USDA Natural Resources Conservation Service

# Ecological site DX032X01A122
# Loamy (Ly) Big Horn Basin Core

Last updated: 3/12/2025
Accessed: 05/12/2025

## General information

**Approved**. An approved ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model, enough information to identify the ecological site, and full documentation for all ecosystem states contained in the state and transition model.

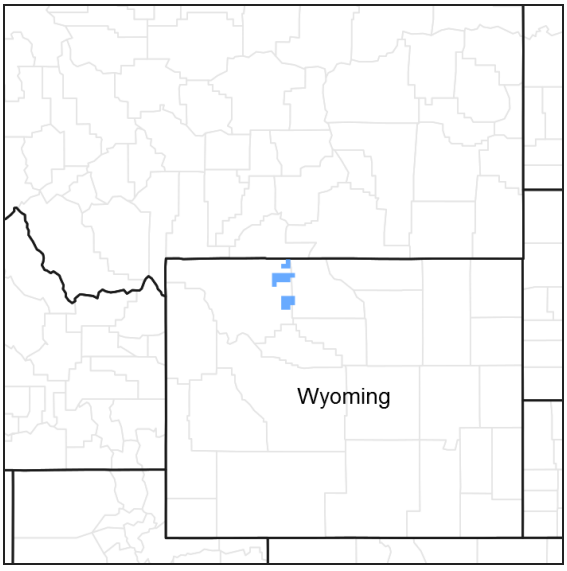


**Figure 1. Mapped extent**

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

## MLRA notes

Major Land Resource Area (MLRA): 032X–Northern Intermountain Desertic Basins

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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):

32X01A (WY): This LRU is the Big Horn Basin within MLRA 32. This LRU is lower in elevation, slightly warmer and receives slightly less overall precipitaiton than the Wind River Basin (LRU 02). This LRU was originally divided into two LRU's - LRU A which was the core and LRU B which was the rim. With the most current standards, this LRU is divided into two Subsets. This subset is Subset A, referred to as the Core, which is warm, dry eroded basin floor. As the LRU shifts outer edges, aspect and relation to the major bodies of water and taller landforms create minor shifts in soil chemistry influencing the variety of ecological sites and plant interactions. 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. Older ESD's will refer to LRU A. LRU A and LRU 01 in MLRA 32X are synonymous.

Moisture Regime: Typic Aridic, prior to 2012, there are map units that cross over to ustic aridic or ustic aridic was correlated into this core area. As progressive mapping continues and when the ability to do update projects, these overlapping map units will be corrected.

Temperature Regime: Mesic
Dominant Cover: Rangeland, with Saltbush flats the dominant vegetative cover for this LRU/ESD.
Representative Value (RV) Effective Precipitation: 5-9 inches (127 – 229 mm)
RV Frost-Free Days: 110-150 days

## Classification relationships

Relationship to Other Established Classification Systems:

National Vegetation Classification System (NVC):
3 Xeromorphic Woodland, Scrub & Herb Vegetation Class
3.B Cool Semi-Desert Scrub & Grassland Subclass
3.B.1 Cool Semi-Desert Scrub & Grassland formation
3.B.1.NE Western North American Cool Semi-Desert Scrub & Grassland Division
M169 Great Basin & Intermountain Tall Sagebrush Shrubland & Steppe Macrogroup
G302 Artemisia Tridentata - Artemisia tripartita - Purshia tridentata Big Sagebrush Steppe Group
CEGL001535 - Artemisia tridentata ssp. wyomingensis/Pseudoroegneria spicata Herbaceous Vegetation or
CEGL001009 - Artemisia tridentata ssp. wyomingensis/Pseudoroegneria spicata Shrubland

Ecoregions (EPA):
Level I: 10 North American Deserts
Level II: 10.1 Cold Deserts
Level III: 10.1.18 Wyoming Basin
Level IV: 10.1.18.g Big Horn Salt Desert Shrub Basin

## Ecological site concept

• Site does not receive any additional water.
• Slope is < 25%.
• Soils are:
o Not saline or saline-sodic.
o Moderately deep, deep, or very deep
o Surface with < 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 No Effervescence to Slight (moderate) effervescence throughout the top 20" (51 cm) of the mineral soil surface.
o Textures usually range from very fine sandy loam to clay loam in the top 4" (10 cm) of the mineral soil surface.
o Clay content is = 32% in top 4" (10 cm) of the mineral soil surface. Each of the following subsurface horizons to a depth of a minimum of 20" (51 cm) has a clay content of < 35%.

Review of typical locations within the Loamy range site determined a need to narrow the concept. The original range site concept included saline and calcareous characteristics (significant calcium carbonate accumulations within the soil profile). Upon further evaluation of the plant communities it was found that the state and transition model was tailored more to the carbonate influenced soils, and as those soils were filtered out the plant composition and production shifted enough to warrant a separation of these sites. So from the original Loamy range site there is now Loamy and Loamy Calcareous ecological sites. The Loamy ecological site concept is based on minimal (no to slight) influence from Salts, Carbonates, Gypsum or other chemistry within the top 20 inches (51 cm) of the soil profile. It is still ranged to include 18-35% clays (sandy loam to clay loam textures). These soils may shift with management as carbonates and/or salts concentrate higher in the profile shifting the plant dynamics that could shift specific locations to a different ecological site from the Loamy Site. This ecological site is highly responsive to the

amount and timing of precipitation. This will be detailed within the plant community narratives.

## Associated sites

| | |
|---|---|
| R032XY104WY | **Clayey (Cy) 5-9” Big Horn Basin Precipitation Zone**<br>Clayey sites will have a higher composition/productivity of Pascopyrum smithii (Western Wheatgrass) and lower productivity of Artemisia tridentata ssp. wyomingensis. and tend to be higher on the origination point of landforms originating from shale parent materials, then blends into loamy sites lower on the landform. |
| R032XY150WY | **Sandy (Sy) 5-9” Big Horn Basin Precipitation Zone,**<br>Sandy sites will have an increased percent production/composition of Achnatherum hymenoides (Indian Ricegrass) and Hesperostipa comata (NeedleandThread) species. And tend to be higher on the origination point of landforms originating from sandstone parent materials, then blends into loamy sites lower on the landform. |
| R032XY162WY | **Shallow Loamy (SwLy) 5-9” Big Horn Basin Precipitation Zone**<br>Shallow Loamy sites will hold a lower productivity and a higher percentage of Pseudoroegneria spicata (Bluebunch Wheatgrass) and low forb species. and tend to be near to the edges/tops of steep slopes or near to rock outcrop formations then blends into loamy sites lower on the landform. |

## Similar sites

| | |
|---|---|
| R032XY222WY | **Loamy (Ly) 5-9” Wind River Basin Precipitation Zone**<br>Wind River Basin has a slightly different climatic pattern so production and plant composition are different. |
| R032XY322WY | **Loamy (Ly) 10-14" East Precipitation Zone**<br>Loamy 10-14” Foothills and Basin East P.Z., R032XY322WY has higher production. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | (1) *Artemisia tridentata ssp. wyomingensis* |
| Herbaceous | (1) *Pseudoroegneria spicata*<br>(2) *Hesperostipa comata* |

## Legacy ID

R032XA122WY

## Physiographic features

This site occurs on nearly level to gently undulating (rolling) lands and on slopes generally less than 25%.

**Figure 2. Loamy 5-9" has good diversity, but lower productiv**

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Basin-floor remnant<br>(2) Alluvial fan<br>(3) Stream terrace |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 3,560–5,000 ft |
| Slope | 0–25% |
| Ponding depth | 0 in |
| Water table depth | 60 in |
| Aspect | Aspect is not a significant factor |

## Climatic features

Annual precipitation and modeled relative effective annual precipitation ranges from 5 to 9 inches (127 – 229 mm). The normal precipitation pattern shows peaks in May and June and a secondary peak in September. The noted peaks account for approximately 50% of the mean annual precipitation. Much of the moisture that falls in the latter part of the summer is lost by evaporation and much of the moisture that falls during the winter is lost by sublimation. Average snowfall is about 20 inches annually. Wide fluctuations may occur in yearly precipitation and result in more dry years than those with more than normal precipitation.

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. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring. High winds are generally blocked from the basin by high mountains, but can occur in conjunction with an occasional thunderstorm.

Growth of native cool-season plants begins approximately on April 1st and continues through to July 1st. Cool weather and moisture in September may produce some green up of cool season plants that will continue to late October.

For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/. “Basin”, "Emblem", "Greybull", “Lovell”, "Worland FAA AP" and “Worland” are the representative climate stations for LRU A. 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 (average) | 125 days |
| Freeze-free period (average) | 149 days |
| Precipitation total (average) | 8 in |

## Climate stations used

- (1) BASIN [USC00480540], Basin, WY
- (2) EMBLEM [USC00483031], Burlington, WY
- (3) GREYBULL [USC00484080], Greybull, WY
- (4) WORLAND [USC00489770], Worland, WY
- (5) WORLAND [USW00024062], Worland, WY
- (6) LOVELL [USC00485770], Lovell, WY

## Influencing water features

No information available.

## Soil features

The soils of this site are moderately deep to very deep (greater than 20” to bedrock), moderately well to well drained, and moderately slow to moderate permeability. The soil characteristic having the most influence on the plant community is available moisture and the potential to develop soluble salts near the surface.

Major Soil Series correlated to this site include: Griffy, Lostwells, Kinnear, Thedalund, Zigweid, Neiber, Olney, Pavillion, Forkwood, Lostwells-Like, Colby, Stormitt. This list of soil series is subject to change upon completion and correlation of the initial soil surveys: WY629, WY603, WY 617; as well as revisions to completed soil surveys: WY043 and MT611.

**Figure 7. Loamy Ecological Site Typical Soil Profile**

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Alluvium–sandstone<br>(2) Residuum–shale |
| Surface texture | (1) Gravelly sandy clay loam<br>(2) Fine sandy loam<br>(3) Loam |
| Family particle size | (1) Loamy |
| Drainage class | Moderately well drained to well drained |
| Permeability class | Moderately slow to moderate |
| Soil depth | 20–60 in |
| Surface fragment cover <=3" | 0–20% |
| Surface fragment cover >3" | 0–3% |
| Available water capacity (0-40in) | 3–6.3 in |
| Calcium carbonate equivalent (0-40in) | 0–15% |
| Electrical conductivity (0-40in) | 0–4 mmhos/cm |
| Sodium adsorption ratio (0-40in) | 0–13 |
| Soil reaction (1:1 water) (0-40in) | 7.4–8.4 |

| | |
|---|---|
| Subsurface fragment volume <=3" (Depth not specified) | 0–15% |
| Subsurface fragment volume >3" (Depth not specified) | 0–10% |

## Ecological dynamics

Potential vegetation on this site is dominated by mid-stature cool season perennial grasses. Other significant vegetation includes Wyoming Big Sagebrush, and a variety of forbs. The expected potential composition for this site is 75% grasses, 10% forbs, and 15% woody plants. The composition and production will vary naturally due to historic use, fluctuating precipitation and fire frequency.

As this site deteriorates species such as Blue grama, Sandberg bluegrass, and Wyoming big sagebrush will increase. Plains prickly pear and weedy annuals will invade. Cool-season grasses such as Bluebunch wheatgrass, rhizomatous wheatgrasses, Needleandthread, and Indian ricegrass will decrease in frequency and production.

Wyoming Big Sagebrush may become dominant on areas with an absence of fire and sufficient amount of precipitation. Wildfires have been actively controlled in recent times and as a result old decadent stands of Wyoming big sagebrush persist. Chemical control using herbicides has replaced the historic role of fire on this site. Recently, prescribed burning has regained some popularity.

Wyoming big sagebrush component lacks resilience due to the fluctuation of precipitation. Once sagebrush is reduced significantly or removed from the canopy, and if the site has maintained a vigorous stand of grass, it has a difficult time re-establishing or sustaining a viable composition. On these open canopies, Blue grama may become dominant with stress from frequent and severe grazing (year-long). As a result, a dense sod cover of Blue grama and/or Threadleaf sedge will become established.

The Reference plant community (description follows the plant community diagram) has been determined by study of rangeland relic areas, or areas protected from excessive disturbance. Trends in plant communities going from heavily grazed areas to lightly grazed areas, seasonal use pastures, and historical accounts have also been used.

The range in plant community composition is influenced by the depth of the soil profile, chemistry, as well as the soil texture within established breaks. When aligning the ecological site concepts with the soil classification guidelines, there are soils that classify to a particle-size class that does not fit the pre-conceived notion of the ecological site that it would typically follow. Plants respond to the mixed texture of the top 8 to10 inches (20-25 cm) of the soil profile.

Many of the soils that have been mapped in the Big Horn Basin have a sandy cap over an accumulation of clays in the profile, better referred to as an argillic horizon, but then as you move further down into the soil profile, the soils become coarser as the clays decrease. The depth of the start of this clay bulge (or argillic) can have a significant influence on the classification of the soils, swaying the classification to a fine-loamy when the plant response to the soils will maintain a sandy response. The reverse is also common where the clay bulge is high enough in the profile or the sandy cap is not present, and the clay percent drops below 18% below the 10 inches (25 cm) swaying the classification to coarse-loamy while the plants maintain a loamy response.

The gray area between the hard breaks for soils taxonomic classification and the softer breaks between ecological sites is captured by the inherent range of variability within each community. Data is being collected to determine if plants are responding in a significant manner to this argillic layer, and if so can a tailored break be made to classify these confused sites as sandy argillic or Loamy argillic rather than sandy or loamy. Sufficient data has not been collected to date to make this distinction, so the range of characteristics within the following plant communities is a reflection of this variability.

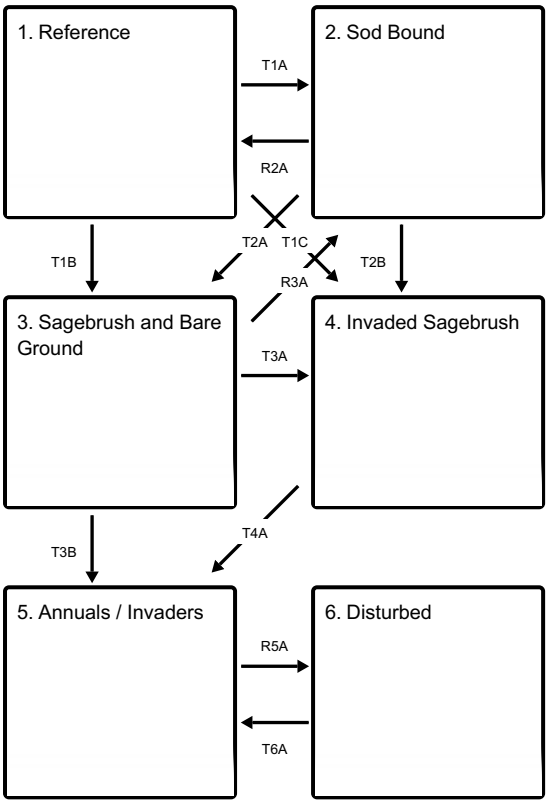
The following is a State and Transition Model (STM) Diagram for this ecological site. An STM has five fundamental components: states, transitions, restoration pathways, community phases and community pathways. The state, designated by the bold box, is a single community phase or suite of community phases. The reference state is recognized as State 1. It describes the ecological potential and natural range of variability resulting from the natural disturbance regime of the site. The designation of alternative states (State 2, etc) in STMs denotes changes in

ecosystem properties that cross a certain threshold.

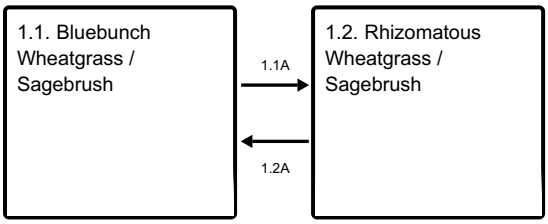
Transitions are represented by the arrows between states moving from a higher state to a lower state (State 1 - State 2) and are denoted in the legend as a “T” (T1-2). They describe the variables or events that contribute directly to loss of state resilience and result in shifts between states. Restoration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

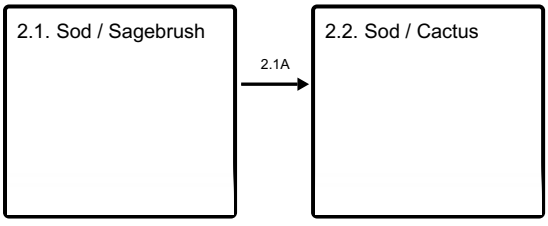
**Ecosystem states**



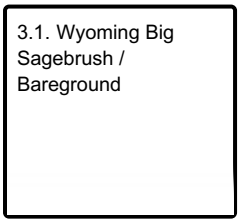

**State 1 submodel, plant communities**



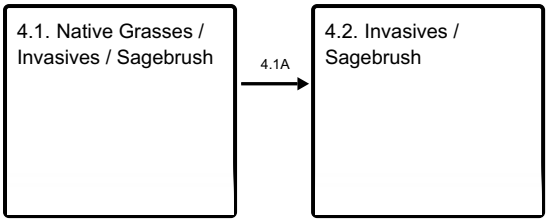

**State 2 submodel, plant communities**



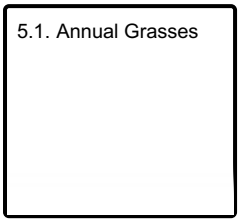

**State 3 submodel, plant communities**



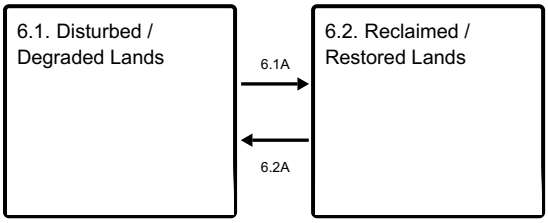
**State 4 submodel, plant communities**




**State 5 submodel, plant communities**




**State 6 submodel, plant communities**




## State 1
## Reference

The reference state is noted with 15% or less composition by weight of Wyoming big sagebrush, with a healthy, diverse mixture of Bluebunch wheatgrass, at 20% or less composition by weight, rhizomatous wheatgrasses, Western and Thickspike, as well as Indian ricegrass, Needleandthread, and Bottlebrush squirreltail. Threadleaf sedge and Blue grama are minor contributors to this state, but are still present in the communities.

## Community 1.1
## Bluebunch Wheatgrass / Sagebrush

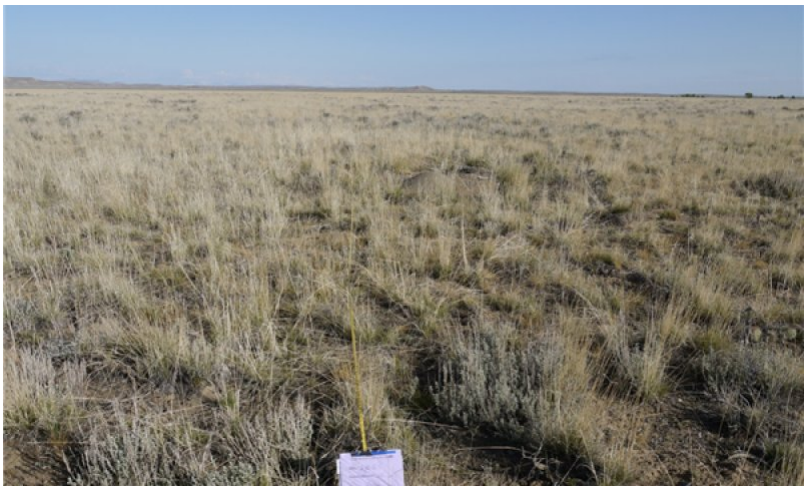


**Figure 8. Reference community for Loamy 32XA.**

The Bluebunch wheatgrass/Rhizomatous Wheatgrasses/Needleandthread/Wyoming Big Sagebrush (Reference) community can be found on areas that are within the original scope of disturbance regimes (grazing by large herbivores and periodic fires, that by which the state evolved), or under properly managed locations with grazing and/or prescribed burning, with periodic short intervals of rest. The potential vegetation is about 75% grasses or grass-like plants, 10% forbs, and 15% woody plants. This state is dominated by cool season mid-stature grasses. The major grasses include Bluebunch wheatgrass, Western wheatgrass, Needleandthread, and Indian ricegrass. Other grasses occurring in this state include Thickspike wheatgrass, Sandberg bluegrass, and Bottlebrush

squirreltail. A variety of forbs and half-shrubs also occur, as shown in the following table. Wyoming Big sagebrush is a conspicuous element of this state, occurring in a mosaic pattern, and makes up 5 to 15% of the annual production. The total annual production (air-dry weight) of this plant community is about 275 lbs/acre, but it can range from about 175 lbs./acre in unfavorable years to about 575 lbs./acre in above average years. Diversity of the plant species found on this site allows for a high drought tolerance, lending this plant community to be well adapted for the limiting climatic conditions of the Big Horn Basin. The sustainability of this community is supported by site/soil stability, watershed function, and biologic integrity. Without any major disturbance this site will remain extremely stable.

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

| Plant Type | Low (Lb/Acre) | Representative Value (Lb/Acre) | High (Lb/Acre) |
|---|---|---|---|
| Grass/Grasslike | 160 | 185 | 375 |
| Shrub/Vine | 5 | 75 | 175 |
| Forb | 10 | 15 | 25 |
| **Total** | **175** | **275** | **575** |

**Table 6. 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 | 8-52% |
| Surface fragments >0.25" and <=3" | 0-3% |
| Surface fragments >3" | 0% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 24-32% |

**Table 7. Canopy structure (% cover)**

| Height Above Ground (Ft) | Tree | Shrub/Vine | Grass/ Grasslike | Forb |
|---|---|---|---|---|
| <0.5 | – | – | – | 1-2% |
| >0.5 <= 1 | – | 2-24% | – | – |
| >1 <= 2 | – | – | – | – |
| >2 <= 4.5 | – | – | – | – |
| >4.5 <= 13 | – | – | – | – |
| >13 <= 40 | – | – | – | – |
| >40 <= 80 | – | – | – | – |
| >80 <= 120 | – | – | – | – |
| >120 | – | – | – | – |

**Figure 10. Plant community growth curve (percent production by month). WY0501, 5-9BH Upland sites. Monthly percentages of total annual growth for all upland sites with dominantly C3 Cool season plants..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 15 | 50 | 20 | 5 | | 10 | | | |

## Community 1.2
## Rhizomatous Wheatgrass / Sagebrush

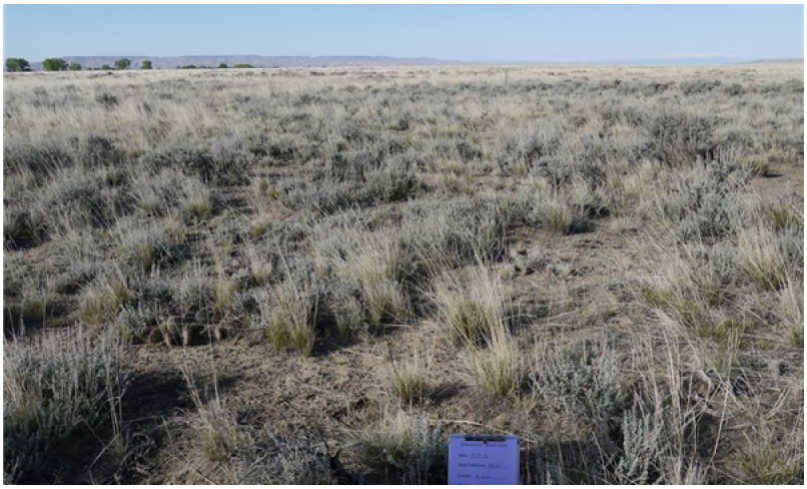


**Figure 11. At Risk Community, 1.2, for Loamy 32XA.**

Rhizomatous Wheatgrass/Needleandthread/Sod formers/Wyoming Big Sagebrush (15-25%) Community is found under moderate, season-long grazing by livestock or under areas affected by extended periods of drought. Historically, this community evolved under a low fire frequency and with grazing pressure. The fire regime for this community, currently, has been modified with extended periods of no fire. This disturbance change has allowed Wyoming big sagebrush to increase on the community, and then become decadent or aged. Although the community is still dominated by cool-season perennial grasses, as the canopy opens as the sagebrush dies back, a stronger presence of short warm-season grasses and miscellaneous forbs begin to hold a higher composition of the understory. Dominant grasses include Needleandthread and Western wheatgrass. Grasses and grass-like species of secondary importance include Blue grama, Sandberg bluegrass and Threadleaf sedge. Forbs commonly found in this plant community include Scarlet globemallow, Biscuitroot (Desert Parley), fleabanes, and phlox. Sagebrush can make up to 25% of the annual production. The overstory of sagebrush and understory of grass and forbs provide a diverse plant community. When compared to the Reference plant community 1.1, Wyoming big sagebrush and Blue grama have increased. Plains prickly pear cactus will also have increased, but occurs only in small patches. Indian ricegrass and Bluebunch wheatgrass have decreased and may occur in only trace amounts under the sagebrush canopy or within the patches of prickly pear. Wyoming big sagebrush is a noticeable part of the overall production and accounts for the majority of the overstory. In some instances, the sagebrush canopy has not increased in the number of plants, but as the understory production is reduced with the shift in species of dominance, the percent composition by production is skewed by the constant of sagebrush giving the appearance that sagebrush has increased when it has remained similar across the community transition. The total annual production (air-dry weight) of this state is about 325 pounds per acre, but it can range from about 200 lbs./acre in unfavorable years to about 500 lbs./acre in above average years. Rangeland Health Implications/Indicators: This plant community is resistant to change, but is the at-risk community for this state. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing, or by drought. The herbaceous component is mostly intact and plant vigor and replacement capabilities are sufficient. Water flow patterns and litter movement may be occurring but only on steeper slopes. Incidence of pedestalling is minimal. Soils are mostly stable and the surface shows minimum soil loss. The watershed is functioning and the biotic community is intact.

**Table 8. Annual production by plant type**

| Plant Type | Low (Lb/Acre) | Representative Value (Lb/Acre) | High (Lb/Acre) |
|---|---|---|---|
| Grass/Grasslike | 150 | 220 | 300 |
| Shrub/Vine | 45 | 75 | 150 |
| Forb | 5 | 30 | 50 |
| **Total** | **200** | **325** | **500** |

**Table 9. 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 | 0-4% |
| Litter | 8-50% |
| Surface fragments >0.25" and <=3" | 0-3% |
| Surface fragments >3" | 0% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 25-36% |

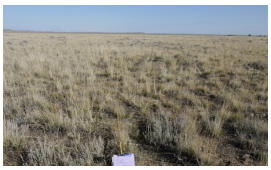
**Table 10. Canopy structure (% cover)**

| Height Above Ground (Ft) | Tree | Shrub/Vine | Grass/ Grasslike | Forb |
|---|---|---|---|---|
| <0.5 | – | – | – | 1-2% |
| >0.5 <= 1 | – | 12-26% | – | – |
| >1 <= 2 | – | – | – | – |
| >2 <= 4.5 | – | – | – | – |
| >4.5 <= 13 | – | – | – | – |
| >13 <= 40 | – | – | – | – |
| >40 <= 80 | – | – | – | – |
| >80 <= 120 | – | – | – | – |
| >120 | – | – | – | – |

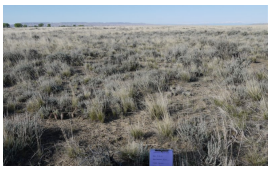
**Figure 13. Plant community growth curve (percent production by month). WY0501, 5-9BH Upland sites. Monthly percentages of total annual growth for all upland sites with dominantly C3 Cool season plants..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 15 | 50 | 20 | 5 | | 10 | | | |

## Pathway 1.1A
## Community 1.1 to 1.2



Bluebunch Wheatgrass / Sagebrush

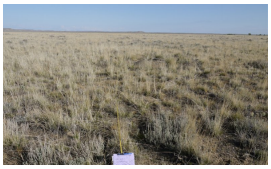


Rhizomatous Wheatgrass / Sagebrush

Drought, Moderate Continuous Season Long Grazing – When this system is exposed to season long grazing with no rest, especially with the drought cycles that have occurred through the last twenty years, the community will transition to fewer bunchgrasses and will see the rhizomatous wheatgrasses and other perennial grasses such as the sod formers (Blue grama and Threadleaf sedge) as well as Sandberg bluegrass increase.

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

Rhizomatous Wheatgrass / Sagebrush



Bluebunch Wheatgrass / Sagebrush

Prescribed Grazing over time will allow this community to shift back to the reference Community. This may be a long term management strategy, with several years required before any trend towards reference is noticed. The overstory of Wyoming big sagebrush may be the one factor that could require further management techniques to manipulate if it has truly increased from 15 to 25% or greater.

**Conservation practices**

| |
|---|
| Integrated Pest Management (IPM) |
| Prescribed Grazing |
| Invasive Plant Species Control |

## State 2
## Sod Bound

The two dominant sod-forming species that currently exist within this LRU are Blue grama and Threadleaf sedge. Both are species that persist as a component of the perennial vegetation naturally (in reference communities 1.1 and 1.2) in the ecological site. The general tendency of these species is to increase under grazing pressure, becoming dominant. The species that gains dominance is unclear. But it appears to be dependent on one or multiple of three specific factors: the specific conditions that forced the transition; underlying soil characteristics for each site; or the species that is more prevalent in the community before grazing disturbance occurs.

### Community 2.1
### Sod / Sagebrush

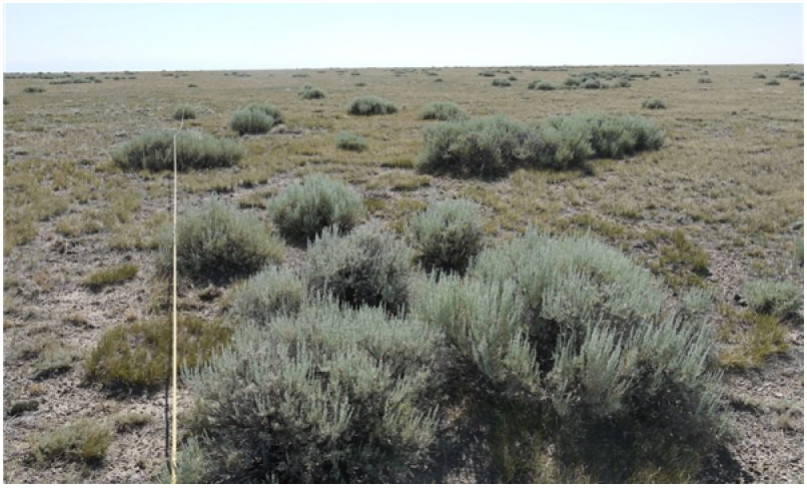


**Figure 14. Sod-Forming dominated Plant community, 2.1**

Blue Grama/Threadleaf Sedge/Wyoming Big Sagebrush plant community is the result of frequent and severe yearlong grazing, which has adversely affected the perennial grasses as well as impacted the shrub component. The nature of the sod decreases infiltration of water with a thick shallow mat of roots, and tends to channelize runoff between established clumps of vegetation. This, with the lack of structure to hold moisture, compounded by drought can reduce the shrubs significantly on this site. A dense sod of Blue grama with patches of Threadleaf sedge is the major grass component of this community with only incidental occurrences of other native species. Prickly pear cactus can provide a niche for other perennial natives to persist in this community. Wyoming big sagebrush has been reduced to small patches or in some cases removed. When compared to the Reference Plant Community 1.2, Blue grama and Threadleaf sedge, have increased. Prickly pear cactus has invaded. All cool-season mid-stature grasses, forbs, and most shrubs have been greatly reduced. Production has been significantly decreased. The total annual production (air-dry weight) of this state is about 100 lbs./acre, but it can range from about 55 lbs./acre in unfavorable years to about 150 lbs./acre in above average years. Rangeland Health Implications/Indicators: This community is at-risk of transition to a completely sod-bound community as explained above, as the sod is extremely resistant to change and continued frequent and severe grazing or the removal of grazing does not seem to affect the plant composition or structure of the sod-formers, but it will eventually remove the shrub component from the plant community. The biotic integrity of this state is not functional and plant diversity is extremely low. The plant vigor is significantly weakened and replacement capabilities are limited due to the reduced number of cool-season grasses. This sod-bound plant community is very resistant to water infiltration. While this sod protects the site itself, off-site areas are affected by excessive runoff that can cause rills and gully erosion. Water flow patterns are obvious in areas of bare ground and pedestalling is apparent along the sod edges. Rill channels are noticeable in the interspaces and down slope. The watershed may or may not be functioning, as runoff may affect adjoining sites.

**Figure 15. Plant community growth curve (percent production by month). WY0504, 5-9 BH Upland Sites Warm Season Dominate. Monthly percentages of total annual growth based on a predominately C4 warm season plant community with shrubs and some C3 plants. Generally sod-forming community..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 15 | 25 | 45 | 10 | 0 | 5 | 0 | 0 | 0 |

## Community 2.2
## Sod / Cactus

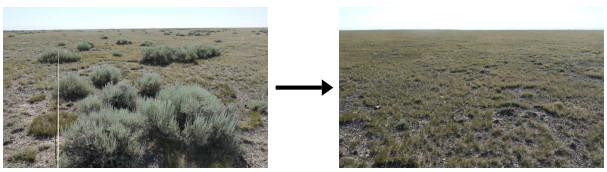
**Figure 16. Loss of Sagebrush with Sod-formers, Community 2.2**

Blue Grama/Threadleaf Sedge Sod/Cactus plant community shift occurs relatively easily after the initial transition into a sod-former state through drought or continued pressure on the remaining shrubs. A dense sod of Blue grama with patches of Threadleaf sedge dominates this state. Prickly pear cactus can become dense enough in patches so that livestock cannot graze forage growing within the cactus clumps. Wyoming big sagebrush has been generally removed from the site with only isolated occurrences. Rubber rabbitbrush is significantly reduced, but is the remaining shrub on the site. When compared to the Reference Community 1.2, Blue grama and Threadleaf sedge, have increased. Prickly pear cactus has invaded. All cool-season mid-stature grasses, forbs, and most shrubs have been greatly reduced or removed. Production has been significantly decreased. The spring of 2014 has proven to provide information that this sight can carry significant production when conditions are optimal. The Big Horn Basin has been in extended drought conditions. Blue grama over the past years has shown the stress of this drought and have weekend and opened up the canopy and have had die back of the root systems. The Cold, snow driven winter followed by a cool spring allowed Sandberg bluegrass to dominate within these opened Blue grama/ Threadleaf sedge sod communities increasing production by 200 to 400 lbs./acre of just Sandberg bluegrass. Other species were more prevalent as well, but the most noted variance was Sandberg bluegrass. This production value was excluded from the production data at this time until further analysis can be completed. The total annual production (air-dry weight) of this state is about 75 pounds per acre, but it can range from about 50 lbs./acre in unfavorable years to about 100 lbs./acre in above average years. Rangeland Health Implications/Indicators: This sod bound community is extremely resistant to change and continued frequent and severe grazing or the removal of grazing does not seem to affect the plant composition or structure of the plant community. The biotic integrity of this state is not functional and plant diversity is extremely low. The plant vigor is significantly weakened and replacement capabilities are limited due to the reduced number of cool-season grasses. This sod bound plant community is very resistant to water infiltration. While this sod protects the site itself, off-site areas are affected by excessive runoff that can cause rills and gully erosion. Water flow patterns are obvious in the bare ground areas and pedestalling is apparent along the sod edges. Rill channels are noticeable in the interspaces and down slope. The watershed may or may not be functioning, as runoff may affect adjoining sites.

**Figure 17. Plant community growth curve (percent production by month). WY0504, 5-9 BH Upland Sites Warm Season Dominate. Monthly percentages of total annual growth based on a predominately C4 warm season plant community with shrubs and some C3 plants. Generally sod-forming community..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 15 | 25 | 45 | 10 | 0 | 5 | 0 | 0 | 0 |

## Pathway 2.1A
## Community 2.1 to 2.2



**Sod / Sagebrush** **Sod / Cactus**

Brush Management, Frequent or Severe Grazing, Drought – The Wyoming big sagebrush component of this community is the at risk species. Sagebrush will decrease under drought, and if grazing pressures persist through the growing season or year-long patterns, becoming decadent and then dying. The sod dominated community reduces the ability for sagebrush to propagate, also leading to a recession of sagebrush. Although rare in occurrence, due to the lack of fine fuels and canopy cover, fire will remove the shrub canopy as well. In some cases on the edge of the precipitation break, Rubber rabbitbrush will dominate a site as sagebrush diminishes. It is also noted that with periods of drought that have occurred in the past ten years, there is a noticeable decrease in the health and vigor of Blue grama and Threadleaf sedge. The dense root structure of the sod-former plants is reduced allowing other species to establish. The spring of 2014 has shown a flush of Sandberg bluegrass occupying Blue grama communities, and in some instances appear to be the dominant production within the community.

## State 3
## Sagebrush and Bare Ground

The low precipitation range and the increased temperatures of the Big Horn Basin, leave many plants stressed without management pressure considered. The average climate shows more below normal years of precipitation than above normal years leaving little margin of error in management. Any state that maintains a sagebrush component within this ecological site is at risk of transitioning to the Sagebrush/Bare ground state. Prolonged drought, timing of grazing and lack of grazing management, as well as lack of fire can exacerbate this transition. In many cases the amount or density of sagebrush will not change in this state, but as the herbaceous species decline, the composition percentage of sagebrush will appear to increase. Given the appropriate conditions, however, sagebrush encroachment can also force herbaceous production to decline.

### Community 3.1
### Wyoming Big Sagebrush / Bareground

**Figure 18. Sagebrush and Bare Ground, Community 3.1**

This plant community is the result of frequent and severe grazing and protection from fire. Sagebrush dominates this plant community, as the annual production of sagebrush exceeds 25%. Wyoming big sagebrush is a significant component of the plant community and the preferred cool season grasses have been eliminated or greatly reduced. The dominant grasses are Sandberg bluegrass and Blue grama. Prickly pear cactus often increases. The interspaces between plants have expanded leaving the amount of bare ground more prevalent. As compared with the Reference Plant community 1.1 or State 1 in general, the annual production is similar, as the shrub production compensates for the decline in the herbaceous production. This community is vulnerable to invasion by noxious weeds such as Cheatgrass, Russian knapweed, leafy spurge, or Canada thistle; if a seed source is available. The total annual production (air-dry weight) of this state is about 300 pounds per acre, but it can range from about 200 lbs./acre in unfavorable years to about 400 lbs./acre in above average years. Rangeland Health Implications/Indicators: This plant community is resistant to change as the stand becomes more decadent, but is at-risk to the establishment of invasive species. These areas may actually be more resistant to fire as less fine fuels are available and the bare ground between the sagebrush plants has increased. Continued frequent and severe grazing or the removal of grazing does not seem to affect the composition or structure of the plant community. Plant diversity is moderate to poor. The plant vigor is diminished and replacement capabilities are limited due to the reduced number of cool-season grasses. Plant litter is noticeably less when compared to the Reference Plant

Community. Soil erosion is accelerated because of increased bare ground. Water flow patterns and pedestalling are obvious. Infiltration is reduced and runoff is increased. Rill channels may be noticeable in the interspaces and gullies may be establishing where rills have concentrated down slope.

**Figure 19. Plant community growth curve (percent production by month). WY0501, 5-9BH Upland sites. Monthly percentages of total annual growth for all upland sites with dominantly C3 Cool season plants..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 15 | 50 | 20 | 5 | | 10 | | | |

## State 4
## Invaded Sagebrush

Invasive plant species are a permanent concern with rangelands and management. Each year new species are discovered and will alter this section as they are. Currently within the Big Horn Basin there are several varieties of thistles, knapweeds, milkweeds, mustards and others that create a management issue for livestock and ecology. In areas where there has been a disturbance, natural or man-made, these species can gain a place in the landscape and are difficult to impossible to eradicate. It becomes a battle to maintain control of these invasive species, with annual and prolonged management, and preventing further shifts or changes to the native composition.

### Community 4.1
### Native Grasses / Invasives / Sagebrush

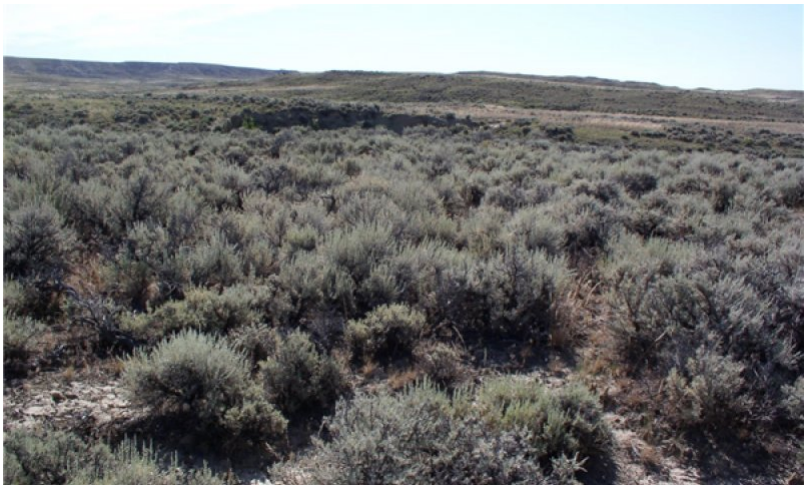


**Figure 20. Loamy 32XA site with invasive species encroachment**

The Perennial (Native) Grasses/Invasive Species/Wyoming big sagebrush phase has maintained a representative sample of the perennial grasses and forbs that are typical of the reference state with the accompanying Wyoming big sagebrush composition. The invasive species are present and hold a significant (10% or greater) composition of the landscape, and are prominent in the community (referring to a more wide scale composition, not one isolated patch in an isolated portion of the landscape). Production of the desired perennial species of this site is generally reduced but the total production is maintained or elevated due to the production potential of many of the annuals or invasive species. Rangeland Health Implications/Indicators: This plant community is resistant to change. These areas may be more prone to fire as fine fuels are more available and the bare ground between the sagebrush plants is decreased. Plant diversity is moderate to poor. The plant vigor is diminished and replacement capabilities are limited due to the reduced number of cool-season grasses. Plant litter is noticeably more when compared to reference communities due to the potential biomass produced by the invasive species (species dependent). Soil erosion is variable depending on the species of invasion and the litter accumulation thus associated, this variability also applies to water flow patterns and pedestalling. Infiltration is reduced and runoff is increased due to loss of perennial vegetation and root density.

**Figure 21. Plant community growth curve (percent production by month). WY0501, 5-9BH Upland sites. Monthly percentages of total annual growth for all upland sites with dominantly C3 Cool season plants..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 15 | 50 | 20 | 5 | | 10 | | | |

## Community 4.2
## Invasives / Sagebrush

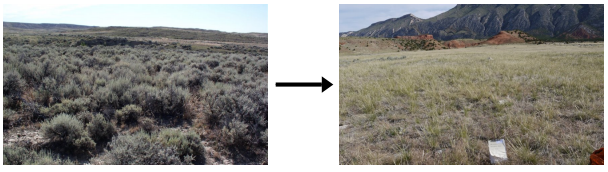
**Figure 22. Sagebrush/Invasive species dominated community**

Invasive Species/Wyoming Big Sagebrush (>15%) Community phase is the at-risk community. As the native populations of perennial grasses and forbs become weakened, the site becomes invader driven, and irreversible. If environmental or management stressors or disturbances occur to remove the shrub component, the site crosses a threshold to State 5, Annual Grasses. Wyoming big sagebrush is able to compete and maintain a strong community under a heavy infestation level unless fire or disturbance of any nature weakens the plant. The canopy of the sagebrush serves as a protected niche in the system that can hold native grass species and help them to persist. But the system is low in resistance and even lower in resilience. Rangeland Health Implications/Indicators: This plant community is resistant to change as the stand becomes more decadent. These areas may be more prone to fire as fine fuels are more available and the bare ground between the sagebrush plants is decreased. Plant diversity is poor. The plant vigor is diminished and replacement capabilities are limited due to the reduced number of cool-season grasses. Plant litter is noticeably more when compared to reference communities due to the potential biomass produced by the invasive species (species dependent). Soil erosion is variable depending on the species of invasion and the litter accumulation thus associated. The variability of the water flow and pedestalling as well as infiltration and runoff is determined again by the species that establishes on this site.

**Figure 23. Plant community growth curve (percent production by month). WY0505, 5-9 BH Upland Sites, Annual Grasses Dominate. Monthly percentages of total annual growth, based on plant communities being affected by annual grasses (cheatgrass) or similar weedy species..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 5 | 25 | 45 | 5 | 0 | 0 | 10 | 5 | 5 | 0 |

## Pathway 4.1A
## Community 4.1 to 4.2



**Native Grasses / Invasives / Sagebrush**

**Invasives / Sagebrush**

Frequent or Severe Grazing, Wildfire, Drought – Drought, wildfire, or other climatic stresses on the system can continue to stress the native species reducing their ability to maintain their footprint in the plant community. This continued stress or the complication with frequent or severe grazing or pressure from wildlife and livestock can

reduce the natives to an unviable or unsustainable population and allow the invasive species to dominate the site. This is more typical in species such as knapweeds, Canada or Bull thistle, and specifically Cheatgrass (Downy brome).

## State 5
## Annuals / Invaders

Currently within the Big Horn Basin, Cheatgrass or Downy brome (*Bromus tectorum*) is the invasive annual grass species that has been a concern for management. Although there are many other species of forbs that are becoming monoculture stands, Cheatgrass is the species that is taking large acres of land quickly in this region. Knapweed, namely spotted, also became dominate in large dense stands and produces an even more challenging set of management issues. As more species are found within the Big Horn Basin or as other species become more prevalent in large scale communities, this section will need to shift to meet the concerns of these species. But with the persistence of Cheatgrass and the lack of a successful control agent at this time, it is not conceivable that Cheatgrass will ever go away or become less of a management challenge. This state is characterized by the lack of all or most of the shrub component of this site. Whether drought or wildfire has removed this component, the competitive nature of annuals, the altered fire regime created by Cheatgrass, and the effect of the loss of the shrub component itself creates an environment that does not support the propagation of new shrubs.

## Community 5.1
## Annual Grasses

**Figure 24. Loamy Site 32XA with Cheatgrass community after fire**

Downy Brome, better known as Cheatgrass or *Bromus tectorum*, is able to green up and grow late into the fall taking advantage of the fall moisture. Seed lays dormant until conditions are positive, and green seedlings can survive under blankets of snow, allowing growth before most native species. The plant's ability to grow quickly utilizes the minimal available resources before the native species can begin to break dormancy for the season. The ability for Cheatgrass to produce a large quantity of seed quickly, and in poor conditions, as well as the morphology of the seed allowing easy dispersal creates a wide spread seed bank that is unmanageable. These traits create a management challenge that has not been successfully met at this time. Once this species has a niche on a landscape it is resistant and resilient to all changes. There may be native species that will persist in small scattered populations and under certain climatic conditions can show their resiliency and respond to the available resources, but generally found unable to out-compete the annual invader. Rangeland Health Implications/Indicators: This plant community is resistant to change. These areas are extremely prone to fire fueled by the high fine fuels load associated with the Cheatgrass litter. Plant diversity is poor. The plant vigor is diminished and replacement capabilities are non-existent due to the loss of cool-season grasses. Plant litter is noticeably more when compared to reference communities in response to the dense duff layer created by Cheatgrass. Soil erosion is generally reduced in response to the litter accumulation; however, the annual nature of this plant accentuates the water flow patterns and pedestalling. Infiltration is reduced and runoff is increased with the loss of perennial vegetation and root depth and density.

**Figure 25. Plant community growth curve (percent production by month). WY0505, 5-9 BH Upland Sites, Annual Grasses Dominate. Monthly percentages of total annual growth, based on plant communities being**

**affected by annual grasses (cheatgrass) or similar weedy species..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 5 | 25 | 45 | 5 | 0 | 0 | 10 | 5 | 5 | 0 |

## State 6
## Disturbed

The Degraded state could be drafted as a stand-alone box within the state and transition model diagram. No matter what state a location originally ranks in, once the land is mechanically disturbed, or suffers a catastrophic or significant natural disaster that alters the soil properties (erosional, depositional, hydrological or chemical), the site potential is altered. To consider this as an alternate ecological site would not be unreasonable. In some cases (site by site consideration), a re-correlation of a location may be the best solution. But in many cases, the site has not been altered out of the current ecological site, but the potential has shifted enough that it is no longer truly comparable to the reference, state 1. So a dynamic state was captured to detail the altered communities that exist on the landscape.

## Community 6.1
## Disturbed / Degraded Lands

**Figure 26. Abandoned field in transition on a Loamy 32XA site**

Through the process of homesteading and settling this landscape, many areas of land were tilled, irrigated and farmed, and then subsequently abandoned. Other areas were leveled, or were used as a source of material for construction, leaving scars on the landscape. Seeding and reclamation were not in the mindset or capabilities of many people who initially settled the Basin. These locations as well as current day development sites, mining sites and general disturbed lands through recreation and human activity have an ecology all of their own. The persisting seedbank, the surrounding seed sources and wildlife influences are what determine the response of many of these locations. The plant community that establishes on these sites never completely resembles the natural community, and many times the harsh straight edges can be seen on aerial photography as a stark contrast. Some common day locations are still in a primary successional state with annual or weedy species established and with slow movement of perennial species into these locations. Unfortunately many of these locations are taken over by annual invaders such as Cheatgrass, or by less invasive annuals such as Six-weeks fescue, False annual wheatgrass or False buffalograss. Halogeton, Kochia, Russian thistle, pigweeds, Lambsquarter, and many other weedy species persist on sites even after natives have established. These species, although weedy, do serve as a food source and can provide a hydrologic benefit to a location. The overall concern with these locations is that recovery and establishment are slow. Once established, as in the case of the abandoned homesteads, they do not respond to management the same as a native location. And no two locations will necessarily respond the same way. These communities require a site-by-site evaluation and plan for specific management. The growth curve of this plant community will vary depending on the species that are selected as the reclamation seed mix. For a more accurate portrait of the growth curve for the seeded community, the species used and the climatic tendencies of the region must be considered. Rangeland Health Implications/Indicators: 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 is generally strong, but is usually lacking in the structural groups

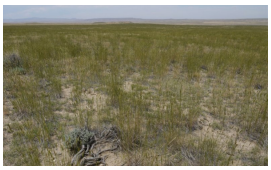
that are desired on the site. Soil erosion is variable depending on the disturbance regime that is occurring on the site and again on the specific community that has established on a specific location. The variability of the water flow and pedestalling as well as infiltration and runoff is determined again by the species that establishes on this site.

### Community 6.2
### Reclaimed / Restored Lands

**Figure 27. Reclamation with non-native species, low establishment**

Reclamation practices have shifted greatly over the last several decades. Crested wheatgrass was a species used frequently for reclamation throughout Wyoming and many of these communities persist today. Although there are areas where native species from neighboring sites are starting to slowly extend into the crested wheatgrass stands, many times, these stands remain as a monoculture until a disturbance occurs to open the canopy slightly to provide a more tolerable niche. Russian wildrye and varieties of rhizomatous and bunch-wheatgrasses have also been used in mixes to help improve rate of seedling establishment and duration of seedings, reducing the monoculture stands. Although the success of vegetative seedings are low in this LRU, due to the low precipitation and timing of precipitation events, there are limited areas along pipeline corridors, well sites or pad sites, and along transportation corridors where re-seeded sites have succeeded. Several 100+ acre plots of Crested wheatgrass and Russian wildrye have been located that were planted in the mid 1960's, that persist today within Eastern Park county. As mentioned in the community phase above, as these seedings mature and the stands open, they can be characteristically similar to other disturbed sites. Where under the more current, and understood definition of reclaimed or restored, disturbed lands are to be reclaimed, or planted to as close to a natural occurring 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. Again, these seedings 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 can be very similar. There are expanses of rangelands that were treated with a chisel or ripper leaving furrows at varying widths (appears to be 6 foot spacings) across the landscape. These sites appear to have become Blue grama/Threadleaf sedge sods with varying levels of prickly pear cactus and little other vegetation. These sites today have not been altered greatly, but do show an increased abundance of Sandberg bluegrass, Prairie junegrass, and a few other native perennial species that were able to establish in the furrows or within the ripper track, but the rest of the community is unaltered. These treatments were completed in the mid 1960's, and are still visible on the landscape today. The growth curve of this plant community will vary depending on the species that are selected as the reclamation seed mix. For a more accurate portrait of the growth curve for the seeded community, the species used and the climatic tendencies of the region must be considered. Rangeland Health Implications/Indicators: Seeding mixtures will determine the plant community resistant to change and resilience to threat of invasive species and to erosion. Many of the stands established during seeding are diversity poor, but are better than the monocultures that were planned historically. Many seeded sites may be prone to fire because of the increased production as they mature (more biomass and possibly more litter) providing more fine fuels to carry a fire. Soil erosion is variable depending on the establishment of the seeding, how it is seeded, and mechanical procedures put in place. The variability of the water flow and pedestalling as well as infiltration and runoff is determined again by the species that establishes on this site.

### Pathway 6.1A
### Community 6.1 to 6.2

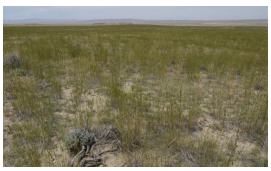
Disturbed / Degraded Lands Reclaimed / Restored Lands

Seeding, Brush Management, Integrated Pest Management, Prescribed grazing management – With the proper mechanical improvements and the follow-up through establishment and then maintenance, a disturbed site can be improved and managed. However, climatic limitations and soil chemistry limit the success of seeding treatments. Depending on the location, invasive species are a risk to most lands within the Basin and create a low success potential for this process.

**Conservation practices**

| |
|---|
| Brush Management |
| Prescribed Burning |
| Critical Area Planting |
| Grazing Land Mechanical Treatment |
| Range Planting |
| Heavy Use Area Protection |
| Integrated Pest Management (IPM) |
| Upland Wildlife Habitat Management |
| Native Plant Community Restoration and Management |
| Prescribed Grazing |
| Invasive Plant Species Control |

### Pathway 6.2A
### Community 6.2 to 6.1




Reclaimed / Restored Lands Disturbed / Degraded Lands

No use, No Fire, Long Term Prescribed Grazing, Frequent or Severe Grazing. In general, if a site is not maintained with the conditions of which the species are adapted under, a decline in vigor will occur and then a shift in composition will occur. Since the site is altered from reference state in soils due to plowing, mining, or other similar disturbances, the plant community will not follow the same expected shifts of a native community and this will refer back to a community more reflective of a disturbed plant composition.

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

Frequent Grazing (Yearlong), Brush Management or Fire with Drought – With time, or acerbated with drought, severe and frequent grazing of this plant community will reduce the bunchgrasses and wheatgrasses, and will allow the short statured warm-season grasses to become dominant. In some cases, Threadleaf sedge will become dominant, or will be equally competitive with Blue grama, in the community. When the Sagebrush component of this community has been affected, by drought or heavy use, or has been removed altogether, this transition has a high probability of occurrence on the landscape. Time and timing of grazing may also have an effect on this transition or may help reduce the risk of this transition.

### Transition T1B

### State 1 to 3

Frequent and severe Grazing, No Fire, Drought - will convert the plant community to the Wyoming Big Sagebrush/*Bare Ground* Plant Community. The probability of this occurring is high. This is especially evident on areas with historically higher precipitation and the sagebrush stand is not adversely impacted by drought or heavy browsing. Drought or shifts in spring precipitation can create this community on locations with a high dominance of Needleandthread. In a normal precipitation pattern, Needleandthread is constant and productive on a reference site. When the spring is cooler or drier than needed for Needleandthread to thrive, the site will have significant reduction in production and show more bare ground or a more open canopy.

### Transition T1C
### State 1 to 4

Frequent and severe Grazing, Fire, or Drought - The influence of fire in these communities opens the canopy for invaders such as Cheatgrass (Downy brome), thistles, knapweeds, and other invasive species to become established. Drought alone, or if acerbated by fire, will also create the perfect conditions for invasion of the plant community. It has been documented across the Big Horn Basin with trend photos, that as the drought persists, Cheatgrass has increased exponentially each year, starting along roadways or disturbed areas and then radiating out from there.

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

Mechanical treatments Range seeding - Grazing land mechanical treatment (chiseling, etc.) and prickly pear cactus control (if needed), followed by prescribed grazing, and possibly seeding of natives was suggested as a possibility to transition this community back to near reference. There are a number of areas within the Basin that were treated with a mechanical measure, some areas were seeded and others were furrowed and left. Success appears to be minimal over all, showing no signs of a location returning to reference community. However, it did show an increase within the chisel rows as well as established fields of Crested Wheatgrass and Russian wild rye. No documentation of trials or success has been located.

**Conservation practices**

| |
|---|
| Brush Management |
| Grazing Land Mechanical Treatment |
| Range Planting |
| Integrated Pest Management (IPM) |
| Native Plant Community Restoration and Management |
| Prescribed Grazing |
| Invasive Plant Species Control |

### Transition T2A
### State 2 to 3

Brush Management, Frequent or Severe Grazing, Drought – The Wyoming big sagebrush component of this community is the at risk species. Sagebrush will decrease under drought, and if grazing pressures persist through the growing season or year-long patterns, becoming decadent and then dying. The sod dominated community reduces the ability for sagebrush to propagate, also leading to a recession of sagebrush. Although rare in occurrence, due to the lack of fine fuels and canopy cover, fire will remove the shrub canopy as well. In some cases on the edge of the precipitation break, Rubber rabbitbrush will dominate a site as sagebrush diminishes. It is also noted that with periods of drought that have occurred in the past ten years, there is a noticeable decrease in the health and vigor of Blue grama and Threadleaf sedge. The dense root structure of the sod-former plants is reduced allowing other species to establish. The spring of 2014 has shown a flush of Sandberg bluegrass occupying Blue grama communities, and in some instances appear to be the dominant production within the community.

### Transition T2B
### State 2 to 4

Fire (wild or prescribed), Brush Management, Drought, Frequent or severe Grazing – When a disturbance decreases and then removes the sagebrush canopy of this site, the perennial grasses and forbs that are established are not able to protect or stabilize the site and it is extremely vulnerable to Cheatgrass invasion, especially following fire and drought, if a seed source is present. As the cheatgrass is left untreated it will eventually push the native species out of the community so that small remnants of sagebrush and a nearly monoculture stand of cheatgrass presists.

### Restoration pathway R3A
### State 3 to 2

Brush management, followed by prescribed grazing, will aid in brining this site back to a herbaceous dominated site. Many times Blue grama or threadleaf sedge, if present, will respond when other forbs will not. If prescribed fire is used as a means to reduce or remove the shrubs, sufficient fine fuels will need to be present. This may require deferment from grazing prior to treatment. Post-management is critical to ensure success. This can range from two or more years of rest to partial growing season deferment, depending on the condition of the understory at the time of treatment and the growing conditions following treatment. In the case of an intense wildfire that occurs when desirable plants are not completely dormant, the length of time for recovery may be increased and seeding of natives is recommended.

**Conservation practices**

| |
|---|
| Brush Management |
| Prescribed Burning |
| Range Planting |
| Integrated Pest Management (IPM) |
| Native Plant Community Restoration and Management |
| Prescribed Grazing |
| Invasive Plant Species Control |

### Transition T3A
### State 3 to 4

Frequent or Severe Grazing, Brush Management, Wildfire, Drought, or No Use – Disturbance from grazing or brush management, or fire can open the canopy and provide a seed source for invasive species to establish, such as knapweed, Cheatgrass, and others. No use can also lead to decadence and then reduction in Wyoming big sagebrush that can lead to a risk from invaders. The amount of bare ground and the lack of perennial grasses lends to a vulnerable plant community.

### Transition T3B
### State 3 to 5

Fire (wild or prescribed), Brush Management, Drought, Frequent or severe Grazing – When a disturbance decreases and then removes the sagebrush canopy of this site, the perennial grasses and forbs that are established are not able to protect or stabilize the site and it is extremely vulnerable to Cheatgrass invasion, especially following fire and drought, if a seed source is present. With the increased fire frequency as Cheatgrass establishes in a community, it leads to the removal of sagebrush and other shrubs; allowing for a monoculture stand of Cheatgrass.

### Transition T4A
### State 4 to 5

Fire (wild), Frequent or severe grazing, Drought – The threshold species in this system is the Wyoming big

sagebrush, which is providing a niche for the perennial natives to persist in the landscape. Once the sagebrush is affected by the altered (shortened) fire frequency of this state due to the invasive species (primarily Cheatgrass), or with the persistence of drought and frequent or severe grazing, then this niche begins to fade or can be taken rather suddenly in the case of a fire. Once the sagebrush has died back or has been removed by fire it is very difficult to return and may require several years (25 years or greater) to return or may not without outside assistance.

### Restoration pathway R5A
### State 5 to 6

Integrated Pest Management, with Seeding the site to a native mixture - Success is not known to have occurred, and is rated to be low and highly variable for the rate of control of most species. Cheatgrass and knapweeds are two of the most invasive species for many locations, but there are many other species; for example, Whitetop (Hoarycress), that can dominate a community. It is a consensus that the site can be reclaimed to nearly an at-risk community within the reference state, but that it is not possible to reach the reference community condition once annuals have established on a site.

**Conservation practices**

| |
|---|
| Critical Area Planting |
| Range Planting |
| Heavy Use Area Protection |
| Integrated Pest Management (IPM) |
| Native Plant Community Restoration and Management |
| Prescribed Grazing |
| Invasive Plant Species Control |

### Transition T6A
### State 6 to 5

No Use, Fire (wild or prescribed), Frequent or severe Grazing, Drought – Reclamation lands that are not managed properly when the establishment is still young or under drought conditions or in the case of a burn or wildfire, may not have the seed bank or a seed source to re-vegetate and may transition back to a disturbed site. Much like native sites, extended periods of no use, as seen in exclosures in the region, the plant community will slowly mature out and loose productivity, creating an open canopy where invasive species can begin to establish in the community. In some instance these sites become soft, inviting small rodent populations to establish and thus creating a disturbance issue. The successional pathways between a disturbed land and a reclaimed land are limited by time and climate greater than a native community.

## Additional community tables

**Table 11. Community 1.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Lb/Acre) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | | | | 45–155 | |
| | bluebunch wheatgrass | PSSP6 | *Pseudoroegneria spicata* | 45–155 | 10–30 |
| | needle and thread | HECO26 | *Hesperostipa comata* | 45–130 | 10–25 |
| 2 | **Rhizomatous Wheatgrasses** | | | 45–130 | |
| | thickspike wheatgrass | ELLAL | *Elymus lanceolatus ssp. lanceolatus* | 45–130 | 10–25 |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 45–130 | 10–25 |
| 3 | | | | 45–100 | |
| | Indian ricegrass | ACHY | *Achnatherum hymenoides* | 45–100 | 10–20 |
| 4 | **Miscellaneous Grasses or Grasslikes** | | | 10–50 | |

| | | | | | |
|---|---|---|---|---|---|
| 4 | **Miscellaneous Grasses - Primary** | | | 10–50 | |
| | squirreltail | ELEL5 | *Elymus elymoides* | 5–25 | 1–5 |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 5–25 | 1–5 |
| | Sandberg bluegrass | POSE | *Poa secunda* | 5–25 | 1–5 |
| 5 | **Miscellaneous Grasses - Secondary** | | | 5–15 | |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 1–20 | 0–5 |
| | threadleaf sedge | CAFI | *Carex filifolia* | 0–20 | 1–5 |
| 6 | **Other Native Perennial Grasses** | | | 0–20 | |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–20 | 0–5 |
| **Forb** | | | | | |
| 7 | **Perennial Forbs Primary** | | | 5–50 | |
| | milkvetch | ASTRA | *Astragalus* | 1–20 | 1–5 |
| | fleabane | ERIGE2 | *Erigeron* | 1–20 | 1–5 |
| | desertparsley | LOMAT | *Lomatium* | 1–20 | 1–5 |
| | spiny phlox | PHHO | *Phlox hoodii* | 1–20 | 1–5 |
| | scarlet globemallow | SPCO | *Sphaeralcea coccinea* | 1–20 | 1–5 |
| | textile onion | ALTE | *Allium textile* | 1–20 | 1–5 |
| | aster | ASTER | *Aster* | 1–20 | 1–5 |
| 8 | **Perennial Forbs - Secondary** | | | 5–15 | |
| | little larkspur | DEBI | *Delphinium bicolor* | 0–20 | 0–5 |
| | plains pricklypear | OPPO | *Opuntia polyacantha* | 0–20 | 0–5 |
| 9 | **Other Perennial Forbs** | | | 0–20 | |
| | Forb, perennial | 2FP | *Forb, perennial* | 0–20 | 0–5 |
| 10 | **Annual Forbs** | | | 0–5 | |
| | flatspine stickseed | LAOC3 | *Lappula occidentalis* | 0–5 | 0–1 |
| | woolly plantain | PLPA2 | *Plantago patagonica* | 0–5 | 0–1 |
| **Shrub/Vine** | | | | | |
| 11 | | | | 10–75 | |
| | Wyoming big sagebrush | ARTRW8 | *Artemisia tridentata ssp. wyomingensis* | 10–75 | 5–15 |
| 12 | **Secondary Shrubs** | | | 0–25 | |
| | rubber rabbitbrush | ERNA10 | *Ericameria nauseosa* | 0–25 | 0–5 |
| | winterfat | KRLA2 | *Krascheninnikovia lanata* | 0–25 | 0–5 |
| 13 | **Mischellaneous Shrubs** | | | 0–25 | |
| | Shrub, other | 2S | *Shrub, other* | 0–25 | 0–5 |
| | yellow rabbitbrush | CHVI8 | *Chrysothamnus viscidiflorus* | 0–25 | 0–5 |
| | Gardner's saltbush | ATGA | *Atriplex gardneri* | 0–5 | 0–1 |

**Table 12. Community 1.2 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Lb/Acre) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | | | | 20–200 | |
| | bluebunch wheatgrass | PSSP6 | *Pseudoroegneria spicata* | 20–145 | 10–30 |
| | needle and thread | HECO26 | *Hesperostipa comata* | 20–95 | 10–20 |

| | | | | | |
|---|---|---|---|---|---|
| 2 | **Rhizomatous Wheatgrasses** | | | 20–95 | |
| | thickspike wheatgrass | ELLAL | *Elymus lanceolatus ssp. lanceolatus* | 20–95 | 10–20 |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 20–95 | 10–20 |
| 3 | | | | 10–50 | |
| | Indian ricegrass | ACHY | *Achnatherum hymenoides* | 10–50 | 5–10 |
| 4 | **Miscellaneous Grasses - Primary** | | | 10–75 | |
| | squirreltail | ELEL5 | *Elymus elymoides* | 5–25 | 1–5 |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 5–25 | 1–5 |
| | Sandberg bluegrass | POSE | *Poa secunda* | 5–25 | 1–5 |
| 5 | **Miscellaneous Grasses - Secondary** | | | 10–25 | |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 5–50 | 1–10 |
| | threadleaf sedge | CAFI | *Carex filifolia* | 5–50 | 1–10 |
| 6 | **Other Native Perennial Grasses** | | | 0–25 | |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–25 | 0–5 |
| **Forb** | | | | | |
| 7 | **Perennial Forbs - Primary** | | | 5–50 | |
| | textile onion | ALTE | *Allium textile* | 1–25 | 1–5 |
| | aster | ASTER | *Aster* | 1–25 | 1–5 |
| | milkvetch | ASTRA | *Astragalus* | 1–25 | 1–5 |
| | fleabane | ERIGE2 | *Erigeron* | 1–25 | 1–5 |
| | desertparsley | LOMAT | *Lomatium* | 1–25 | 1–5 |
| | spiny phlox | PHHO | *Phlox hoodii* | 1–25 | 1–5 |
| | scarlet globemallow | SPCO | *Sphaeralcea coccinea* | 1–25 | 1–5 |
| 8 | **Perennial Forbs - Secondary** | | | 5–15 | |
| | little larkspur | DEBI | *Delphinium bicolor* | 0–25 | 0–5 |
| | plains pricklypear | OPPO | *Opuntia polyacantha* | 0–25 | 0–5 |
| 9 | **Other Perennial Forbs** | | | 0–25 | |
| | Forb, perennial | 2FP | *Forb, perennial* | 0–25 | 0–5 |
| 10 | **Annual Forbs** | | | 0–5 | |
| | flatspine stickseed | LAOC3 | *Lappula occidentalis* | 0–5 | 0–1 |
| | woolly plantain | PLPA2 | *Plantago patagonica* | 0–5 | 0–1 |
| **Shrub/Vine** | | | | | |
| 11 | **Primary Shrub** | | | 10–120 | |
| | Wyoming big sagebrush | ARTRW8 | *Artemisia tridentata ssp. wyomingensis* | 10–120 | 5–25 |
| 13 | **Secondary Shrubs** | | | 0–25 | |
| | rubber rabbitbrush | ERNA10 | *Ericameria nauseosa* | 0–25 | 0–5 |
| | winterfat | KRLA2 | *Krascheninnikovia lanata* | 0–25 | 0–5 |
| 14 | **Miscellaneous Shrubs** | | | 0–25 | |
| | Shrub, other | 2S | *Shrub, other* | 0–25 | 0–5 |
| | yellow rabbitbrush | CHVI8 | *Chrysothamnus viscidiflorus* | 0–25 | 0–5 |
| | Gardner's saltbush | ATGA | *Atriplex gardneri* | 0–5 | 0–1 |

## Animal community

Animal Community – Wildlife Interpretations:

1.1 - Bluebunch Wheatgrass/Rhizomatous Wheatgrasses/Needleandthread/Wyoming Big Sagebrush (Reference Community): The predominance of grasses in this plant community favors grazers and mixed-feeders, such as bison, elk, and antelope. Suitable thermal and escape cover for deer may be limited due to the low quantities of woody plants. However, topographical variations could provide some escape cover. When found adjacent to sagebrush dominated states, this plant community may provide brood rearing/foraging areas for sage grouse, as well as lek sites. Other birds that would frequent this plant community include western meadowlarks, horned larks, and golden eagles. Many grassland obligate small mammals would occur here.

1.2 - Rhizomatous Wheatgrasses/Needleandthread/Sod formers/Wyoming Big Sagebrush Plant Community: The combination of an overstory of sagebrush and an understory of grasses and forbs provide a very diverse plant community for wildlife. The crowns of sagebrush tend to break up hard crusted snow on winter ranges, so mule deer and antelope may use this state for foraging and cover year-round, as would cottontail and jack rabbits. It provides important winter, nesting, brood-rearing, and foraging habitat for sage grouse. Brewer's sparrows' nest in big sagebrush plants and hosts of other nesting birds utilize stands in the 20-30% cover range.

2.1 - Blue Grama/Threadleaf Sedge/Wyoming Big Sagebrush Plant Community: This community provides limited foraging for antelope and other grazers. They may be used as a foraging site by sage grouse where reference state community phases are limited. Generally, these are not target plant communities for wildlife habitat management.

2.2 - Blue Grama/Threadleaf Sedge Sod/Cactus Plant Community: This community provides limited foraging for antelope and other grazers. They may be used as a foraging site by sage grouse if proximal to woody cover and if the Reference Plant Community or the Rhizomatous wheatgrasses/Perennial Grasses/Sod-formers/Wyoming Big Sagebrush Plant Community are limited. Generally, these are not target plant communities for wildlife habitat management.

3.1 - Wyoming Big Sagebrush/*Bare Ground* Plant Community: This plant community can provide important winter foraging for elk, mule deer and antelope, as sagebrush can approach 15% protein and 40-60% digestibility during that time. This community provides excellent escape and thermal cover for large ungulates, as well as nesting habitat for sage grouse.

4.1 - Perennial Grasses/Invasive Species/Wyoming Big Sagebrush Plant Community: The retained combination of sagebrush and the added diversity with the invasive grasses and/or forbs provide an extended plant community for wildlife. The similarities to Community Phase 1.2 (Rhizomatous Wheatgrasses/Perennial Grasses/Sod formers/Wyoming Big Sagebrush) are to some extent 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 decreased as well.

4.2 - Invasive Species/Wyoming Big Sagebrush Plant Community: Limited nesting and cover is provided by the persistent overstory cover of the Wyoming big sagebrush.

5.1 - Annual Grasses Plant Community: Early spring and fall green up of Cheatgrass provides foraging opportunities for many of our grazers and mixed feeders.

6.1 - Disturbed Lands Plant Community and 6.2 - Restored/Reclaimed Lands Plant Community: The variability of this site prevents a detailed review of wildlife benefits. However, many of the introduced grasses, forbs and shrubs can provide adequate cover, 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 under 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 for a normal year X .25 efficiency factor / 912.5 #/AUM to calculate the AUM's/Acre.

Plant Community Description/Title: Lbs./Acre AUM/Acre
1.1 Bluebunch Wheatgrass/ Rhizomatous Wheatgrasses/ Needleandthread/ Wyoming Big Sagebrush 175-575 0.07
1.2 Rhizomatous Wheatgrasses/ Needleandthread/ Sod formers/ Wyoming Big Sagebrush 200-500 0.09
2.1 Blue Grama/Threadleaf Sedge/Wyoming Big Sagebrush 55-150 0.03
2.2 Blue Grama/Threadleaf Sedge Sod/Cactus 50-100 0.02
3.1 Wyoming Big Sagebrush/*Bare Ground* 200-400 0.08
4.1 Perennial Grasses/Invasive Species/Wyoming Big Sagebrush ** **
4.2 Invasive Species/Wyoming Big Sagebrush ** **
5.1 Annual Grasses ** **
6.1 Disturbed Lands ** **
6.2 Restored/Reclaimed Lands ** **
* - Carry 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 and C, with localized areas in hydrologic group D. Infiltration ranges from moderately slow 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. An example of an exception would be where short-grasses form a strong sod and dominate the site. 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. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non-existent. Cryptogamic crusts are present, but only cover 1-2% of the soil surface.

## Recreational uses

This site provides hunting opportunities for upland game species. The wide varieties of plants which bloom from spring until fall 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. The extent of this ecological site is found within three different wild horse use areas; Pryor Mountain, McCullough Peaks, and 15 Mile. Wild

horse/Wildlife Excursions are found as recreational venues for BLM lands and State lands within the Big Horn Basin. 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

No appreciable wood products are present on the site.

## Other products

Herbs: The forb species of the Loamy Ecological site have medicinal characteristics and have been used by the Native Americans in this area and more recently by the naturopathic profession.

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

## Inventory data references

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 Loamy range site include: Chris Krassin, Range Management Specialist, NRCS and Everet Bainter, Range Management Specialist. Those involved in the development of the Loamy Mesic 5-9” Precipitation Big Horn Basin Ecological site include: Ray Gullion, Area Range Management Specialist, NRCS; Jim Wolf, Resource Manager, USDI-BLM; Jack Mononi, Range Management Specialist, USDI-BLM; Daniel Wood, MLRA Soil Survey Leader, NRCS; Jane Karinen, Soil Data Quality Specialist, NRCS; and Marji Patz, Ecological Site Specialist, NRCS.
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 (9.6 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 (overstory 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.),
• Sample Point (10 – 1 meter square point photographs taken at set distances on transect. Read using the sample point computer program established by the High Plains Agricultural Research Center, Cheyenne, WY).
• Soil Stability (Slake Test – surface and subsurface samples collected and processed according to the soil stability guidelines provided by the Joranada Research Center, NM.)

## Type locality

| Location 1: Big Horn County, WY | |
|---|---|
| Township/Range/Section | T52N R97W S13 |
| UTM zone | N |
| UTM northing | 4927986 |
| UTM easting | 701641 |
| Latitude | 44° 28′ 37″ |
| Longitude | 108° 27′ 52″ |
| General legal description | Site is 512 meters north, 681 meters east of Southwest Corner sec.13 T52N, R97W. Site is located 3.85 miles west of Emblem on Highway 14/20 (Greybull Highway), then turn south on BLM Access Road and go 0.5 miles. Site is on west side of road. |

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## Contributors

Marji Patz

## Approval

Kirt Walstad, 3/12/2025

## 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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| Approved by | Kirt Walstad |
| Approval date | |
| Composition (Indicators 10 and 12) based on | Annual Production |

## Indicators

1. **Number and extent of rills:** Rills should not be present, but may be occurring on slopes up to 20%. Where occurring, short and widely spaced.

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2. **Presence of water flow patterns:** Barely observable but may be occurring on steeper slopes.

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3. **Number and height of erosional pedestals or terracettes:** Essentially non-existent.

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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 15 - 35%, as small areas dispersed across the site.

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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):** Little to no plant litter movement. Plant litter remains in place and is not moved by erosional forces.

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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 1 (interspaces) to 6 (under plant canopy), but the average values should be 3.33 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 1-12 inches (3-30 cm's) in depth with Organic Matter (OM) of 1 to 2%.

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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 60-75% grasses, 10% forbs and 15-30%

shrubs. Evenly distributed plant canopy (35-75%) and litter plus moderate to moderately rapid infiltration rates result in minimal runoff. Basal cover is typically less than 5% for this site and does very little to 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: Mid-size cool season bunchgrasses

    Sub-dominant: perennial shrubs=cool season rhizomatous grasses

    Other: perennial forbs > short cool season bunchgrass = short warm season bunchgrasses

    Additional:

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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 shrub component of canopy cover.

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14. **Average percent litter cover (%) and depth ( in):** Litter ranges from 5-30% of total canopy measurement with total litter (including beneath the plant canopy) from 25-50% expected. Herbaceous litter depth typically ranges from 3-10 mm. Woody litter can be up to a couple inches (4-6 cm's).

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** English: 190 - 515 lbs/ac (320 lbs/ac average); Metric: 213 - 577 kg/ha (358.7 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 50% is an indicator that a threshold is being crossed. Corresponding increase will be noted in one or more of the following species is common: Blue grama, Sandberg bluegrass, Fendler threeawn, Fringed sagewort, Broom snakeweed, Prickly pear cactus, and Wyoming big sagebrush. Annual weeds such as kochia, mustards, Lambsquarter, Russian thistle, and pepperweeds are common invasive species in disturbed sites. Common noxious weeds that invade are: Cheatgrass (Downy brome), knapweeds, thistles (Bull, Canada), Houndstongue, Black henbane and Whitetop.

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

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