monoculture until a disturbance creates a niche for native species to establish. Russian wildrye and varieties of rhizomatous and bunch-wheatgrasses are used in mixes to help increase establishment on many locations. Policies on federal lands, especially on forest lands, limits the use of non-native species and further limits where seed sources must be collected for use on these lands. Current interpretations of reclamation specifies the source of viable seed and the mix acceptable to achieve a composition as close to a natural (pre-disturbance) plant community as possible. This excludes the use of non-native species and allows for a more similar ecological response than what is expected with non-native species. These plantings will not replicate the reference community in response to management due to the change in soil dynamics with mechanical disturbance (seedbed preparation and seeding), but they may be similar. The growth curve of this plant community is generally species dependent, but the climatic limitations are the major driver of this system. The short growing season with persistent snow cover through early fall to late spring and delayed warm up are the limitations to seedling establishment. For non-typical seed mixes and for project specific scenarios, the species used and the climatic tendencies of the site must be considered, and appropriate adjustments made to the growth curve provided below.

**Resilience management.** Seeding mixtures will determine the plant community's resistance to change and resilience against the threat of invasive species and to erosion. Many of the stands established during seeding are diversity poor, but are better than monocultures that were seeded historically. Soil erosion is variable depending on the establishment of the seeding, how it is seeded, and mechanical procedures used during the seeding. The variability of the water flow, infiltration and runoff is determined again by the species that comprise the community and the method of seeding (site preparation and seeding practice).

### Pathway CP 4.1-4.2
### Community 4.1 to 4.2

Completion of a re-vegetation project with seedbed preparation, re-seeding, integrated pest management, and long-term prescribed grazing or other managed use of the landscape is needed to shift a disturbed community back to a representative or functional plant community. However, climatic variability and topography limits the success of seeding projects (accessibility by equipment, lack of suitable seed sources, limited growing season, and timing of precipitation). The level of cover by dense spikemoss and topographical limitations can make ground preparations and weed/grazing management challenging as well.

**Conservation practices**

| |
|---|
| Critical Area Planting |
| Access Control |
| Grazing Land Mechanical Treatment |
| Range Planting |
| Heavy Use Area Protection |
| Integrated Pest Management (IPM) |
| Upland Wildlife Habitat Management |
| Early Successional Habitat Development/Management |
| Planned Grazing System |
| Native Plant Community Restoration and Management |

| |
|---|
| Invasive Plant Species Control |
| Grazing Management Plan |
| Grazing management to improve wildlife habitat |
| Intensive Management of Rotational Grazing |

### Pathway CP 4.2-4.1
### Community 4.2 to 4.1

If a reclaimed or restored site is not maintained or managed for the species implemented, whether with non-use or lack of a disturbance regime to maintain function of the system, the community will degrade over time. In the same, over-use of the system by livestock or wildlife can also shift the composition or revert the site back to a degraded phase. Since the soils are altered from reference state due to development, timber harvest/mining, or other similar disturbances, the plant community will not follow the same expected shifts as the native community. Monitoring and trend over time need to be recorded to determine if a location is degrading or adjusting with the climatic variables of the site. The initial establishment phase of a reclaimed site is crucial to determine success, but at any stage of a seeding, degradation or further disturbance can occur forcing the site to phase back to the disturbed community.

### Transition T 1-2
### State 1 to 2

Drought, season-long or severe grazing by livestock or large ungulates lowers the vigor of the perennial native grasses that dominate this site and encourage the native forbs to increase in prominence in the community. As more soil is exposed with the increased number of forbs, the dense spikemoss ground cover increases. Repeated early season grazing by cattle and elk, or by extended drought periods, grasses are reduced and forbs become the dominant cover, reducing the resiliency of this community. Seasonal fluctuations in moisture will affect the composition of species present and thus impact the grazers that can utilize the site. Larkspur is a major concern in years with a slow green up, as it will respond quickly while grasses may be slow with a slow warm up, increasing the risk of toxicity and poisoning in livestock. The same concern with lupine, in wet years, the abundance of lupine and groundsels can be significant, increasing the risk of toxicity; however, when abundant grass is present, the risk is manageable.

### Transition T 1-3
### State 1 to 3

Drought, season-long or severe grazing by livestock or large ungulates weaken the perennial native vegetation that comprises this community, and provides an opening for non-native, invasive or aggressive species to encroach into the community. During dry, open winters, cold and exposure can weaken the prominent grasses within the community, and if there are seed-sources that have been carried in on livestock or wildlife, then these non-native or invasive species find a foothold to establish within the community. If the drought or use continues, and the encroached species is not addressed, it will continue to gain a hold in the community until it is unfeasible to control or eradicate it from the community. Conifer enroachment is thought to be driven more by melt off and dry down of soils during the germination and establishment of seedlings to maturity. Periods of or the cycle of drought and winter snow melt have the most significant influence with management factors serving only as a minor contribution to the soil attributes.

**Constraints to recovery.** The species that are moving into the reference system and the mechanism for encroachment are the two factors that will limit the ability for a site to maintain or recover. Site and time specific observations are necessary to understand the full potential of recovery for communities in this state.

### Restoration pathway R 2-1
### State 2 to 1

Recovery time will be necessary with a prescribed grazing system developed specific to the forb species that are dominant and the grass species that are lost. Not all sites will have the ability to recover without significant inputs of

energy and resources. In extreme cases, chemical or mechanical methods of treating the forbs on the site as well as mechanical methods to break the significant ground cover of dense spikemoss cover to permit seedling establishment. Seeding may be necessary to help restore the grass and grass-like structure and to further aid the recovery of the hydrology lost with the increase in forbs and dense spikemoss ground cover.

**Context dependence.** Not all communities will be hindered by a significant understory of dense spikemoss. For those communities that are, the ability to enhance or improve the community without major soil disturbance is not possible at this time. For those without this understory, the ability to use natural process to improve this site are more feasible.

**Conservation practices**

| |
|---|
| Access Control |
| Prescribed Grazing |
| Grazing Land Mechanical Treatment |
| Heavy Use Area Protection |
| Integrated Pest Management (IPM) |
| Upland Wildlife Habitat Management |
| Early Successional Habitat Development/Management |
| Prescribed Grazing |
| Grazing Management Plan |
| Monitor key grazing areas to improve grazing management |
| Intensive Management of Rotational Grazing |
| Prescriptive grazing management system for grazed lands |

### Transition T 2-3
### State 2 to 3

Drought, continued season-long grazing or severe use provides the opportunity for aggressive species to establish in this community. The weakened plant structure leaves the community vulnerable to encroachment or species creep by non-native species such as Kentucky bluegrass, dandelions, smooth brome, and in some instances conifers. This also leaves the site vulnerable for invasive species such as toadflax, cheatgrass, thistles, and others to establish.

**Constraints to recovery.** The ability to eradicate or control non-native species without affecting the native composition is the only significant constraint of recovery to a native or less degraded plant community.

**Context dependence.** The specific limitations to recovery is based on which/what species are encroaching on the community and what other species are in the surrounding vicinity.

### Restoration pathway R 2-4
### State 2 to 4

In the case of significant ground cover by dense spikemoss, mechanical disturbance to break up or loosen the ground cover is necessary to allow desired grasses and forbs the ability to establish. Hoof action in high intensity may be an option, but no trials were found to determine the likelihood of success. With mechanical disturbance to break up the soil cover, restoring hydrology to the site, seeding will be necessary with integrated pest management to ensure that no undesirable species move into the community. The act of tilling or breaking the soil crust alters the site, so that even after re-vegetation, the soils and hydrology will not function as an undisturbed site. The potential for the site will be shifted from the reference and further recovery will require different mechanisms to allow the soil to redevelop. This prevents this community from being reference even though it may resemble reference.

**Conservation practices**

| |
|---|
| Critical Area Planting |
| Prescribed Grazing |
| Grazing Land Mechanical Treatment |
| Range Planting |
| Integrated Pest Management (IPM) |
| Upland Wildlife Habitat Management |
| Early Successional Habitat Development/Management |
| Planned Grazing System |
| Native Plant Community Restoration and Management |
| Prescribed Grazing |
| Grazing Management Plan |
| Grazing management to improve wildlife habitat |
| Intensive Management of Rotational Grazing |
| Intensive rotational grazing |
| Prescriptive grazing management system for grazed lands |

### Restoration pathway R 3-4
### State 3 to 4

Significant treatments may be needed, including integrated pest management, soil disturbance or seeding, to eradicate the invasive species and to reclaim the community. The use of improved varieties, limited diversity in a seeding, as well as seed bed preparation and eradication processes alters the hydrology and compositional function of the system. Policy for federal and state lands sets parameters for species selection; however, a factor that determines reclamation options is limited more by the lack of seed availability for many of the native species.

**Conservation practices**

| |
|---|
| Critical Area Planting |
| Access Control |
| Prescribed Grazing |
| Grazing Land Mechanical Treatment |
| Heavy Use Area Protection |
| Integrated Pest Management (IPM) |
| Upland Wildlife Habitat Management |
| Early Successional Habitat Development/Management |
| Planned Grazing System |
| Native Plant Community Restoration and Management |
| Prescribed Grazing |
| Invasive Plant Species Control |
| Grazing Management Plan |
| Improve the plant diversity and structure of non-cropped areas for wildlife food and habitat |
| Biological suppression and other non-chemical techniques to manage herbaceous weeds invasive species |
| Prescriptive grazing management system for grazed lands |

### Transition T 4-3

### State 4 to 3

Following a ground disturbance, whether planned or incidental in nature, provides a niche for non-native species to establish. This same niche is an opportunity for non-typical natives (juniper/spruce) to encroach into the area. Disturbance by means of equipment, vehicles, or human activity, as well as domestic animals and wildlife provide a means for introducing seed sources for these undesirable species into the system. Planned disturbances, seeding or development activities provides the open niche for invasive species to establish in an area. Ground disturbances of any nature introduces seed sources from surrounding areas into a prime seedbed. In the reclamation or restoration process, if no management is put into place to prevent an infestation of weeds, the community will transition (or possibly revert back) to an invaded state. Wildfire, prescribed burning, drought, or frequent and severe over-use by large herbivores can be a source of the disturbance that either opens the canopy and/or introduces the species to the location. Extended periods of non-use creates a decadent community with a large proportion of dead growth persisting around the crown of the plants, reducing vigor and production. As the plants begin to die-back, the community becomes vulnerable to weed invasions. This invasion triggers the transition to an invaded state.

**Context dependence.** Once the soils of a community are mechanically altered, the community will no longer function or respond as an undisturbed soils. Although it may be very similar, there will be subtle differences. For this transition, soil disturbance has occurred, but the function or driver for State 3 is a response to the non-native or invasive species, not to the soil properties.

## Additional community tables

**Table 17. Community 1.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Tall-stature, Cool-season Bunchgrasses** | | | 644–1031 | |
| | Columbia needlegrass | ACNE9 | *Achnatherum nelsonii* | 387–516 | 15–20 |
| | slender wheatgrass | ELTR7 | *Elymus trachycaulus* | 258–516 | 10–20 |
| | nodding brome | BRAN | *Bromus anomalus* | 0–129 | 0–5 |
| 2 | **Mid-stature, Cool-season Bunchgrasses** | | | 392–841 | |
| | Idaho fescue | FEID | *Festuca idahoensis* | 392–785 | 15–30 |
| | Letterman's needlegrass | ACLE9 | *Achnatherum lettermanii* | 0–129 | 0–5 |
| | alpine timothy | PHAL2 | *Phleum alpinum* | 0–129 | 0–5 |
| | rough bentgrass | AGSC5 | *Agrostis scabra* | 0–129 | 0–5 |
| 3 | **Rhizomatous Grasses** | | | 112–392 | |
| | Montana wheatgrass | ELAL7 | *Elymus albicans* | 112–280 | 5–10 |
| | spike fescue | LEKI2 | *Leucopoa kingii* | 0–135 | 0–5 |
| 4 | **Short-stature, Cool-season Bunchgrasses** | | | 0–224 | |
| | Cusick's bluegrass | POCU3 | *Poa cusickii* | 0–129 | 0–5 |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–129 | 0–5 |
| | spike trisetum | TRSP2 | *Trisetum spicatum* | 0–129 | 0–5 |
| | timber oatgrass | DAIN | *Danthonia intermedia* | 0–129 | 0–5 |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 0–129 | 0–5 |
| | Parry's oatgrass | DAPA2 | *Danthonia parryi* | 0–129 | 0–5 |
| 5 | **Miscellaneous Grasses and Grass-likes** | | | 0–448 | |
| | needleleaf sedge | CADU6 | *Carex duriuscula* | 0–129 | 0–5 |
| | sedge | CAREX | *Carex* | 0–129 | 0–5 |
| | twoflowered rush | JUBI2 | *Juncus biglumis* | 0–129 | 0–5 |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–129 | 0–5 |

| | | | | | |
|---|---|---|---|---|---|
| **Forb** | | | | | |
| 6 | **Dominant Perennial Forbs** | | | 280–560 | |
| | hoary balsamroot | BAIN | *Balsamorhiza incana* | 0–56 | 0–5 |
| | myosoton | MYOSO2 | *Myosoton* | 0–56 | 0–5 |
| | fleabane | ERIGE2 | *Erigeron* | 0–56 | 0–5 |
| | ragwort | SENEC | *Senecio* | 0–56 | 0–5 |
| | Rocky Mountain goldenrod | SOMU | *Solidago multiradiata* | 0–56 | 0–5 |
| | arnica | ARNIC | *Arnica* | 0–56 | 0–5 |
| | varileaf cinquefoil | PODI2 | *Potentilla diversifolia* | 0–56 | 0–5 |
| | slender cinquefoil | POGR9 | *Potentilla gracilis* | 0–56 | 0–5 |
| | bluebells | MERTE | *Mertensia* | 0–56 | 0–5 |
| | bluebell bellflower | CARO2 | *Campanula rotundifolia* | 0–56 | 0–5 |
| | blanketflower | GAILL | *Gaillardia* | 0–56 | 0–5 |
| | cutleaf anemone | PUPAM | *Pulsatilla patens ssp. multifida* | 0–56 | 0–5 |
| | old man's whiskers | GETR | *Geum triflorum* | 0–56 | 0–5 |
| | littleflower penstemon | PEPR2 | *Penstemon procerus* | 0–56 | 0–5 |
| | pale agoseris | AGGL | *Agoseris glauca* | 0–56 | 0–5 |
| | milkvetch | ASTRA | *Astragalus* | 0–56 | 0–5 |
| | Indian paintbrush | CASTI2 | *Castilleja* | 0–56 | 0–5 |
| | common yarrow | ACMI2 | *Achillea millefolium* | 0–56 | 0–5 |
| | white locoweed | OXSE | *Oxytropis sericea* | 0–56 | 0–5 |
| | silvery lupine | LUAR3 | *Lupinus argenteus* | 0–56 | 0–5 |
| | elkweed | FRSP | *Frasera speciosa* | 0–56 | 0–2 |
| | violet | VIOLA | *Viola* | 0–28 | 0–2 |
| | shootingstar | DODEC | *Dodecatheon* | 0–28 | 0–2 |
| | hooded lady's tresses | SPRO | *Spiranthes romanzoffiana* | 0–28 | 0–2 |
| | yampah | PERID | *Perideridia* | 0–28 | 0–2 |
| | little larkspur | DEBI | *Delphinium bicolor* | 0–28 | 0–2 |
| | diamondleaf saxifrage | SARH2 | *Saxifraga rhomboidea* | 0–28 | 0–2 |
| | sego lily | CANU3 | *Calochortus nuttallii* | 0–28 | 0–2 |
| | textile onion | ALTE | *Allium textile* | 0–28 | 0–2 |
| | American bistort | POBI6 | *Polygonum bistortoides* | 0–28 | 0–2 |
| | meadow deathcamas | ZIVE | *Zigadenus venenosus* | 0–28 | 0–2 |
| | leafy wildparsley | MUDI | *Musineon divaricatum* | 0–28 | 0–2 |
| 7 | **Low-stature Forbs** | | | 0–280 | |
| | Forb, perennial | 2FP | *Forb, perennial* | 0–56 | 0–5 |
| | hairy false goldenaster | HEVI4 | *Heterotheca villosa* | 0–28 | 0–5 |
| | ballhead sandwort | ARCO5 | *Arenaria congesta* | 0–28 | 0–5 |
| | rosy pussytoes | ANRO2 | *Antennaria rosea* | 0–28 | 0–5 |
| | longleaf phlox | PHLO2 | *Phlox longifolia* | 0–28 | 0–5 |
| | field chickweed | CEAR4 | *Cerastium arvense* | 0–28 | 0–5 |
| | northern bedstraw | GABO2 | *Galium boreale* | 0–28 | 0–5 |
| | sulphur-flower buckwheat | ERUM | *Eriogonum umbellatum* | 0–28 | 0–5 |

| | | | | | |
|---|---|---|---|---|---|
| | sulphur flower buckwheat | ERUM | *Eriogonum umbellatum* | 0–28 | 0–5 |
| **Shrub/Vine** | | | | | |
| 8 | **Miscellaneous Shrubs** | | | 0–56 | |

**Table 18. Community 2.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Mid-stature, Cool-season Bunchgrasses** | | | 364–757 | |
| | Idaho fescue | FEID | *Festuca idahoensis* | 280–560 | 15–30 |
| | Letterman's needlegrass | ACLE9 | *Achnatherum lettermanii* | 84–196 | 5–10 |
| | alpine timothy | PHAL2 | *Phleum alpinum* | 0–196 | 0–10 |
| | rough bentgrass | AGSC5 | *Agrostis scabra* | 0–95 | 0–5 |
| 2 | **Rhizomatouz Grasses** | | | 84–308 | |
| | Montana wheatgrass | ELAL7 | *Elymus albicans* | 84–196 | 5–10 |
| | spike fescue | LEKI2 | *Leucopoa kingii* | 0–112 | 0–5 |
| 3 | **Tall-stature, Cool-season Bunchgrasses** | | | 84–280 | |
| | slender wheatgrass | ELTR7 | *Elymus trachycaulus* | 84–280 | 5–15 |
| | Columbia needlegrass | ACNE9 | *Achnatherum nelsonii* | 0–95 | 0–5 |
| | nodding brome | BRAN | *Bromus anomalus* | 0–95 | 0–5 |
| 4 | **Short-stature, Cool-season Bunchgrasses** | | | 0–280 | |
| | Parry's oatgrass | DAPA2 | *Danthonia parryi* | 0–95 | 0–5 |
| | timber oatgrass | DAIN | *Danthonia intermedia* | 0–95 | 0–5 |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 0–95 | 0–5 |
| | Cusick's bluegrass | POCU3 | *Poa cusickii* | 0–95 | 0–5 |
| | spike trisetum | TRSP2 | *Trisetum spicatum* | 0–95 | 0–5 |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–95 | 0–5 |
| 5 | **Miscellaneous Grasses and Grass-likes** | | | 84–392 | |
| | needleleaf sedge | CADU6 | *Carex duriuscula* | 0–95 | 0–5 |
| | sedge | CAREX | *Carex* | 0–95 | 0–5 |
| | twoflowered rush | JUBI2 | *Juncus biglumis* | 0–95 | 0–5 |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–95 | 0–5 |
| | Grass, annual | 2GA | *Grass, annual* | 0–95 | 0–5 |
| **Forb** | | | | | |
| 6 | **Dominant Pernennial Forbs** | | | 112–841 | |
| | Indian paintbrush | CASTI2 | *Castilleja* | 0–112 | 0–5 |
| | common yarrow | ACMI2 | *Achillea millefolium* | 0–112 | 0–5 |
| | white locoweed | OXSE | *Oxytropis sericea* | 0–112 | 0–5 |
| | silvery lupine | LUAR3 | *Lupinus argenteus* | 0–112 | 0–5 |
| | meadow deathcamas | ZIVE | *Zigadenus venenosus* | 0–112 | 0–5 |
| | arnica | ARNIC | *Arnica* | 0–112 | 0–5 |
| | varileaf cinquefoil | PODI2 | *Potentilla diversifolia* | 0–112 | 0–5 |
| | slender cinquefoil | POGR9 | *Potentilla gracilis* | 0–112 | 0–5 |
| | bluebells | MERTE | *Mertensia* | 0–112 | 0–5 |
| | blanketflower | GAILL | *Gaillardia* | 0–112 | 0–5 |

| | | | | | |
|---|---|---|---|---|---|
| | cutleaf anemone | PUPAM | *Pulsatilla patens ssp. multifida* | 0–112 | 0–5 |
| | old man's whiskers | GETR | *Geum triflorum* | 0–112 | 0–5 |
| | Chelan beardtongue | PEPR3 | *Penstemon pruinosus* | 0–112 | 0–5 |
| | milkvetch | ASTRA | *Astragalus* | 0–112 | 0–5 |
| | hoary balsamroot | BAIN | *Balsamorhiza incana* | 0–112 | 0–5 |
| | shootingstar | DODEC | *Dodecatheon* | 0–112 | 0–5 |
| | forget-me-not | MYOSO | *Myosotis* | 0–112 | 0–5 |
| | Rocky Mountain goldenrod | SOMU | *Solidago multiradiata* | 0–112 | 0–5 |
| | aster | ASTER | *Aster* | 0–112 | 0–5 |
| | fleabane | ERIGE2 | *Erigeron* | 0–112 | 0–5 |
| | ragwort | SENEC | *Senecio* | 0–112 | 0–5 |
| | elkweed | FRSP | *Frasera speciosa* | 0–112 | 0–2 |
| | textile onion | ALTE | *Allium textile* | 0–84 | 0–5 |
| | violet | VIOLA | *Viola* | 0–84 | 0–5 |
| | bluebell bellflower | CARO2 | *Campanula rotundifolia* | 0–56 | 0–5 |
| | American bistort | POBI6 | *Polygonum bistortoides* | 0–28 | 0–5 |
| | leafy wildparsley | MUDI | *Musineon divaricatum* | 0–28 | 0–5 |
| | sego lily | CANU3 | *Calochortus nuttallii* | 0–28 | 0–5 |
| | little larkspur | DEBI | *Delphinium bicolor* | 0–28 | 0–5 |
| | diamondleaf saxifrage | SARH2 | *Saxifraga rhomboidea* | 0–28 | 0–2 |
| | yampah | PERID | *Perideridia* | 0–28 | 0–2 |
| | hooded lady's tresses | SPRO | *Spiranthes romanzoffiana* | 0–28 | 0–2 |
| | dock | RUMEX | *Rumex* | 0–28 | 0–2 |
| 7 | **Low-stature Forbs** | | | 280–1121 | |
| | Forb, perennial | 2FP | *Forb, perennial* | 0–112 | 0–5 |
| | field chickweed | CEAR4 | *Cerastium arvense* | 0–112 | 0–5 |
| | northern bedstraw | GABO2 | *Galium boreale* | 0–112 | 0–5 |
| | sulphur-flower buckwheat | ERUM | *Eriogonum umbellatum* | 0–112 | 0–5 |
| | hairy false goldenaster | HEVI4 | *Heterotheca villosa* | 0–112 | 0–5 |
| | ballhead sandwort | ARCO5 | *Arenaria congesta* | 0–112 | 0–5 |
| | rosy pussytoes | ANRO2 | *Antennaria rosea* | 0–112 | 0–5 |
| | longleaf phlox | PHLO2 | *Phlox longifolia* | 0–112 | 0–5 |
| **Shrub/Vine** | | | | | |
| 8 | **Miscellaneous Shrubs** | | | 0–56 | |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 0–56 | 0–5 |
| | mountain big sagebrush | ARTRV | *Artemisia tridentata ssp. vaseyana* | 0–56 | 0–5 |
| | Michaux's wormwood | ARMI4 | *Artemisia michauxiana* | 0–28 | 0–5 |
| | prairie sagewort | ARFR4 | *Artemisia frigida* | 0–28 | 0–5 |

**Table 19. Community 3.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 1 | **Mid-stature, Cool-season Bunchgrasses** | | | 252–897 | |
| | Idaho fescue | FEID | *Festuca idahoensis* | 224–673 | 10–30 |
| | Letterman's needlegrass | ACLE9 | *Achnatherum lettermanii* | 28–112 | 1–5 |
| | rough bentgrass | AGSC5 | *Agrostis scabra* | 0–112 | 0–5 |
| | alpine timothy | PHAL2 | *Phleum alpinum* | 0–112 | 0–5 |
| 2 | **Rhizomatous Grasses** | | | 112–560 | |
| | Kentucky bluegrass | POPR | *Poa pratensis* | 112–224 | 5–10 |
| | smooth brome | BRIN2 | *Bromus inermis* | 0–112 | 0–5 |
| | spike fescue | LEKI2 | *Leucopoa kingii* | 0–112 | 0–5 |
| | bluebunch wheatgrass | PSSP6 | *Pseudoroegneria spicata* | 0–112 | 0–5 |
| | Montana wheatgrass | ELAL7 | *Elymus albicans* | 0–112 | 0–5 |
| 3 | **Short-stature, Cool-season Bunchgrasses** | | | 56–336 | |
| | timber oatgrass | DAIN | *Danthonia intermedia* | 28–112 | 1–5 |
| | Parry's oatgrass | DAPA2 | *Danthonia parryi* | 0–112 | 0–5 |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 0–112 | 0–5 |
| | Cusick's bluegrass | POCU3 | *Poa cusickii* | 28–112 | 1–5 |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–112 | 0–5 |
| | spike trisetum | TRSP2 | *Trisetum spicatum* | 0–112 | 0–5 |
| 4 | **Tall-stature, Cool-season Bunchgrasses** | | | 0–224 | |
| | timothy | PHPR3 | *Phleum pratense* | 0–224 | 0–10 |
| | orchardgrass | DAGL | *Dactylis glomerata* | 0–112 | 0–5 |
| | nodding brome | BRAN | *Bromus anomalus* | 0–112 | 0–5 |
| | Columbia needlegrass | ACNE9 | *Achnatherum nelsonii* | 0–112 | 0–5 |
| | slender wheatgrass | ELTR7 | *Elymus trachycaulus* | 0–112 | 0–5 |
| 5 | **Miscellaneous Grasses and Grass-likes** | | | 0–224 | |
| | needleleaf sedge | CADU6 | *Carex duriuscula* | 0–112 | 0–5 |
| | sedge | CAREX | *Carex* | 0–112 | 0–5 |
| | twoflowered rush | JUBI2 | *Juncus biglumis* | 0–112 | 0–5 |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–112 | 0–5 |
| | Grass, annual | 2GA | *Grass, annual* | 0–112 | 0–5 |
| **Forb** | | | | | |
| 6 | **Dominant Perennial Forbs** | | | 0–560 | |
| | common yarrow | ACMI2 | *Achillea millefolium* | 0–112 | 0–5 |
| | hoary balsamroot | BAIN | *Balsamorhiza incana* | 0–112 | 0–5 |
| | shootingstar | DODEC | *Dodecatheon* | 0–112 | 0–5 |
| | forget-me-not | MYOSO | *Myosotis* | 0–112 | 0–5 |
| | white locoweed | OXSE | *Oxytropis sericea* | 0–112 | 0–5 |
| | silvery lupine | LUAR3 | *Lupinus argenteus* | 0–112 | 0–5 |
| | meadow deathcamas | ZIVE | *Zigadenus venenosus* | 0–112 | 0–5 |
| | arnica | ARNIC | *Arnica* | 0–112 | 0–5 |
| | varileaf cinquefoil | PODI2 | *Potentilla diversifolia* | 0–112 | 0–5 |
| | slender cinquefoil | POGR9 | *Potentilla gracilis* | 0–112 | 0–5 |
| | bluebells | MERTE | *Mertensia* | 0–112 | 0–5 |
| | Rocky Mountain | SOMU | *Solidago multiradiata* | 0–112 | 0–5 |

| | | | | | |
|---|---|---|---|---|---|
| | goldenrod | | | | |
| | Indian paintbrush | CASTI2 | *Castilleja* | 0–112 | 0–5 |
| | blanketflower | GAILL | *Gaillardia* | 0–112 | 0–5 |
| | cutleaf anemone | PUPAM | *Pulsatilla patens ssp. multifida* | 0–112 | 0–5 |
| | old man's whiskers | GETR | *Geum triflorum* | 0–112 | 0–5 |
| | Chelan beardtongue | PEPR3 | *Penstemon pruinosus* | 0–112 | 0–5 |
| | milkvetch | ASTRA | *Astragalus* | 0–112 | 0–5 |
| | ragwort | SENEC | *Senecio* | 0–112 | 0–5 |
| | fleabane | ERIGE2 | *Erigeron* | 0–112 | 0–5 |
| | aster | ASTER | *Aster* | 0–112 | 0–5 |
| | elkweed | FRSP | *Frasera speciosa* | 0–112 | 0–2 |
| | violet | VIOLA | *Viola* | 0–84 | 0–5 |
| | textile onion | ALTE | *Allium textile* | 0–84 | 0–5 |
| | bluebell bellflower | CARO2 | *Campanula rotundifolia* | 0–56 | 0–5 |
| | American bistort | POBI6 | *Polygonum bistortoides* | 0–28 | 0–5 |
| | little larkspur | DEBI | *Delphinium bicolor* | 0–28 | 0–5 |
| | sego lily | CANU3 | *Calochortus nuttallii* | 0–28 | 0–5 |
| | leafy wildparsley | MUDI | *Musineon divaricatum* | 0–28 | 0–5 |
| | diamondleaf saxifrage | SARH2 | *Saxifraga rhomboidea* | 0–28 | 0–2 |
| | dock | RUMEX | *Rumex* | 0–28 | 0–2 |
| | hooded lady's tresses | SPRO | *Spiranthes romanzoffiana* | 0–28 | 0–2 |
| | yampah | PERID | *Perideridia* | 0–28 | 0–2 |
| 7 | **Low-stature Forbs** | | | 0–841 | |
| | Forb, perennial | 2FP | *Forb, perennial* | 0–112 | 0–5 |
| | field chickweed | CEAR4 | *Cerastium arvense* | 0–112 | 0–5 |
| | northern bedstraw | GABO2 | *Galium boreale* | 0–112 | 0–5 |
| | sulphur-flower buckwheat | ERUM | *Eriogonum umbellatum* | 0–112 | 0–5 |
| | hairy false goldenaster | HEVI4 | *Heterotheca villosa* | 0–112 | 0–5 |
| | ballhead sandwort | ARCO5 | *Arenaria congesta* | 0–112 | 0–5 |
| | rosy pussytoes | ANRO2 | *Antennaria rosea* | 0–112 | 0–5 |
| | longleaf phlox | PHLO2 | *Phlox longifolia* | 0–112 | 0–5 |
| 8 | **Non-Native Forbs** | | | 0–841 | |
| | common dandelion | TAOF | *Taraxacum officinale* | 0–280 | 0–10 |
| | thistle | CIRSI | *Cirsium* | 0–112 | 0–5 |
| | rockcress | ARABI | *Arabidopsis* | 0–56 | 0–5 |
| | rusty lupine | LUPU | *Lupinus pusillus* | 0–56 | 0–5 |
| | Virginia strawberry | FRVI | *Fragaria virginiana* | 0–56 | 0–5 |
| | groundsmoke | GAYOP | *Gayophytum* | 0–56 | 0–5 |
| | western tansymustard | DEPI | *Descurainia pinnata* | 0–56 | 0–5 |
| | starwort | STELL | *Stellaria* | 0–56 | 0–5 |
| **Shrub/Vine** | | | | | |
| 9 | **Miscellaneous Shrubs** | | | 0–56 | |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 0–56 | 0–5 |
| | mountain big sagebrush | ARTRV | *Artemisia tridentata ssp.* | 0–56 | 0–5 |

| | | | | | |
|---|---|---|---|---|---|
| | mountain big sagebrush | ARTRV | *Artemisia tridentata ssp. vaseyana* | 0–36 | 0–5 |
| | prairie sagewort | ARFR4 | *Artemisia frigida* | 0–28 | 0–5 |
| | Michaux's wormwood | ARMI4 | *Artemisia michauxiana* | 0–28 | 0–5 |

## Animal community

Animal Community – Wildlife Interpretations:

1.1 – Mixed Bunchgrasses/Forbs (Reference Community): The predominance of grasses in this plant community favors grazers and mixed-feeders, such as elk, mule deer and antelope. Suitable thermal and escape cover for deer may be limited due to the low quantities of woody plants. However, topographical variations and proximity to timber could provide some escape cover. Many grassland obligate small mammals would occur here.

2.1 – Forb/Mixed Grasses Plant Community: The combination of an increase in forbs and persistence of many grasses provide a very diverse plant community for wildlife. The lack of sagebrush limits the use because of the lack of cover. May provide winter forage for mule deer and elk, when accessible (snow depth may limit some areas). Snow melt occurs earlier and fall drift occurs later in the season, allowing use for longer periods through the year.

3.1 – Non-native Plant Community: This community provides limited foraging for antelope and other grazers. Generally, these are not target plant communities for wildlife habitat management.

3.2- Invasive Plant Community: The diversity with the invasive grasses and/or forbs provide an extended plant community for wildlife. The similarities to Community Phase 1.1 and 2.1 can be enhanced for some species with the added forage provided by the invasive species. But as the invasive species increase, decreasing the desirable species, the wildlife species benefits are variable and species dependent.

4.1 - Disturbed/Degraded Lands Plant Community and 4.2 - Restored/Reclaimed Lands Plant Community: The variability of this site limits a detailed review of wildlife benefits. However, the native species used for most seeding mixes, and the successional species that will establish provide the similar cover to the reference state or adequate cover for feed and nesting sites for those wildlife species that would have selected the site prior to disturbance. Limitations and enhancements need to be considered by specific locations.

Animal Community – Grazing Interpretations:

The following table lists suggested stocking rates for cattle under continuous season-long grazing with normal growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of the conservation planning process. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Because of this, a field visit is recommended, in all cases, to document plant composition and production. More precise carrying capacity estimates should eventually be calculated using this information along with animal preference data, particularly when grazers other than cattle are involved. Under more intensive grazing management, improved harvest efficiencies can result in an increased carrying capacity. If distribution problems occur, stocking rates must be reduced to maintain plant health and vigor.

Plant Community Production Carrying Capacity*

The Carrying capacity is calculated as the production (normal year) X .25 efficiency factor / 912.5 # / AUM to calculate the AUM's/Acre.
Plant Community Description/Title Lbs./Acre AUM/Acre* Acre/AUM
Below Ave. Normal Above Ave.
1.1 Mixed Bunchgrasses/Sagebrush 1700 2300 2850 0.63 1.59
2.1 Sagebrush/Mixed Grasses 1100 1650 2750 0.45 2.21
3.1 Non-natives 1250 2000 3000 0.55 1.83
3.2 Invasive ** ** ** ** **
4.1 Disturbed/Degraded ** ** ** ** **
4.2 Restored/Reclaimed ** ** ** ** **

* - Carrying Capacity is figured for continuous, season-long grazing by cattle under average growing conditions.

** - Sufficient data for invaded and reclaimed communities has not be collected or evaluated, at this time, so no projection of a stocking rate recommendation or production range will be established at this time.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage for cattle, sheep, or horses. During the dormant period, the forage for livestock use needs to be supplemented with protein because the quality does not meet minimum livestock requirements.

Distance to water, shrub density, and slope can affect carrying capacity (grazing capacity) within a management unit. Adjustments should be made for the area that is considered necessary for reduction of animal numbers. For example, 30% of a management unit may have 25% slopes and distances of greater than one mile from water; therefore, the adjustment is only calculated for 30% of the unit (i.e. 50% reduction on 30% of the management unit).

Fencing, slope length, management, access, terrain, kind and class of livestock, and breeds are all factors that can increase or decrease the percent of graze-able acres within a management unit. Adjustments should be made that incorporate these factors when calculating stocking rates.

## Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group B, with localized areas in hydrologic group A and C. Infiltration ranges from rapid to moderate. Runoff potential for this site varies from low to moderate depending on soil hydrologic group and ground cover. In many cases, areas with greater than 75% ground cover have the greatest potential for high infiltration and lower runoff. Areas where ground cover is less than 50% have the greatest potential to have reduced infiltration and higher runoff (refer to Part 630, NRCS National Engineering Handbook for detailed hydrology information).

Rills and gullies should not typically be present. Water flow patterns should be barely distinguishable if at all present. Pedestals are only slightly present in association with bunchgrasses and shrubs. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non-existent. Cryptogrammic crusts are present, but only cover 1-2% of the soil surface. Spikemoss can become a significant restriction to the hydrology, specifically infiltration, on sites with high disturbance.

## Recreational uses

This site provides hunting opportunities for upland game species. The wide varieties of plants which bloom through the summer have an aesthetic value that appeals to visitors. Outside of plants, the extent offers a variety of culture resources to view on the landscape based on the location of many of these sites on higher ground on the benches and fans which also provides a rich source of geology for exploration. This ecological site has minimal limitations when associated with roadways and trails, and provides a sound base for travel and camping in relation to erosion potential and functionality.

## Wood products

Woody or forest encroachment is less of an occurrence than in sedimentary parent materials, but will occur in areas that have been protected from fire or that have had disturbance, breaking the vegetation mat, allowing trees to establish. Minor harvest of Christmas trees by individuals, or firewood may be isolated and sparse.

## Other products

Herbs: Many of the forb species found within the Granitic Loamy site were edible, or had medicinal and cultural significance to the Native Americans. Edible roots, teas from leaves and fruits, to the medicinal uses of many of the forbs are still valued by outdoor enthusiasts today.

Ornamental Species: The forbs commonly found as well as the shrub component of these communities have been used in landscaping and xeriscaping.

Aesthetics: Wildflower enthusiasts, photographers, and others enjoy the color and variety of flowers that the forbs provide in this landscape. The humming birds, moths, butterflies and wildlife that frequent these areas are also a favorite of most recreationalists.

## Inventory data references

Inventory Data References
Information presented in the original site description was derived from NRCS inventory data. Field observations from range trained personnel were also used. Those involved in developing the original site include: Bill Christensen, Range Management Specialist, NRCS Karen Clause, Range Management Specialist, MRCS; and Everet Bainter, Range Management Specialist, NRCS. Other sources used as references include USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, and USDA NRCS Soil Surveys from various counties.

Information presented here has been derived from NRCS inventory data, Field observations from range trained personnel, and the existing range site descriptions. Those involved in developing the Granitic Loamy range site include: Chris Krassin, Range Management Specialist (retired), NRCS and Everet Bainter, Range Management Specialist (retired), Ray Gullion, Range Management Specialist, NRCS; Thad Berrett, Supervisory Range Management Specialist, USFS; Zach Palm, Range Management Specialist, USFS; and Heather Riechter, Range Management Specialist, USFS.

Inventory Data References:
Ocular field estimations observed by trained personnel were completed at each site. Then sites were selected where a 100 foot tape was stretched and the following sample procedures were completed by inventory staff. For full sampling protocol and guidelines with forms please refer to the Wyoming ESI Operating Procedures, compiled in 2012 for the Powell and Rock Springs Soil Survey Office, USDA-NRCS.
• Double Sampling Production Data (4.8 hoop used to estimate 10 points, clipped a minimum of 3 of these estimated points, with two 21 foot X 21 foot square extended shrub plots).
• Line Point Intercept (over story and understory captured with soil cover). Height of herbaceous and woody cover is collected every three feet along established transect.)
• Continuous Line Intercept (Woody Canopy Cover, with minimum gap of 0.2 of a foot for all woody species and succulents. Intercept height collected at each measurement.),
• Gap Intercept (Basal Gap measured with a minimum gap requirement of 0.7 foot.)

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## Approval

Scott Woodall, 10/04/2019

## Rangeland health reference sheet

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

| | |
|---|---|
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| Date | 08/30/2018 |
| Approved by | Marji Patz |
| Approval date | |
| Composition (Indicators 10 and 12) based on | Annual Production |

## Indicators

1. **Number and extent of rills:** Rare to nonexistent. Where present, short and widely spaced.

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2. **Presence of water flow patterns:** Barely observable. Lack of sagebrush or other woody vegetation allow for water flow patterns to be slightly more visible if present, but they should not be present in any significance.

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3. **Number and height of erosional pedestals or terracettes:** Rare to nonexistent.

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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 can range from 0-10%.

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5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Rare to nonexistent.

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7. **Amount of litter movement (describe size and distance expected to travel):** Herbaceous and woody debris should show no expected movement.

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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):** Soil Stability Index ratings range from 3 (interspaces) to 6 (under plant canopy), but average values should be 4.0 or greater.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil data is limited for this site. Described A-horizons vary from 3 -12 inches (7-30 cm) with OM of 6 to 16%.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The plant community consists of 65-75% grasses, 20% forbs and 0-5% shrubs. Evenly distributed plant canopy (70-95%) and litter plus moderate to moderately rapid infiltration rates result in minimal runoff. Basal cover is typically greater than 15% for this site and does effect runoff on this 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):** 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: Cool-season Tall-stature Bunchgrasses Cool-season Mid-stature Grasses

    Sub-dominant: Perennial Forbs Cool-season Rhizomatous Grasses

    Other: Dwarf Shrubs

    Additional: Dominance of Mid-stature grasses varies with the extent of use and depth to gravels/grus. Generally, they are thought to be dominant but could fall as sub-dominant.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Minimal decadence, typically associated with bunchgrass canopy component.

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14. **Average percent litter cover (%) and depth ( in):** Litter ranges from 5-15% of total canopy measurement with total litter (including beneath the plant canopy) from 15-30% expected. Herbaceous litter depth typically ranges from 5-15 mm. Woody litter would be considered incidental with minimal accumulation (< 1 in or 25 mm).

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** English: 1500 - 2600 lbs/ac (2200 lbs/ac average); Metric: 1680 - 2915 kg/ha (2465 kg/ha average).

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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:** The increase of bare ground above 30% is an indicator that a threshold is being crossed. Corresponding increase will be noted in one or more of the following species is common: Sandberg bluegrass, buckwheat, phlox, and yarrow are common increasers. Non-native species such as common dandelion, smooth brome, Kentucky bluegrass, and timothy will also increase. Annual weeds and thistles are common on disturbed sites. Common noxious weeds that invade are: houndstongue, yellow toadflax, dalmation toadflax, common burdock, mullein, leafy spurge, and oxeye daisy. Cheatgrass and ventanata grass may be a concern in some areas.

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17. **Perennial plant reproductive capability:** All species are capable of reproducing, except in drought years.

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