USDA Natural Resources Conservation Service

# Ecological site DX032X02A144
# Saline Upland (SU) Wind River Basin Core

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Accessed: 05/18/2024

## 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.

## MLRA notes

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

032 – Northern Intermountain Desertic Basins – This MLRA is comprised of two major Basins, the Big Horn and Wind River. These two basins are distinctly different and are split by LRU's to allow individual ESD descriptions. These warm basins are surrounded by uplifts and rimmed by mountains, creating a unique set of plant responses and communities. Unique characteristics of the geology and geomorphology further individualize these two basins.

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):

32X02A (WY): This LRU is the Wind River Basin within MLRA 32X. This LRU is tends to be just a fraction higher in elevation, slightly cooler (by 1 degree celsius), and spring snowpack tends to persist longer into the spring than the Big Horn Basin (LRU 01). This LRU was originally divided into two LRU's - LRU C which was the core and LRU D 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 subset shifts towards the outer edges, aspect and relation to the mountains 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 subset boundaries. While some of the map units are approved (not correlated), all other map units are correlated. Some as small inclusions within other MLRA's/LRU's based on location and surveys. Questionable correlations will be reviewed and corrected as update projects.

Moisture Regime: Typic Aridic
Temperature Regime: Mesic
Dominant Cover: Rangeland, Saltbush flats.
Representative Value (RV) Effective Precipitation: 5-9 inches (127 – 229 mm)
RV Frost-Free Days: 105-130 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 Saltbush Scrub Macrogroup
G301 Atriplex corrugate – Artemisia pedatifida – Picrothamnus desertorum Dwarf-Scrub Group
CEGL001439 Atriplex gardneri – Bud Sagebrush Dwarf-shrubland
CEGL001445 Atriplex gardneri / Pascopyrum smithii Dwarf-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.a Semi-arid Rolling Sagebrush Steppe (and)
10.1.18.g Big Horn Salt Desert Shrub Basin

## Ecological site concept

• Site receives no additional water.
• Slope is <30%

• Soils are:
- saline, sodic, or saline-sodic, gypsic
- Shallow, moderately deep, deep, or very deep (depth to restrictive layer is greater than 10” (25 cm).
- With < 3% stone and boulder cover and < 20% cobble and gravel cover
- Not skeletal (<35% rock fragments) within 20” (51 cm) of mineral soil surface
- Textures usually range from very fine sandy loam to clay loam
- Clay content is < 40% in mineral soil surface 4”.
- With an average particle size class < 60% clay

The site concept is based on soils that are well drained, alluvium or residuum of a composite of alkaline or sodic sedimentary sources. Originally, Saline Upland spanned the full spectrum of textural classes (sandy through clayey), grouping them based on the chemical similarities. Closer review in the Bighorn Basin showed a shift in plant communities as this ecological site transitioned across the soil textural gradient. The Saline Upland ecological site for the Wind River Basin will be reviewed to determine if it should be divided into: Saline Upland, Loamy; Saline Upland, Sandy; and Saline Upland, Clayey as the Bighorn Basin was divided. There is a further need to evaluate the differences in saline/sodic soils that are influenced strongly by gypsum or calcium carbonate accumulations, lab samples will be need to be collected and processed to document if it is warranted. Until such time, these communities will be documented within the original scope of the Saline Upland site.

## Associated sites

| | |
|---|---|
| R032XY118WY | **Impervious Clay (IC) 5-9” Big Horn Basin Precipitation Zone**<br>Impervious Clay sites typically are found at the base of shale outcrops and as they transition down slope gain silt and sands, increasing in vegetation and productivity. |
| DX032X01A122 | **Loamy (Ly) Big Horn Basin Core**<br>Loamy sites are found adjacent to Saline upland sites. Generally are in depressional or concave areas that allow salts to be flushed lower in the profile. |

## Similar sites

| | |
|---|---|
| DX032X01A143 | **Saline Upland Clayey (SUC) Big Horn Basin Core**<br>This site is within the Big Horn Basin and is the clayey fraction of the general Saline Upland site. This site has greater than 35% clays within the particle control section and classifies typically as a fine textural class. The site has a lower total canopy cover, and is lacking in diversity and production of grasses and forbs. |

| | |
|---|---|
| R032XY244WY | **Saline Upland (SU) 5-9” Wind River Basin Precipitation Zone**<br>This site was the original ecological site established for the entire Wind River Basin. As the MLRA was re-evaluated and LRU’s official established, this concept was corrected and narrowed to fit the specific geographic range determined to be representative. |
| DX032X01A141 | **Saline Upland Loamy (SUL) Big Horn Basin Core**<br>This site is within the Big Horn Basin and is the loamy fraction of the general Saline Upland site. This site has 18 to 35% clays within the particle control section and classifies typically as a fine-loamy textural class. The site has a similar composition to the original saline upland site, with a more narrow concept and corrected range of production. |
| R032XY344WY | **Saline Upland (SU) 10-14" East Precipitation Zone**<br>This site was all-encompassing for the 10-14" precipitation zone in Wyoming following the removal of MLRA 46. Shifting lines to move only the frigid band of 10-14” precipitation to the foothills, and creating a mesic 10-14” band will narrow the concept for C144. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | (1) *Atriplex gardneri* |
| Herbaceous | (1) *Achnatherum hymenoides*<br>(2) *Elymus elymoides* |

## Legacy ID

R032XC144WY

## Physiographic features

These sites generally occur on slopes ranging from nearly level to 20%. Commonly, these soils occur where marine shale outcrop or along fans formed from inter-bedded sandstone and shale. They may also occupy residual and fan soils of the foothills and lower mountain ranges with lower precipitations. The inter-bedded and dissected geomorphic features within the Wind River Basin has a range of saline-driven communities. The dominant landform associated with this site is fan aprons (including alluvial fans and fan remnants). There are sites that occur on relict stream terraces just a step above incised drainage channels; and will be associated with saline lowland and saline lowland, drained.

Many of these landforms are erosional remnants and have soils ranging from shallow to very deep. The variability of soils across the landform is influenced by the geology and its inherent chemistry. This will create pockets of calcareous or saline/sodic soils as well as areas that are not influenced by chemistry. Transitioning across the landform positions, soils shift with the deposition of salt laden materials or with the overflow of chemistry laden runoff. With these transitions, the break between one ecological site and another (and the representative plant community for each) is often a broad and non-descript band between the two sites. This can make it difficult, when on the landscape, to identify clearly which site is dominant for a specific point along that transitional gradient.

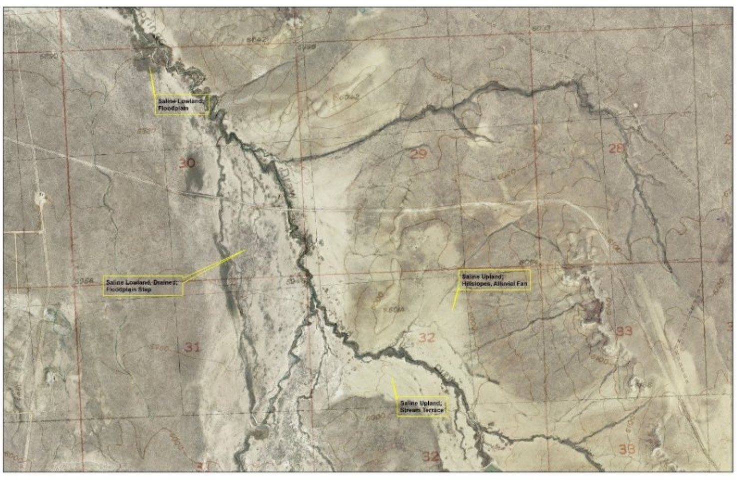


**Figure 1.**

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Intermontane basin > Alluvial fan<br>(2) Intermontane basin > Stream terrace<br>(3) Intermontane basin > Hillslope |
| Runoff class | Negligible to very high |
| Elevation | 1,369–2,021 m |
| Slope | 0–20% |
| Water table depth | 152 cm |
| 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. This amounts to about 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.

Average 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 about April 1st and continues until about July 1st. Cool weather and moisture in September may produce some green-up of cool season plants that will continue through late October.

Review of 30 year trend data for average temperature, as well as average precipitation, indicates there has been a warming trend. The last 12 years graphed; however, show temperatures have swayed high and low, but overall have maintained a steady trajectory, neither increasing nor decreasing. On the moisture side, the trajectory in trend has been a slow decline. The swings of when spring warm up and first frost hit, combined with the decline in average precipitation, have produced a drought effect where the moisture is not being received when the plants and soils are able to utilize the moisture. In some cases, the late precipitation has encouraged the warm season or mat forming species over the cool season bunchgrasses that are the drivers of the natural system. Early frosts, with dry open winters have created a more arid or desert effect on plants resulting in high rates of winter kill, loss of vigor or overall damage to the plant.

For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/. “Riverton” and "Pavillion" are the representative weather stations within LRU C. The following graphs and charts are a collective sample representing the averaged normals and 30 year annual rainfall data for the selected weather stations from 1981 to 2010.

**Table 3. Representative climatic features**

| | |
|---|---|
| Frost-free period (characteristic range) | 92-93 days |
| Freeze-free period (characteristic range) | 112-123 days |
| Precipitation total (characteristic range) | 203 mm |
| Frost-free period (actual range) | 91-94 days |
| Freeze-free period (actual range) | 109-126 days |
| Precipitation total (actual range) | 203 mm |

| | |
|---|---|
| Frost-free period (average) | 93 days |
| Freeze-free period (average) | 118 days |
| Precipitation total (average) | 203 mm |

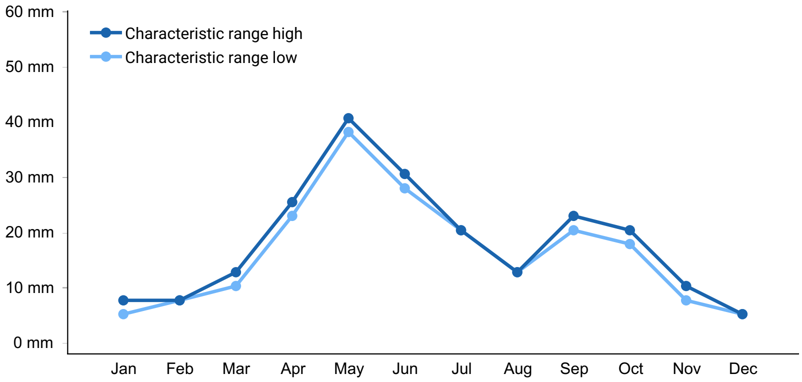



**Figure 2. Monthly precipitation range**

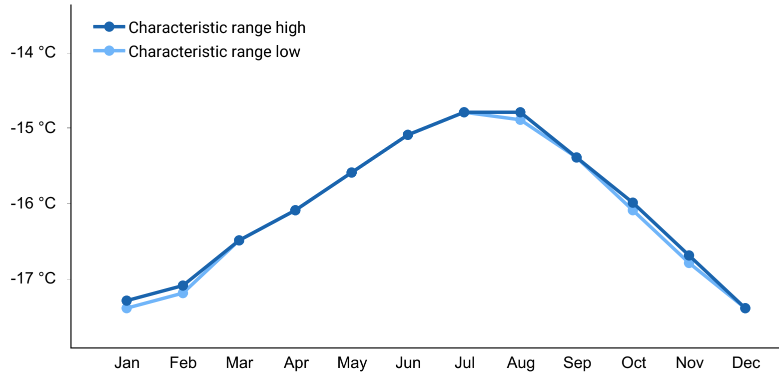



**Figure 3. Monthly minimum temperature range**

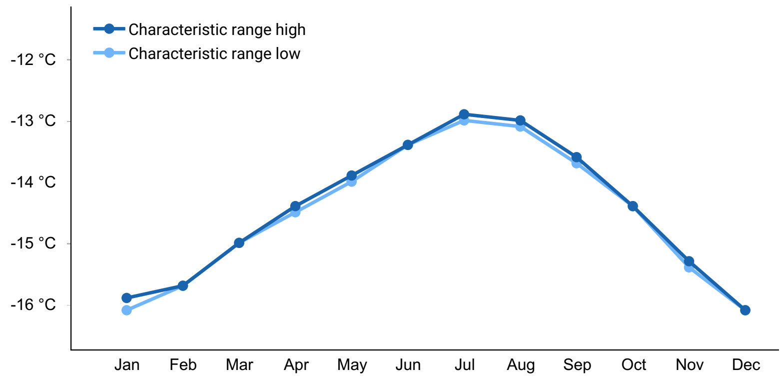



**Figure 4. Monthly maximum temperature range**

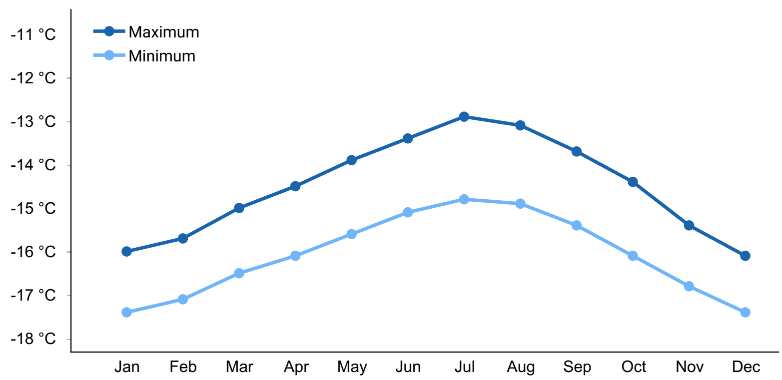



**Figure 5. Monthly average minimum and maximum temperature**

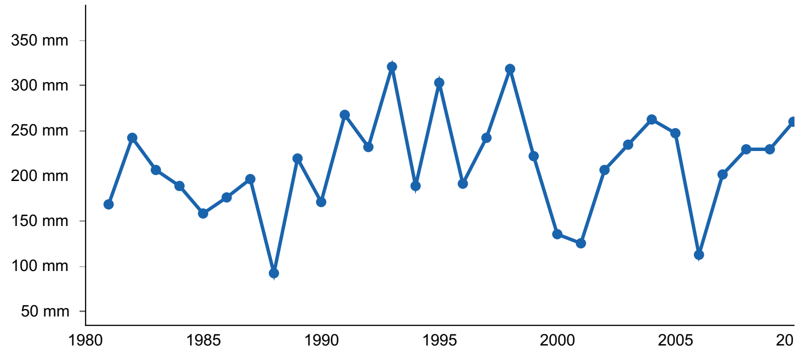



**Figure 6. Annual precipitation pattern**

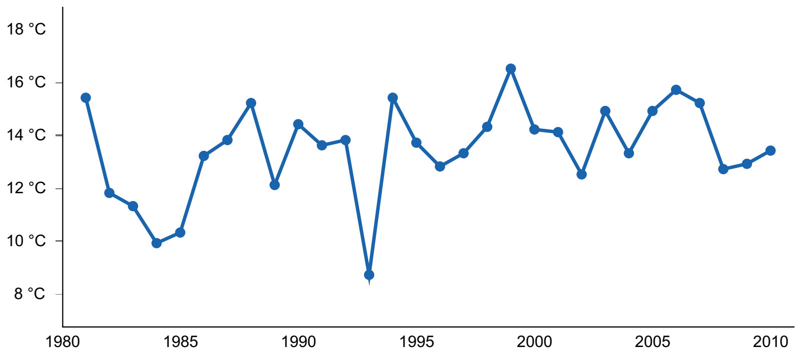



**Figure 7. Annual average temperature pattern**

## Climate stations used

- (1) PAVILLION [USC00487115], Pavillion, WY
- (2) RIVERTON [USC00487760], Riverton, WY

## Influencing water features

The characteristics of these upland soils have no influence from ground water (water table below 60 inches (150 cm)) and have minimal influence from surface water/overland flow. No streams are classified within this ecological site. The lack of water table above 60 in (150 cm) during any part of the growing season is a key factor for the Saline Upland sites. As the landscape transitions into the bottomlands (lowlands) or drainages, gaining overland flow and ground water influence changes the site to a saline lowland or saline subirrigated ecological site. In areas where there was historically a water table, but the stream or source has down cut or has been depleted, a site labeled Saline Lowland, Drained was created to cover a mixed or relict plant community.

## Soil features

The soils of this site are shallow to very deep (greater than 10” (25 cm) to bedrock), well drained soils with moderate to slow permeability. The soils are also moderately to strongly saline and/or alkaline. The surface soil will vary from 1 to 6 inches (3 - 15 cm) thick; there is extents that have been disturbed where the surface ranges from 6 to 10 inches (15 – 25 cm) thick. The soil characteristics that have the most influence on the plant community are the high quantity of soluble salts. Some soils may contain more soluble salts in the subsurface than in the surface.

Major soil series correlated to this site include: Fivemile, Muff, Uffens, and Fruita. This list of soil series is subject to change upon completion and correlation of the initial soil surveys: WY647 and WY617; as well as revisions to completed soil surveys: WY613, WY713, WY625, and WY677.

**Figure 8.**

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Residuum–shale<br>(2) Slope alluvium–sedimentary rock<br>(3) Alluvium |
| Surface texture | (1) Loam<br>(2) Silt loam<br>(3) Clay loam<br>(4) Silty clay loam |
| Family particle size | (1) Loamy |
| Drainage class | Moderately well drained to well drained |
| Permeability class | Slow to moderate |
| Soil depth | 25–152 cm |
| Surface fragment cover <=3" | 0–20% |
| Surface fragment cover >3" | 0–5% |
| Available water capacity (0-101.6cm) | 0.76–20.83 cm |
| Calcium carbonate equivalent (0-101.6cm) | 0–15% |
| Electrical conductivity (0-101.6cm) | 2–16 mmhos/cm |
| Sodium adsorption ratio (0-101.6cm) | 3–40 |
| Soil reaction (1:1 water) (0-101.6cm) | 7.4–9 |
| 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 salt tolerant plants and drought resistant mid-stature cool-season perennial grasses. The expected potential composition for this site is 40% grasses, 10% forbs and 50% woody plants. The composition and production will vary naturally due to historical use and fluctuating precipitation.

As this site deteriorates, species such as birdfoot sagebrush and greasewood will increase. Weedy annuals will invade. Cool-season grasses such as Indian ricegrass, bottlebrush squirreltail, and rhizomatous wheatgrasses will decrease in frequency and production.

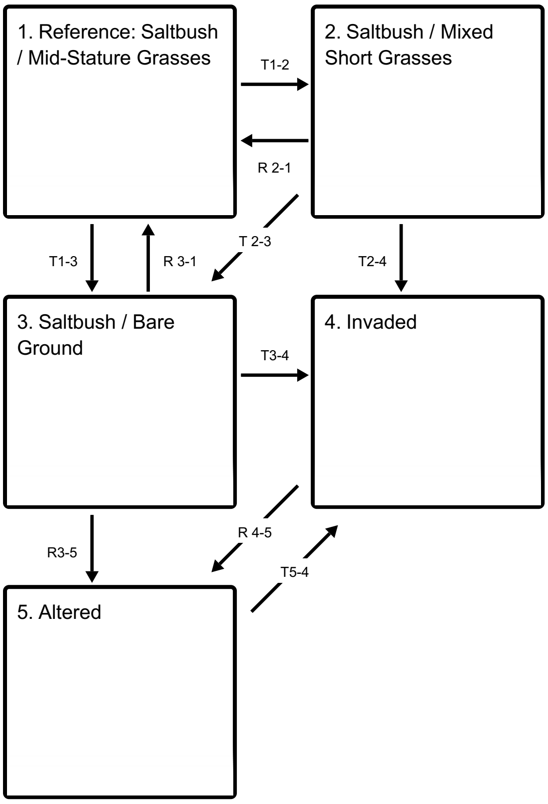
Historically, fire frequency has been included as a driving factor for these sites. Because of the increase in naturally occurring bare ground, lack of herbaceous cover, and corresponding fine fuels fire is not a potential threat. Fires are non-existent to extremely rare and incidental.

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

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

## State and transition model

**Ecosystem states**




**T1-2** - Drought alone or in conjunction with frequent or severe grazing will reduce the grass species, specifically Indian ricegrass and bottlebrush squirreltail and encourage bluegrasses and sod-formers forcing this transition.

**T1-3** - Frequent and Severe Grazing, Ground Disturbance, and/or Drought will reduce the herbaceous cover, leaving a shrub dominated community. Remnant grasses persist in the protection of cactus clumps.

**R 2-1** - Long-term Prescribed Grazing allows existing populations to gain vigor and encourages seedlings if seed source is available and climatic conditions are favorable. This site may require mechanical or cultural inputs to allow minor improvements in a foreseeable time frame.

**T2-4** - Drought, Ground Disturbance, Frequent or Severe Grazing or Non-Use with seed source present allows the soil surface to be opened and vulnerable to invasive species. Non-use has shown to create a “fluffy” soil scenario in which seeds are readily able to establish, but not necessarily persist.

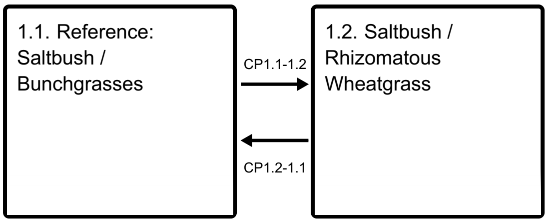
**R 3-1** - Long-term Prescribed Grazing allows existing populations to gain vigor and encourages seedlings if seed source is available and climatic conditions are favorable. This site may require mechanical or cultural inputs to allow minor improvements in a foreseeable time frame.

**T3-4** - Drought, Frequent or Severe Grazing, Non-Use, or Ground Disturbance with seed source present exposes this barren community to invasion by weedy species.

**R 4-5** - Integrated Pest Management, Grazing Lands Mechanical Treatment, or Rangeland Seeding with Prescribed Grazing will be required inputs to alter the soils and hydrology of this site, but allow a desirable plant cover to establish and reduce the invasive species (species dependent.)

**T5-4** - Drought, Severe and Frequent Grazing, Ground Disturbance, or Non-Use with seed source present leaves restored or reclaimed sites vulnerable to invasive species.

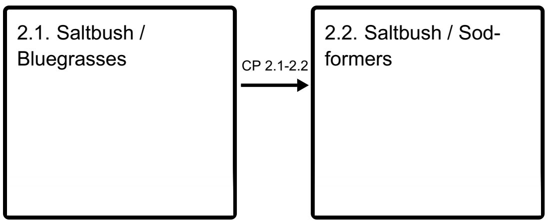
**State 1 submodel, plant communities**




**CP1.1-1.2** - Long-term Prescribed Grazing allows existing populations to gain vigor and encourages seedlings if seed source is available and climatic conditions are favorable. This site may require mechanical or cultural inputs to allow minor improvements in a foreseeable time frame.

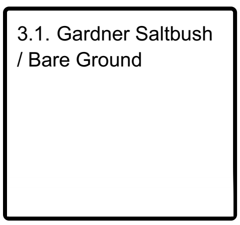
**CP1.2-1.1** - Prescribed Grazing (possibly Long-term), allows the sensitive “decreaser” species a chance to recover where remnant populations are still viable.

**State 2 submodel, plant communities**

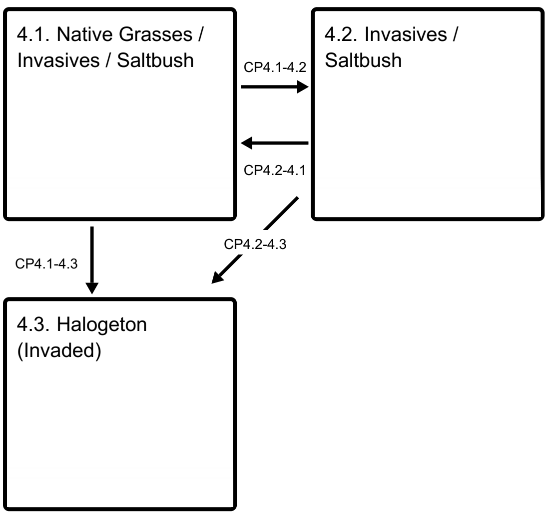



**CP 2.1-2.2** - Frequent and Severe Grazing of cool season grasses during growing season, and Drought removes or reduces Sandberg bluegrass and bottlebrush squirreltail on these sites, allowing blue grama and alkali sacaton to increase.

**State 3 submodel, plant communities**




**State 4 submodel, plant communities**



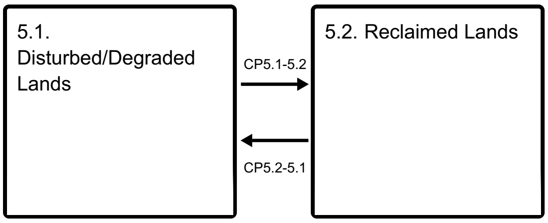

**CP4.1-4.2** - Drought, Non-Use, Disturbance, or Frequent or Severe Grazing weakens the herbaceous species on this site, allowing invasive species to increase in dominance.

**CP4.1-4.3** - Frequent or Severe Grazing, Major Ground Disturbance, or Non-Use with Drought opens the soil and the site allowing halogeton to increase and dominate the location.

**CP4.2-4.1** - Integrated Pest management with Prescribed Grazing reduces the density of the weed population and allows the native species to increase only with proper deferment and seed bank.

**CP4.2-4.3** - Frequent and Severe Grazing, Drought, Disturbance, or Non-Use opens the site to increased density of halogeton, which continues to increase on the site reducing sustainability of Gardner's saltbush.

**State 5 submodel, plant communities**




**CP5.1-5.2** - Grazing Land Mechanical Treatment and/or Rangeland Seeding with Prescribed Grazing provides a seed source to improve the disturbed or degraded site to a prescribed plant community.

**CP5.2-5.1** - Non-Use, Drought, Disturbance, Severe and Frequent Grazing reduces the introduced (seeded) species and allows the site to degrade and be non-productive.

## State 1
## Reference: Saltbush / Mid-Stature Grasses

Saline Upland is a dynamic and complex concept that crossed soil textural breaks and includes a wide range of soil chemistry, that work together to create a salt-tolerant community. Field sampling cannot capture the full dynamic of the chemistry and the current lack of soil laboratory data prevents clear separation of specific characteristics. Composition and production for this state have been designed to incorporate the full range of possibilities. Soils within the 5-9" precipitation zone, and with a wide range of alkali, saline, sodic and gypsum influences, are characterized by Gardner's saltbush dominated plant communities. These communities may also have birdfoot sagebrush, spiny hopsage, shadscale, four-wing saltbush, and in some locations greasewood; these woody species together will comprise approximately 50% of the production on the site. Soil texture will help determine what species are more apt to be on a specific site, although they do cross over. Sandy (coarse-loamy) soils support spiny hopsage and four-wing saltbush more often, where clayey (fine) soils support birdfoot sagebrush. Loamy (fine-loamy) soils tend to support for shadscale, but again many variations have been observed. The grasses, comprising 40% of the plant community, are predominately Indian ricegrass, bottlebrush squirreltail and rhizomatous wheatgrasses. Needleandthread is incidental in this state. The forb component is minor with only 10% of the production from a few select forbs. A variety of biscuitroot/desert parsleys (Lomatiums), wild onion, milkvetches, and asters are found in this state.

### Dominant plant species

- Gardner's saltbush (*Atriplex gardneri*), shrub
- Indian ricegrass (*Achnatherum hymenoides*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- squirreltail (*Elymus elymoides*), grass

## Community 1.1
## Reference: Saltbush / Bunchgrasses

**Figure 9. Indian Ricegrass and wheatgrass dominated community with Gardner's Saltbush.**

This is the Reference Plant Community for the Saline Upland ecological site. The community evolved with grazing by large herbivores and droughty saline and/or alkaline soils. This plant community can be found on areas that are properly managed with grazing and on areas receiving periods of rest. Potential vegetation is about 40% grasses or grass-like plants, 10% forbs, and 50% woody plants. Gardner's saltbush dominates this state. Other salt tolerant shrubs include bud sagebrush and birdfoot sagebrush. The major grasses include Indian ricegrass, bottlebrush squirreltail, and rhizomatous wheatgrasses. Other grasses occurring in this state include Sandberg bluegrass and needleandthread. A variety of forbs also occurs in this state and plant diversity is high (see Plant Composition Table). 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.

**Resilience management.** Rangeland Health Implications/Indicators: This state is fragile, but well adapted to the variable climatic conditions within the Wind River Basin. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community, but is difficult to reestablish when degraded. Site/soil stability, watershed function, and biologic integrity are unique to this site and function at the best possible level. Higher extents of bare ground and the erosional tendencies of salt laden soils, leaves this site naturally vulnerable to sheet erosion and wind erosion.

### Dominant plant species

- Gardner's saltbush (*Atriplex gardneri*), shrub
- Indian ricegrass (*Achnatherum hymenoides*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- squirreltail (*Elymus elymoides*), grass

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

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Shrub/Vine | 129 | 224 | 448 |
| Grass/Grasslike | 84 | 168 | 213 |
| Forb | 3 | 22 | 50 |
| **Total** | **216** | **414** | **711** |

**Table 6. Ground cover**

| | |
|---|---|
| Tree foliar cover | 0% |
| Shrub/vine/liana foliar cover | 20-45% |
| Grass/grasslike foliar cover | 25-40% |
| Forb foliar cover | 0-10% |
| Non-vascular plants | 0% |

| | |
|---|---|
| Biological crusts | 0-5% |
| Litter | 15-25% |
| Surface fragments >0.25" and <=3" | 0-30% |
| Surface fragments >3" | 0% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 35-45% |

**Table 7. Soil surface cover**

| | |
|---|---|
| Tree basal cover | 0% |
| Shrub/vine/liana basal cover | 0% |
| Grass/grasslike basal cover | 0% |
| Forb basal cover | 0% |
| Non-vascular plants | 0% |
| Biological crusts | 0-5% |
| Litter | 20-35% |
| Surface fragments >0.25" and <=3" | 0-30% |
| Surface fragments >3" | 0% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 35-45% |

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

| Height Above Ground (M) | Tree | Shrub/Vine | Grass/ Grasslike | Forb |
|---|---|---|---|---|
| <0.15 | – | 10-20% | 1-10% | 0-5% |
| >0.15 <= 0.3 | – | 1-10% | 0-2% | 0-1% |
| >0.3 <= 0.6 | – | – | – | – |
| >0.6 <= 1.4 | – | – | – | – |
| >1.4 <= 4 | – | – | – | – |
| >4 <= 12 | – | – | – | – |
| >12 <= 24 | – | – | – | – |
| >24 <= 37 | – | – | – | – |
| >37 | – | – | – | – |

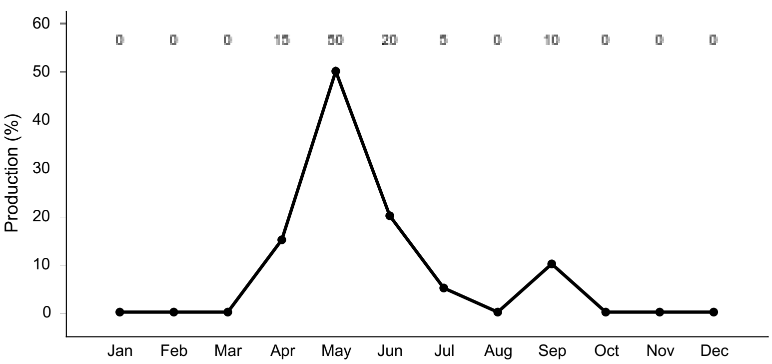


**Figure 11. Plant community growth curve (percent production by month).**

**WY0501, 5-9BH Upland sites. Monthly percentages of total annual growth for all upland sites with dominantly C3 Cool season plants..**

### Community 1.2
### Saltbush / Rhizomatous Wheatgrass

**Figure 12. Rhizomatous Wheatgrass and Squirreltail dominated community with Gardner's Saltbush.**

Historically, this plant community evolved under grazing by large ungulates. Currently this plant community is found under moderate, season-long grazing by livestock. Gardner’s saltbush and rhizomatous wheatgrasses are the major components of this plant community. Cool-season grasses make up the majority of the understory with the balance made up of short warm-season grasses, annual cool-season grasses, and various forbs. Dominant grasses include rhizomatous wheatgrasses, bottlebrush squirreltail, Sandberg bluegrass, and blue grama. Forbs commonly found in this plant community include smooth woodyaster, Cous biscuitroot, wild onion, and fernleaf biscuitroot. Plains prickly pear and winterfat can also occur. When compared to the Reference Plant Community (1.1), birdfoot sagebrush and blue grama have increased. Plains prickly pear cactus will also increase, but occurs only in small patches. Indian ricegrass has decreased and may occur in only trace amounts within the patches of prickly pear. In addition, winterfat and shadscale may or may not have changed depending on the season of use by livestock. The total annual production (air-dry weight) of this community is about 240 lbs/acre, but it can range from about 150 lbs./acre in unfavorable years to about 350 lbs./acre in above average years.

**Resilience management.** Rangeland Health Implications/Indicators: This plant community is relatively resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term severe grazing. Prolonged drought can also play an important role, exacerbating these conditions. The herbaceous component is mostly intact and plant vigor and replacement capabilities are sufficient. Water flow patterns and litter movement may occur, but are not extensive. Incidence of pedestalling is minimal. Soils are mostly stable and the surface shows minimal soil loss. The watershed is functioning and the biotic community is intact.

#### Dominant plant species

- Gardner's saltbush (*Atriplex gardneri*), shrub
- squirreltail (*Elymus elymoides*), grass
- western wheatgrass (*Pascopyrum smithii*), grass

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

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Shrub/Vine | 90 | 168 | 224 |
| Grass/Grasslike | 62 | 84 | 135 |
| Forb | 17 | 28 | 34 |
| **Total** | **169** | **280** | **393** |

**Table 10. Ground cover**

| | |
|---|---|
| Tree foliar cover | 0% |
| Shrub/vine/liana foliar cover | 15-30% |
| Grass/grasslike foliar cover | 10-30% |
| Forb foliar cover | 0-5% |
| Non-vascular plants | 0% |
| Biological crusts | 0-5% |
| Litter | 10-20% |
| Surface fragments >0.25" and <=3" | 0-30% |
| Surface fragments >3" | 0% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 35-45% |

**Table 11. Soil surface cover**

| | |
|---|---|
| Tree basal cover | 0% |
| Shrub/vine/liana basal cover | 0% |
| Grass/grasslike basal cover | 0% |
| Forb basal cover | 0% |
| Non-vascular plants | 0% |
| Biological crusts | 0-5% |
| Litter | 10-20% |
| Surface fragments >0.25" and <=3" | 0-30% |
| Surface fragments >3" | 0% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 35-45% |

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

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

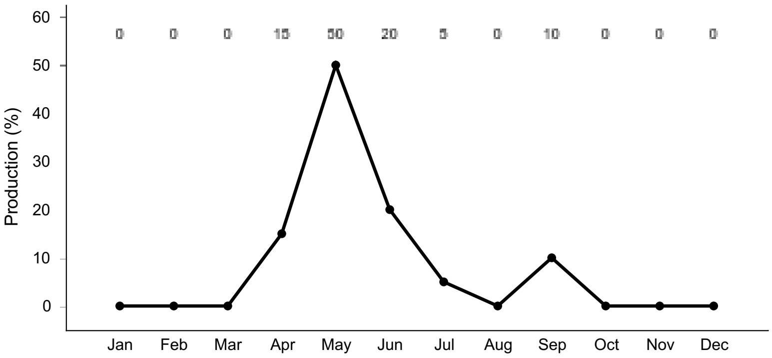



**Figure 14. Plant community growth curve (percent production by month). WY0501, 5-9BH Upland sites. Monthly percentages of total annual growth for all upland sites with dominantly C3 Cool season plants..**

## Pathway CP1.1-1.2
## Community 1.1 to 1.2

**Reference: Saltbush / Bunchgrasses**

**Saltbush / Rhizomatous Wheatgrass**

Moderate Continuous Season-long Grazing, Drought - Gardner’s Saltbush has shown a tolerance or resilience under slight and moderate grazing pressures over a period of time, however the herbaceous component is susceptible, and is weakened under constant use. Indian Ricegrass is the main species that will decrease initially. As the pressure persists, vigor and density of Indian Ricegrass will decrease while Sandberg Bluegrass increases, and Bottlebrush Squirreltail will remain fairly stable. Production may not be altered depending on the precipitation for the year, but with continued stress the production will decrease as overall diversity and herbaceous cover is reduced.

## Pathway CP1.2-1.1
## Community 1.2 to 1.1

**Saltbush / Rhizomatous Wheatgrass**

**Reference: Saltbush / Bunchgrasses**

Prescribed Grazing or Long-term Prescribed Grazing - Given there is a viable seed source within distance, and appropriate rest and recovery time between grazing periods occurs, Indian Ricegrass and Bottlebrush Squirreltail can re-establish. The recovery process will take time and with the low precipitation rates and the tendency towards less than desirable seed establishment conditions, it may take several years (10-30 years). At this stage, seeding or other mechanical treatments are not suggested. Increased ground disturbance increases the potential risk of introducing invasive species. Considering the reduced vigor and diversity at this stage, the lower the risks taken the more apt the site is to recover.

### Conservation practices

| |
|---|
| Brush Management |
| Integrated Pest Management (IPM) |
| Upland Wildlife Habitat Management |
| Planned Grazing System |

| |
|---|
| Prescribed Grazing |
| Grazing Management Plan - Applied |

## State 2
## Saltbush / Mixed Short Grasses

The Saltbush/Mixed Short Grasses State (State 2) is dominated by mid-stature bluegrasses and low-stature warm season grasses, reducing the resiliency of the community. Species diversity has been reduced. The state is stable with approximately 50% canopy cover by saltbush or salt tolerant shrubs. However, the production is reduced. Yet long term studies with exclosures across the Wind River and Bighorn Basin, have shown a significant fluctuation of annual production within these communities.

### Dominant plant species

- Gardner's saltbush (*Atriplex gardneri*), shrub
- blue grama (*Bouteloua gracilis*), grass

## Community 2.1
## Saltbush / Bluegrasses

**Figure 15. Sandberg Bluegrass dominated community with Gardner's saltbush.**

Currently, this community persists under moderate, season-long grazing by livestock and can be the result of prolonged drought conditions. This site appears to respond with extreme variation in annual production caused by wet, normal and dry growing seasons. This plant community is still dominated by short cool-season grasses, while short warm-season grasses and forbs account for the remaining composition of the understory. Continued drought or severe grazing places this community at-risk of shifting to a sod-forming, warm-season grass dominated plant community. The dominant plants for this community are Gardner’s saltbush and Sandberg bluegrass, with lesser amount of blue grama. Incidental grass species include: prairie junegrass, western wheatgrass, bottlebrush squirreltail, and needleandthread. Forbs commonly found in this plant community include annual mustards, stickseeds, desert parsley/biscuitroot, milkvetches and asters. This site can still provide a diverse plant community, but lacks the structure for nesting cover and wildlife habitat. When compared to the Reference Community, Sandberg bluegrass and blue grama have increased; and plains prickly pear has invaded. Indian ricegrass and bottlebrush squirreltail have decreased and may occur in trace amounts protected within the patches of plains prickly pear. Livestock grazing season of use and land treatment type may have limited or removed winterfat and shadscale from this community. The total annual production (air-dry weight) of this community phase is about 200 pounds per acre, but it can range from about 75 lbs./acre in unfavorable years to about 300 lbs./acre in above average years.

**Resilience management.** Rangeland Health Implications/Indicators: This plant community is resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term severe grazing. The herbaceous component is mostly intact and plant vigor and replacement capabilities are sufficient (plants are still producing seeds, and seedlings are present). 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 minimal soil loss. The watershed is functioning, and the biotic community is intact.

### Dominant plant species

- Gardner's saltbush (*Atriplex gardneri*), shrub
- Sandberg bluegrass (*Poa secunda*), grass

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

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Shrub/Vine | 45 | 112 | 196 |
| Grass/Grasslike | 34 | 95 | 112 |
| Forb | 6 | 17 | 28 |
| **Total** | **85** | **224** | **336** |

**Table 14. Ground cover**

| | |
|---|---|
| Tree foliar cover | 0% |
| Shrub/vine/liana foliar cover | 0% |
| Grass/grasslike foliar cover | 0% |
| Forb foliar cover | 0% |
| Non-vascular plants | 0% |
| Biological crusts | 0-5% |
| Litter | 10-25% |
| Surface fragments >0.25" and <=3" | 0-30% |
| Surface fragments >3" | 0% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 35-60% |

**Table 15. Soil surface cover**

| | |
|---|---|
| Tree basal cover | 0% |
| Shrub/vine/liana basal cover | 0% |
| Grass/grasslike basal cover | 0% |
| Forb basal cover | 0% |
| Non-vascular plants | 0% |
| Biological crusts | 0-5% |
| Litter | 10-25% |
| Surface fragments >0.25" and <=3" | 0-30% |
| Surface fragments >3" | 0% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 35-60% |

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

| Height Above Ground (M) | Tree | Shrub/Vine | Grass/ Grasslike | Forb |
|---|---|---|---|---|
| <0.15 | – | 10-20% | 5-20% | 0-5% |
| >0.15 <= 0.3 | – | 0-5% | 0-5% | 0-5% |
| >0.3 <= 0.6 | – | – | – | – |
| >0.6 <= 1.4 | – | – | – | – |
| >1.4 <= 4 | – | – | – | – |
| >4 <= 12 | – | – | – | – |
| >12 <= 24 | – | – | – | – |
| >24 <= 37 | – | – | – | – |
| >37 | – | – | – | – |

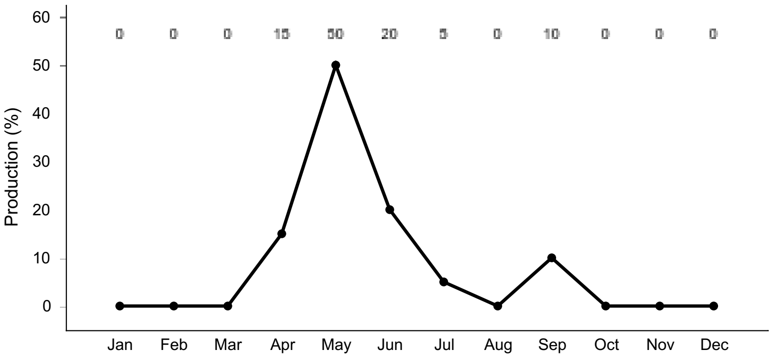



**Figure 17. Plant community growth curve (percent production by month). WY0501, 5-9BH Upland sites. Monthly percentages of total annual growth for all upland sites with dominantly C3 Cool season plants..**

## Community 2.2
## Saltbush / Sod-formers

**Figure 18. Blue grama dominated saltbush community in the WRB Core.**

This plant community evolved under frequent and severe grazing on saline and/or sodic soils. Gardner’s saltbush, birdfoot sagebrush and blue grama are the dominant species of this plant community. A dense sod of blue grama can be common but mostly occurs in large mosaic patterns. Cool-season grasses have almost been eliminated and if still present can only be found within patches of plains prickly pear. Blue grama will appear to be in a monoculture with Gardner’s saltbush; however, Sandberg bluegrass or prairie junegrass will be present in the interspaces of sod. Cactus often has increased. When compared with the Reference State (1), the annual production is lower for the Gardner’s saltbush and the perennial cool-season grasses. Total average annual production is 150 lbs./acre, but it can range from 25 lbs./acre in unfavorable years to 200 lbs./acre in above average years.

**Resilience management.** Rangeland Health Implications/Indicators: This plant community is resistant to change;

the established stand of blue grama is able to resist the impacts of continued frequent and severe grazing. The removal of grazing does not seem to affect the plant composition or structure of the plant community. The biotic integrity of this community is compromised and minimally functional; with moderate to low plant diversity. Since the biotic integrity of this plant community is not intact, it is vulnerable to noxious weeds such as Russian knapweed and halogeton. Plant vigor is weakened and replacement capabilities are limited due to the reduced number of cool-season grasses. This community is stable. However, the sod formed by blue grama is resistant to water infiltration, protecting the soil under the sod, while excessive off-site runoff may occur between sod-patches; resulting in rills or other more severe erosional issues on the adjoining sites. The watershed may or may not be functioning, as runoff may affect adjoining sites.

### Dominant plant species

- Gardner's saltbush (*Atriplex gardneri*), shrub
- blue grama (*Bouteloua gracilis*), grass

**Table 17. Annual production by plant type**

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Shrub/Vine | 28 | 84 | 112 |
| Grass/Grasslike | 28 | 84 | 112 |
| Forb | – | 11 | 22 |
| **Total** | **56** | **179** | **246** |

**Table 18. Ground cover**

| | |
|---|---|
| Tree foliar cover | 0% |
| Shrub/vine/liana foliar cover | 10-35% |
| Grass/grasslike foliar cover | 10-25% |
| Forb foliar cover | 0-5% |
| Non-vascular plants | 0% |
| Biological crusts | 0-5% |
| Litter | 10-20% |
| Surface fragments >0.25" and <=3" | 0-30% |
| Surface fragments >3" | 0% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 40-60% |

**Table 19. Soil surface cover**

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

| | |
|---|---|
| Water | 0% |
| Bare ground | 40-60% |

**Table 20. Canopy structure (% cover)**

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

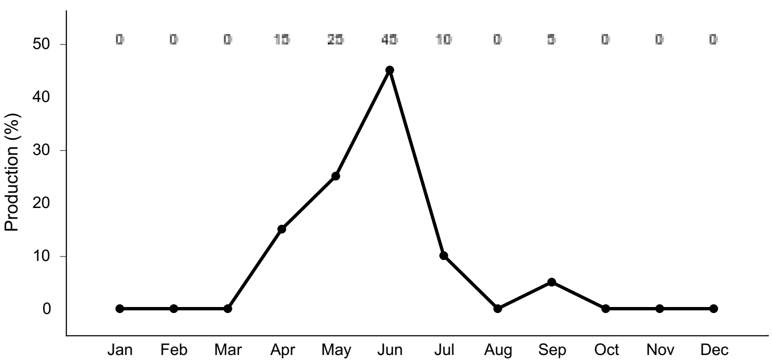



**Figure 20. Plant community growth curve (percent production by month). WY0504, 5-9 BH Upland Sites Warm Season Dominate. Monthly percentages of total annual growth based on a predominately C4 warm season plant community with shrubs and some C3 plants. Generally sod-forming community..**

## Pathway CP 2.1-2.2
## Community 2.1 to 2.2

**Saltbush / Bluegrasses**

**Saltbush / Sod-formers**

Frequent and Severe Utilization of cool season mid-grasses during the growing season, Drought - The low growing warm season grass, blue grama, is encouraged with high utilization of the cool-season mid-stature grasses. As severe grazing reduces Sandberg bluegrass and opens the canopy, blue grama, if present in the system, increases in density forming a sod-mat between Gardner’s saltbush plants. Drought will also open the canopy, encouraging blue grama to gain dominance in this community.

## State 3
## Saltbush / Bare Ground

A saltbush dominant site with bare ground is the most degraded native community for Saline Upland. As more soils data and vegetation data were analyzed, a trend shows many of the study locations with this community contained a higher percent clay. The determination if this state is produced by soil texture, management, or climatic conditions may not be conclusive, and require additional investigation. It is recognized that with continued grazing pressure and drought conditions, the productivity and sustainability of most perennial grasses will decrease leaving a shrub dominated state. In the absence of invasive species, this state can persist on the landscape. Very long-term prescribed grazing and grazing land mechanical treatment (with seeding possibly) may be practices that can be used to bring this state near or similar to reference. Remnant populations of native perennial grasses will persist in pockets within the Gardner's Saltbush, but in some instances, seeding may be required to help re-establish herbaceous species to these sites. No research was located for large areas of re-vegetation, but limited success has occurred with seeding trials completed by BLM and University of Wyoming.

**Dominant plant species**

- Gardner's saltbush (*Atriplex gardneri*), shrub

## Community 3.1
## Gardner Saltbush / Bare Ground

**Figure 21. Saltbush dominated community, with minimal other vegetation on a Saline Upland WRB Core site.**

This plant community can occur where sites are subjected to continuous year-long grazing and where soils are highly sodic. Gardner's saltbush dominates this site and in some cases comprises almost 100% of the plant community. The interspaces between plants have expanded significantly leaving the amount of bare ground very high and the soil surface exposed to erosive elements. Cool season grasses have been eliminated or greatly reduced. When compared to the Reference State (1), plant production is greatly diminished due to the excessive amount of bare ground. Sandberg bluegrass comprises a portion of the grass cover, but blue grama is prominent in the understory. Given, the wide range of productivity in bluegrasses depending on timing of precipitation and spring conditions, the following production range does not capture the extremely abnormal years. The total annual production (air-dry weight) of this state averages 90 pounds per acre, but it can range from 50 lbs./acre in unfavorable years to 150 lbs./acre in above average years.

**Resilience management.** Rangeland Health Implications/Indicators: This plant community is resistant to change as the stand becomes more decadent. These areas are resistant to fire as no or minimal fine fuels are available and the bare ground between plants is increased. Continued frequent and severe grazing or the removal of grazing does not seem to affect the plant composition or structure of the plant community. Plant diversity is extremely low. The plant vigor is diminished and replacement capabilities are severely reduced due to the decrease in the amount of cool-season grasses. Plant litter is noticeably less when compared to the Reference plant communities (1.1 and 1.2). Noxious weeds such as Russian knapweed and halogeton are able to invade the large openings and can become dominate, forcing the transition to the invaded state. 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 establish where rills have concentrated down slope.

**Dominant plant species**

- Gardner's saltbush (*Atriplex gardneri*), shrub

**Table 21. Annual production by plant type**

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Shrub/Vine | 34 | 84 | 140 |
| Grass/Grasslike | 17 | 22 | 28 |
| Forb | 6 | 11 | 17 |
| **Total** | **57** | **117** | **185** |

**Table 22. Ground cover**

| | |
|---|---|
| Tree foliar cover | 0% |
| Shrub/vine/liana foliar cover | 15-45% |
| Grass/grasslike foliar cover | 0-10% |
| Forb foliar cover | 0-5% |
| Non-vascular plants | 0% |
| Biological crusts | 0-5% |
| Litter | 5-20% |
| Surface fragments >0.25" and <=3" | 0-30% |
| Surface fragments >3" | 0% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 45-70% |

**Table 23. 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 | 5-20% |
| Surface fragments >0.25" and <=3" | 0-30% |
| Surface fragments >3" | 0% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 45-70% |

**Table 24. Canopy structure (% cover)**

| Height Above Ground (M) | Tree | Shrub/Vine | Grass/ Grasslike | Forb |
|---|---|---|---|---|
| <0.15 | – | 10-20% | 0-5% | 0-5% |
| >0.15 <= 0.3 | – | – | – | – |
| >0.3 <= 0.6 | – | – | – | – |
| >0.6 <= 1.4 | – | – | – | – |
| >1.4 <= 4 | – | – | – | – |
| >4 <= 12 | – | – | – | – |
| >12 <= 24 | – | – | – | – |
| >24 <= 37 | – | – | – | – |
| >37 | – | – | – | – |

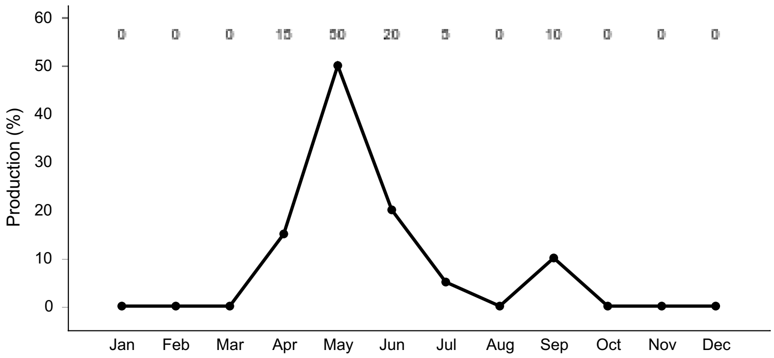



**Figure 23. Plant community growth curve (percent production by month). WY0501, 5-9BH Upland sites. Monthly percentages of total annual growth for all upland sites with dominantly C3 Cool season plants..**

## State 4
## Invaded

The Saline Upland site has proven to be more tolerable or resistant to invasion by many of the invasive species threatening the rangelands today. However, there are a few species that still present issues as these lands are disturbed by development, continued drought, and shifts in use patterns. Many of these sites are at risk from local threats such as mustards, kochia, and field pennycress; as well as the national threats of halogeton, cheatgrass (downy brome), and a variety of knapweeds and thistles. The persistence, resistance and resilience of specific communities within this state will be discussed further below.

### Dominant plant species

- Gardner's saltbush (*Atriplex gardneri*), shrub
- Sandberg bluegrass (*Poa secunda*), grass

## Community 4.1
## Native Grasses / Invasives / Saltbush

**Figure 24. Cheatgrass Enroachment on Saline Upland, Loamy sit**

The Saltbush/Annuals (Invaders)/Perennial Grasses phase has maintained a representative sample of the native perennial grasses and forbs with the accompanying Gardner's Saltbush composition. The invasive species are present and hold a significant (10% or greater) composition of the landscape, and are prominent on the site (referring to a more wide scale composition, not isolated patches on 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 annual or invasive species. Production of this community phase will vary depending on the invasive species. Site-specific evaluation will need to be completed to determine productivity and the growth curve that is best suited. The curve selected below is for a Cheatgrass influenced community.

**Resilience management.** Rangeland Health Implications/Indicators: This plant community is resistant to change. Plant diversity is moderate to poor. The plant vigor is diminished and replacement capabilities are limited due to the reduced composition 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 associated litter accumulation. 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.

**Dominant plant species**

- Gardner's saltbush (*Atriplex gardneri*), shrub
- squirreltail (*Elymus elymoides*), grass
- Indian ricegrass (*Achnatherum hymenoides*), grass

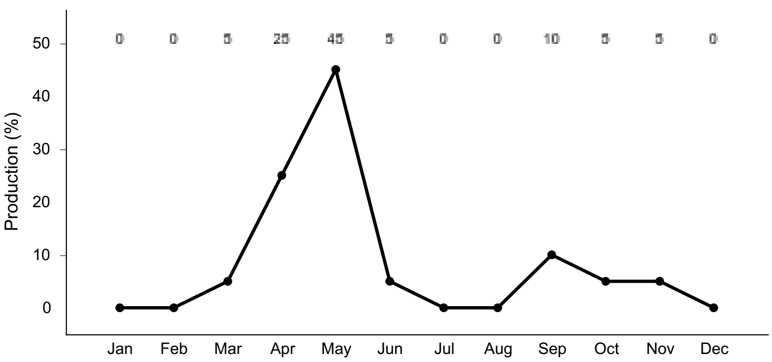



**Figure 25. Plant community growth curve (percent production by month). WY0505, 5-9 BH Upland Sites, Annual Grasses Dominate. Monthly percentages of total annual growth, based on plant communities being affected by annual grasses (cheatgrass) or similar weedy species..**

## Community 4.2
## Invasives / Saltbush

**Figure 26. Halogeton and Gardner Saltbush dominated community**

This community phase is the at-risk community. As the native populations of perennial grasses and forbs become weakened, the site becomes invader driven, and is extremely difficult to improve. Gardner's Saltbush is able to compete and maintain a strong community under a heavy infestation level. The canopy, although dwarfed, can serve as a protective niche in the system to help native grass species to persist. But the system has low resiliency.

**Resilience management.** Rangeland Health Implications/Indicators: This plant community is resistant to change. Plant diversity is poor. The plant vigor is diminished and replacement capabilities are limited due to the reduced component of cool-season grasses. Plant litter is noticeably more when compared to reference communities as a response to the potential biomass produced by invasive species (species dependent). Soil erosion is variable depending on the species of invasion and the associated litter accumulation. Variability of water flow, pedestalling, infiltration and runoff is determined by the invasive species inhabiting the community.

### Dominant plant species

- Gardner's saltbush (*Atriplex gardneri*), shrub

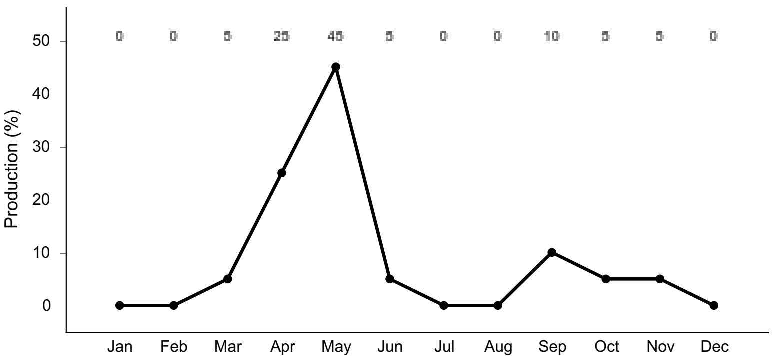



**Figure 27. Plant community growth curve (percent production by month). WY0505, 5-9 BH Upland Sites, Annual Grasses Dominate. Monthly percentages of total annual growth, based on plant communities being affected by annual grasses (cheatgrass) or similar weedy species..**

## Community 4.3
## Halogeton (Invaded)

Halogeton is a common weed found on a variety of soils and in a wide range of climates. It is aggressive and able to take advantage of disturbed and degraded soils, out-competing other species for limited resources. It is a common species found on alkaline soils, especially saline or sodic soils. It was thought to fill a niche until perennial natives could establish and begin to out compete for the limited moisture and nutrients. Studies completed by the University of Wyoming and partnering agencies have found that over time, Halogeton has been able to encroach into and force Gardner's saltbush out of locations. Photo point and transect data has shown that Gardner's Saltbush can fluctuate significantly with precipitation and extended periods of drought, and will recover with the return of adequate moisture events; but given time and continued pressure from Halogeton, the shrub component will eventually be reduced or eliminated. This was documented with grazed as well as ungrazed locations (unpublished study completed with established exclosures and photo points over time – presented at Wyoming Section Society for Range Management in Evanston, WY 2012). Management solutions are still being evaluated, but it appears that grazing is not a factor affecting the movement of this species. As perennial grasses decrease and annual forbs begin to dominate a site, the niche for halogeton to take over increases. Although chemical control is an option, success and longevity of this type of treatment is being reviewed. It is not seen as a stable state that cannot be transitioned out of without significant inputs. However it is a community that is of significant management impacts and is a concern for livestock on the landscape, especially sheep operations. Currently only small isolated areas of this site have been identified on the landscape and no production data has been collected at this time. Halogeton is known to exhibit a wide swing in productivity based on the time and timing of precipitation for the year.

**Resilience management.** This plant community is resistant to change. Plant diversity is poor, and vigor is diminished. Replacement capabilities are significantly reduced due to the loss of cool-season grasses. Soil erosion is generally reduced in response to the litter accumulation. However, the annual nature of this plant accentuates the water flow patterns. Infiltration is reduced and runoff is increased with the loss of perennial vegetation, root depth and density.

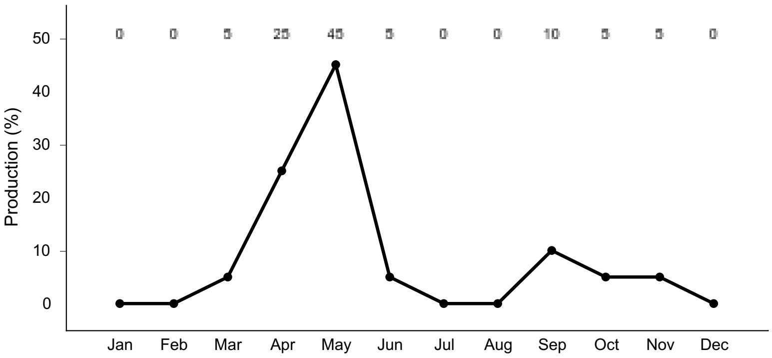
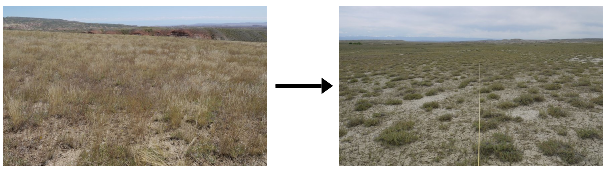



**Figure 28. Plant community growth curve (percent production by month). WY0505, 5-9 BH Upland Sites, Annual Grasses Dominate. Monthly percentages of total annual growth, based on plant communities being affected by annual grasses (cheatgrass) or similar weedy species..**

## Pathway CP4.1-4.2
## Community 4.1 to 4.2



**Native Grasses / Invasives / Saltbush** **Invasives / Saltbush**

No Use, Severe or Frequent Grazing, Drought, Disturbance – After crossing the threshold into an invaded state, the community will continue to degrade if disturbances(or over-use) are repetitive or persist. Drought and non-use can leave soils dispersed, disturbed, and susceptible to further loss of perennial grasses. Once an invasive species has gained a niche within a community and is able to begin to propagate, the transition from the initial phase in this state to a more degraded phase may happen quickly, especially if there are multiple factors working to remove or weaken the perennial grasses.

## Pathway CP4.1-4.3
## Community 4.1 to 4.3

No Use, Severe and Frequent Grazing with Drought or major disturbance – As mentioned above, once a community has transitioned into an invaded state it is at-risk of deteriorating quickly. The severity of the disturbance will exacerbate the situation even more. In cases where the disturbance or use removes the native vegetation, including the saltbush, the site will become a monoculture of Halogeton or at least dominated by the invasive species that was introduced to the site.

## Pathway CP4.2-4.1

## Community 4.2 to 4.1

Invasives / Saltbush

Native Grasses / Invasives / Saltbush

Integrated Pest Management with Prescribed Grazing – The native grasses displaced by invasive species will persist in remnant populations within the crowns of the Saltbush or scattered in small pockets on the landscape. If a site is addressed in the preliminary stages of the phase transition, there is a higher likelihood that integrated pest management (weed control) and grazing management will encourage the perennial grasses to increase or persist on the landscape. But as the site continues to degrade or transition to an invasive dominated community, the ability to recover becomes more and more minimal. Halogeton maintains a more desirable community for grasses to persist. Where Cheatgrass and knapweeds tend to overpower and remove or inhibit the perennial grasses from the system, making recovery more difficult without major inputs.

### Conservation practices

| |
|---|
| 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 |
| Grazing Management Plan - Applied |

## Pathway CP4.2-4.3
## Community 4.2 to 4.3

No Use, Severe or Frequent Grazing, Drought with Disturbance – Photo point studies of Halogeton infested communities over a period of years have shown that continued season or year-long grazing pressure, or in areas with extended drought and development disturbance, transitions to a Halogeton dominated community with only a few random annual weedy species in the interspaces. The photo point studies also showed that non-use (exclosures) allowed the transition to continue, and was expedited by drought.

## State 5
## Altered

Mining/energy development, borrow/gravel pits, farming/irrigation, and roads are only a few of the land uses that have had an impact on this site. Much of the land correlated as Saline Upland is deemed unfit or non-productive, and either no attempt was made to reclaim areas or reseeding attempts have failed. As this land recovers, is restored or reclaimed, or further disturbances occur, the site potential and stability is greatly affected. Historic attempts to improve productivity of these areas has altered the resilience and response to management/natural disturbance regimes. Specific references will be discussed below.

### Dominant plant species

- Gardner's saltbush (*Atriplex gardneri*), shrub

## Community 5.1

## Disturbed/Degraded Lands

**Figure 29. Contour Furrows completed in the late 1960s by BLM**

Degraded or disturbed lands are locations that have been impacted by human settlement and land use development. Wind River Basin was farmed during settlement periods; however, scarcity of water and drought impacts, caused many to abandon farming for other land uses. In more current times, advancement of irrigation techniques extended farm fields or created edges/corners that are difficult to farm and have low productivity of salt-affected areas. The expanded zone was then abandoned and left to natural processes or seeded to a generic seed mix. Rangeland improvement trials were completed in the late 1940's and early 1960's by the Bureau of Land Management in conjunction with University of Wyoming. Trials included, water spreader dikes, contour furrowing and range seeding. These barren landscapes were contour furrowed and/or seeded with pre-dominantly crested wheatgrass (Agropyron Cristatum) and Russian wildrye (*Psathyrostachys juncea*). The objective was to create increased water holding capacity, improving vigor and production of Nuttall's (Gardner's) Saltbush, and enhance seed establishment. In 2015, a few of these locations were visited within the Wind River Basin to find varying degrees of persistence of seeded species. The most dominant was the crested wheatgrass and rhizomatous wheatgrasses. However, the furrows were still visible to the eye and the spreader dikes, although visible) were holding significant sediment loads. An exclosure comparison of this treatment exhibited significant persistence of seeded species and the presence of native species as well. Productivity of Gardner's saltbush and Sandberg bluegrass was markedly higher than expected, within the exclosure compared to outside. Because these areas were mechanically altered with lasting affects to hydrology, in conjunction with a seeding of an introduced species, even though introduced species did not persist in all locations, these locations are marked as disturbed lands to capture the altered functionality when compared to the reference functionality group. Given more time the furrows may completely disappear from view and the benefits of such furrows will be decreased, but the argument is made that these communities will not respond the same as an unaltered, native community. Similarly, with lands that were farmed/irrigated and then left to return to a natural state of vegetation will never respond the same as a reference community. Persistence of an introduced, non-native species is a very indicative trait that will assist in identifying this community. These non-native species are not invasive, although they may be persistent and aggressive. Crested wheatgrass, Russian wildrye, rhizomatous wheatgrasses, Indian ricegrass, and big bluegrass are a few cultivar species that have been planted that have persisted on the landscape, altering the community. The act of seedbed preparation alone, without consideration of the original disturbance, can be seen as an alteration to the soil function. The restored/reclaimed lands community phase is very similar to this concept; however, in the term restored/reclaimed the inference is "to a native or natural state pre-disturbance". With the use of introduced or improved cultivars, the site is not similar to pre-disturbance. Productivity of these sites varies greatly dependent on the disturbance, age and successional stage of recovery, and if or what species were seeded. Due to the lack of current and comparative production data, no production estimate is provided. The growth curve will depend on the species seeded, or the succession completed. So no growth curve will be given.

## Community 5.2
## Reclaimed Lands

When restoring a site (returning disturbed lands to a former, original, normal or unimpaired condition) or reclaiming a site (restoring to a pre-determined level of productivity or usefulness similar to pre-disturbance) within the Wind River Basin, climate is the most limiting factor for success. However, the sodicity/salinity/alkalinity of the soil also causes further complication and limitation of available species. Research has been completed by Plant Material

Centers (Bridger, MT) and Universities, improving the seedling establishment of Gardner's Saltbush and developing newer cultivars of key species. Review of disturbed areas, showed very limited or non-existent success in reclamation. Every site that was found had a high rate of annuals and only trace amounts of desired grasses and forbs. Saltbush establishment was found to be very low, but the rate of desired and planted was unknown. Production and the growth curve factors are dependent on the seeding mixtures selected and the level of establishment achieved. As with the disturbed lands, these sites are highly vulnerable to erosion and invasion by annuals or other undesirable species.

## Pathway CP5.1-5.2
## Community 5.1 to 5.2

Grazing Land Mechanical Treatment and/or Rangeland Seeding with Prescribed Grazing – Degraded communities may be at various levels of succession or ground condition. To have the desired seedbed, most areas will require site preparation (disking, plowing, harrowing, etc.) to seed a large area. In some instances, contour furrow plantings similar to those completed in the 1960s by the BLM, may be a preferred practice. No matter whether the area has a grazing land mechanical treatment or is seeded to natives (or selected seed mix), once the seed has a chance to establish, prescribed grazing is necessary to maintain the established plant community.

**Conservation practices**

| |
|---|
| Critical Area Planting |
| Grazing Land Mechanical Treatment |
| Range Planting |
| Heavy Use Area Protection |
| Integrated Pest Management (IPM) |
| Upland Wildlife Habitat Management |
| Early Successional Habitat Development/Management |
| Livestock Use Area Protection |
| Native Plant Community Restoration and Management |
| Prescribed Grazing |
| Invasive Plant Species Control |
| Grazing Management Plan - Applied |

## Pathway CP5.2-5.1
## Community 5.2 to 5.1

No Use, Drought, Disturbances, Severe and Frequent Grazing – After initiation of the reclamation process, establishment of seed mixture or recovery of vegetation is affected by land use and environmental factors. Further/continued disturbances or use before fully established will quickly degrade the community. Non-use for extended periods of time after establishment has led to some species becoming decadent, causing reduced vigor and potentially leading to die off.

## Transition T1-2
## State 1 to 2

Drought, Frequent or Severe Grazing – Drought conditions over extended periods of time weaken plant species beyond their resiliency, forcing the community over the threshold into the next state. Drought with added stress of frequent severe grazing can expedite the process. Frequent severe grazing of key species causes the site to become dominated by less desirable herbaceous species. Any combination of these factors reduces or removes the key bunchgrasses (Indian ricegrass and bottlebrush squirreltail), and causes Sandberg bluegrass or blue grama to become dominant.

**Constraints to recovery.** The loss of seed source, lack of hydrology (dry climate, sporadic rainfall, and alteration to water infiltration and runoff by sod-formers), and salt-laden soils limit the ability for seedling establishment.

## Transition T1-3
## State 1 to 3

Frequent and Severe Grazing, Severe Ground Disturbance, Drought - The combination of frequent and severe grazing and drought reduces the key bunchgrasses of this community. With no recovery time or rest, the forbs and grasses may become very sparse or may be removed from the community leaving a saltbush dominated site. Extended long periods of drought alone, or severe ground disturbance, reduces or inhibits resiliency of this community, including Gardner's saltbush.

**Constraints to recovery.** The development of a soil crust is prevalent in this soil, especially with the lack of herbaceous cover to protect from rain-drop impact. With the loss of grasses in this system, the crusting becomes a hindrance to seedling establishment. The loss of seed sources for the native key species also limits the ability for this community to recover.

**Context dependence.** The texture of soils within each community can influence the ability to recover. Heavier textured soils (higher clay content) will favor soil crusting or become "fluffy" easier as a response to the increased sodic or saline properties within the shales that many of the heavier textured soils are derived. Soils that are coarser or lighter textured (sandy and loamy textures) tend to have a lest prominent crust or soil cap, and tend to not become as loose or "fluffy" as the heavier textures do.

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

Prescribed Grazing (Long-term), (possibly with seeding) – By reducing use and allowing native grasses to propogate with rest or deffered grazing rotations, the potential to recover increases, but is dependent on a seed source and climate. The time necessary to see a transition back to reference may extend past what is feasible. Once this State has crossed into a blue grama dominated community, the potential for recovery is completely lost. Native seed mixtures that have been proven to tolerate saline, sodic, or saline/sodic soils are not necessarily the key species for the Reference communities. Once a site is seeded (drilled or broadcast seeding), the response to management and climatic conditions may be altered, and the site will not function as a native (undisturbed) site, and would correlate as a reclaimed site (R3-5).

**Conservation practices**

| |
|---|
| Fence |
| Livestock Pipeline |
| Prescribed Grazing |
| Pumping Plant |
| Grazing Land Mechanical Treatment |
| Range Planting |
| Watering Facility |
| Water Well |
| Upland Wildlife Habitat Management |
| Early Successional Habitat Development/Management |
| Planned Grazing System |
| Native Plant Community Restoration and Management |
| Prescribed Grazing |
| Pumping plant powered by renewable energy |
| Prescriptive grazing management system for grazed lands |

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

Frequent and Severe Grazing, Severe Ground Disturbance, Drought – Further stress opens the transition from the Saltbush/Perennial grasses to a Saltbush/*Bare Ground* dominated community (State 3). Reduced function of the perennial herbaceous species and decreased diversity weakens the resilience to changing conditions within the community. As grazing intensity remains high, drought is extensive, or if a source of ground disturbance occurs, the native perennial grasses can not maintain a foothold in the community forcing the community across the threshold to a Saltbush/*Bare Ground* state.

### Transition T2-4
### State 2 to 4

Non-Use, Ground Disturbance (with presence of seed source), Drought, Frequent or Severe Grazing – The vulnerability of transitioning from the Saltbush/Other Perennial Native Grasses state to an invaded state is increased as the canopy is opened with further disturbance, drought or grazing use. Non-use of a community opens the possibility of the soils becoming loose (fluffy), open to seedling establishment, but highly erosive.

**Constraints to recovery.** The inability to eradicate fully the invasive species (Cheatgrass and Halogeton) from a community is the limiting constraint to recover. Cost for initial treatment, and the need for continued treatment limit the economic feasibility of recovery as well.

**Context dependence.** The spatial extent of the infestation and the intended use of the land may alter the economic feasibility of treating a site-specific community.

### Restoration pathway R 3-1
### State 3 to 1

Prescribed Grazing (Long-term), (possibly with seeding) – By reducing use and allowing native grasses to recover with prescribed grazing, the potential to recover is dependent on a seed source and climate. However, the time required may not be feasible. If management is not maintained, this community may shift to State 2 before it will shift to Reference. Native seed mixtures that have been proven to tolerate saline, sodic, or saline/sodic soils are not necessarily the key species for the Reference communities. Once a site is seeded (drilled or broadcast seeding), the response to management and climatic conditions may be altered, and the site will not function as a native (undisturbed) site, and would correlate as a reclaimed site (R3-5).

**Conservation practices**

| |
|---|
| Critical Area Planting |
| Fence |
| Livestock Pipeline |
| Prescribed Grazing |
| Pumping Plant |
| Grazing Land Mechanical Treatment |
| Range Planting |
| Water Well |
| Upland Wildlife Habitat Management |
| Early Successional Habitat Development/Management |
| Native Plant Community Restoration and Management |
| Prescribed Grazing |
| Grazing Management Plan |
| Grazing management to improve wildlife habitat |
| Pumping plant powered by renewable energy |

| |
|---|
| Prescriptive grazing management system for grazed lands |

### Transition T3-4
### State 3 to 4

Non-Use, Ground Disturbance (with seed source present), Drought, Frequent or Severe Grazing – Once a community has transitioned to a saltbush dominated community, productivity and functionality of the site are at risk. If further disturbance (livestock, human or environmental disturbance) occurs, saltbush will begin to decrease and annuals and other less desirable species will begin to dominate. Hydrologic function will decrease and erosion hazard will increase as a community transitions into an invaded state.

**Constraints to recovery.** The lack of native key species and the harsh environment of the salt-laden soils reduces the ability for this site to recover. The difficulties of treating the non-native invaders also limits the recovery opportunities for these communities.

**Context dependence.** Spatial distribution of specific non-native/invasive species will determine what species may inhibit the community. Each species has a select influence and restriction to control that will need to be evaluated on a case by case basis.

### Restoration pathway R3-5
### State 3 to 5

Grazing Land Mechanical Treatment or Rangeland Seeding with Prescribed Grazing - The large scale success of contour furrowing on the rangelands with a mixture of crested wheatgrass and other introduced/cultivated species has shown that this landscape can be restored to a functional state using improved varieties and selective grazing land mechanical treatments. Once established the site will need to be managed for the species selected to ensure proper use of the resource. Once the site is disturbed there is a risk of erosion until establishment of the seedlings can occur. Management of undesired species (noxious or invasive weed species) is an integral component of the reclamation process to ensure the community is restored to an acceptable condition.

**Conservation practices**

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

### Restoration pathway R 4-5
### State 4 to 5

Integrated Pest Management, Grazing Land Mechanical Treatment, or Rangeland Seeding with Prescribed Grazing – Once invasive species such as cheatgrass, halogeton, or knapweeds are established, complete eradication is generally not a feasible option, limiting the ability to restore the community to a higher state. An invaded site, however, can be restored to a functional plant community through intensive or integrated pest management. Grazing land mechanical treatments to reduce existing invasive populations and to introduce forage species that are desirable and able to compete with the invasive species will provide limited grazing. When a community has been significantly invaded, losing all of the key forage species, re-seeding the site to a competitive species may be the only option. Establishment will be slow and the variety of available seed sources for saline/sodic/alkaline soil conditions is limited; however, small scale projects have been achieved with marginal success.

**Conservation practices**

| |
|---|
| Critical Area Planting |
| Grazing Land Mechanical Treatment |
| Range Planting |
| Heavy Use Area Protection |
| Integrated Pest Management (IPM) |
| Upland Wildlife Habitat Management |
| Early Successional Habitat Development/Management |
| Livestock Use Area Protection |
| Native Plant Community Restoration and Management |
| Prescribed Grazing |
| Invasive Plant Species Control |
| Grazing Management Plan - Applied |

### Transition T5-4
### State 5 to 4

Non-Use, Disturbance, Severe and Frequent Grazing, Drought with a seed source present – Loose soils as a result of non-use or the decrease in key species due to severe and frequent grazing, drought or disturbance opens the canopy and provides opportunity for invasive species to establish. Continued pressure, added disturbances, or introduction of undesirable species will weaken and trigger a shift from the degraded state to an Invaded state.

**Constraints to recovery.** The alternation to the soils and exiting herbaceous cover due to ground manipulation and disturbance shift the response of this site from natural conditions and will impact the ability to respond as an undisturbed site. Although this may be to a positive factor for the community and soils, it does shift the potential recovery to an altered state, not to a reference or native state.

**Context dependence.** This transition and these community will vary in appearance due to locality of specific seed sources (a wide variety of invasive or non-native species exists across this MLRA). The specific species that dominates this site will determine the response, recovery, and potential treatments required.

## Additional community tables

**Table 25. Community 1.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Mid-stature, Cool-season Bunchgrasses** | | | 34–84 | |
| | Indian ricegrass | ACHY | *Achnatherum hymenoides* | 34–84 | 10–25 |
| | needle and thread | HECO26 | *Hesperostipa comata* | 0–17 | 0–5 |
| 2 | **Short-stature, Cool-season Bunchgrasses** | | | 34–84 | |
| | squirreltail | ELEL5 | *Elymus elymoides* | 34–84 | 10–25 |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–17 | 0–5 |
| 3 | **Rhizomatous, Cool-season Grasses** | | | 34–50 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 34–50 | 10–15 |
| 4 | **Mat-forming (Tillering), Warm-season Grasses** | | | 0–17 | |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 0–17 | 0–5 |
| 5 | **Miscellaneous Grasses and Grass-likes** | | | 0–17 | |
| | Grass-like (not a true grass) | 2GL | *Grass-like (not a true grass)* | 0–17 | 0–5 |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–17 | 0–5 |
| **Forb** | | | | | |
| 6 | **Perennial Forbs** | | | 0–34 | |
| | tansyaster | MACHA | *Machaeranthera* | 0–17 | 0–5 |
| | cous biscuitroot | LOCO4 | *Lomatium cous* | 0–17 | 0–5 |
| | fernleaf biscuitroot | LODI | *Lomatium dissectum* | 0–17 | 0–5 |
| | pale bastard toadflax | COUMP | *Comandra umbellata ssp. pallida* | 0–17 | 0–5 |
| | plains pricklypear | OPPO | *Opuntia polyacantha* | 0–17 | 0–5 |
| | Missouri milkvetch | ASMI10 | *Astragalus missouriensis* | 0–17 | 0–5 |
| | yellow salsify | TRDU | *Tragopogon dubius* | 0–17 | 0–5 |
| | woodyaster | XYLOR | *Xylorhiza* | 0–17 | 0–5 |
| | Forb, perennial | 2FP | *Forb, perennial* | 0–17 | 0–5 |
| | textile onion | ALTE | *Allium textile* | 0–17 | 0–5 |
| **Shrub/Vine** | | | | | |
| 7 | **Dominant Shrubs** | | | 78–168 | |
| | Gardner's saltbush | ATGA | *Atriplex gardneri* | 56–168 | 20–45 |
| 8 | **Miscellaneous Shrubs** | | | 0–56 | |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 0–22 | 0–5 |
| | birdfoot sagebrush | ARPE6 | *Artemisia pedatifida* | 0–22 | 0–5 |
| | winterfat | KRLA2 | *Krascheninnikovia lanata* | 0–22 | 0–5 |
| | greasewood | SAVE4 | *Sarcobatus vermiculatus* | 0–22 | 0–5 |
| | bud sagebrush | PIDE4 | *Picrothamnus desertorum* | 0–22 | 0–5 |
| | shadscale saltbush | ATCO | *Atriplex confertifolia* | 0–22 | 0–5 |

**Table 26. Community 1.2 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Short-stature, Cool-season Bunchgrasses** | | | 34–84 | |
| | squirreltail | ELEL5 | *Elymus elymoides* | 34–84 | 10–25 |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–17 | 0–5 |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 0–17 | 0–5 |
| 2 | **Rhizomatous, Cool-season Grasses** | | | 34–84 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 34–84 | 10–25 |
| 3 | **Mid-stature, Cool-season Bunchgrasses** | | | 0–34 | |
| | Indian ricegrass | ACHY | *Achnatherum hymenoides* | 0–34 | 0–10 |
| | needle and thread | HECO26 | *Hesperostipa comata* | 0–17 | 0–5 |
| 4 | **Mat-forming (Tillering), Warm-season Grasses** | | | 0–17 | |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 0–17 | 0–5 |
| | alkali sacaton | SPAI | *Sporobolus airoides* | 0–17 | 0–5 |
| 5 | **Miscellaneous Grasses** | | | 0–17 | |
| | Grass-like (not a true grass) | 2GL | *Grass-like (not a true grass)* | 0–17 | 0–5 |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–17 | 0–5 |
| **Forb** | | | | | |
| 6 | **Perennial Forbs** | | | 17–34 | |
| | plains pricklypear | OPPO | *Opuntia polyacantha* | 0–17 | 0–5 |
| | textile onion | ALTE | *Allium textile* | 0–17 | 0–5 |
| | aster | ASTER | *Aster* | 0–17 | 0–5 |
| | cous biscuitroot | LOCO4 | *Lomatium cous* | 0–17 | 0–5 |
| | tansyaster | MACHA | *Machaeranthera* | 0–17 | 0–5 |
| | Missouri milkvetch | ASMI10 | *Astragalus missouriensis* | 0–17 | 0–5 |
| | Forb, perennial | 2FP | *Forb, perennial* | 0–17 | 0–5 |
| | smooth woodyaster | XYGL | *Xylorhiza glabriuscula* | 0–17 | 0–5 |
| | yellow salsify | TRDU | *Tragopogon dubius* | 0–17 | 0–5 |
| | leafy wildparsley | MUDI | *Musineon divaricatum* | 0–17 | 0–5 |
| | western aster | SYAS3 | *Symphyotrichum ascendens* | 0–17 | 0–5 |
| 7 | **Annual Forbs** | | | 0–11 | |
| | flatspine stickseed | LAOC3 | *Lappula occidentalis* | 0–11 | 0–5 |
| | woolly plantain | PLPA2 | *Plantago patagonica* | 0–11 | 0–5 |
| | madwort | ALYSS | *Alyssum* | 0–11 | 0–5 |
| **Shrub/Vine** | | | | | |
| 8 | **Dominant Shrubs** | | | 67–224 | |
| | Gardner's saltbush | ATGA | *Atriplex gardneri* | 67–224 | 15–25 |
| 9 | **Miscellaneous Shrubs** | | | 22–56 | |
| | birdfoot sagebrush | ARPE6 | *Artemisia pedatifida* | 0–22 | 0–5 |
| | shadscale saltbush | ATCO | *Atriplex confertifolia* | 0–22 | 0–5 |
| | Shrub, other | 2S | *Shrub, other* | 0–22 | 0–5 |
| | greasewood | SAVE4 | *Sarcobatus vermiculatus* | 0–22 | 0–5 |
| | winterfat | KRLA2 | *Krascheninnikovia lanata* | 0–22 | 0–5 |

**Table 27. Community 2.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Short-stature, Cool-season Bunchgrasses** | | | 34–112 | |
| | Sandberg bluegrass | POSE | *Poa secunda* | 17–67 | 5–20 |
| | squirreltail | ELEL5 | *Elymus elymoides* | 17–34 | 5–10 |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 0–11 | 0–5 |
| 2 | **Mat-forming (Tillering), Warm-season Grasses** | | | 6–50 | |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 6–50 | 0–15 |
| 3 | **Rhizomatous, Cool-season Grasses** | | | 0–17 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 0–17 | 0–5 |
| 4 | **Mid-stature, Cool-season Bunchgrasses** | | | 0–17 | |
| | needle and thread | HECO26 | *Hesperostipa comata* | 0–17 | 0–5 |
| | Indian ricegrass | ACHY | *Achnatherum hymenoides* | 0–17 | 0–5 |
| 5 | **Miscellaneous Grasses and Grass-likes** | | | 0–17 | |
| | Grass-like (not a true grass) | 2GL | *Grass-like (not a true grass)* | 0–17 | 0–5 |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–17 | 0–5 |
| **Forb** | | | | | |
| 6 | **Perennial Forbs** | | | 0–22 | |
| | yellow salsify | TRDU | *Tragopogon dubius* | 0–17 | 0–5 |
| | tansyaster | MACHA | *Machaeranthera* | 0–17 | 0–5 |
| | smooth woodyaster | XYGL | *Xylorhiza glabriuscula* | 0–17 | 0–5 |
| | fernleaf biscuitroot | LODI | *Lomatium dissectum* | 0–17 | 0–5 |
| | textile onion | ALTE | *Allium textile* | 0–17 | 0–5 |
| | cous biscuitroot | LOCO4 | *Lomatium cous* | 0–17 | 0–5 |
| | pale bastard toadflax | COUMP | *Comandra umbellata ssp. pallida* | 0–17 | 0–5 |
| | Missouri milkvetch | ASMI10 | *Astragalus missouriensis* | 0–17 | 0–5 |
| | plains pricklypear | OPPO | *Opuntia polyacantha* | 0–17 | 0–5 |
| 7 | **Annual Forbs** | | | 0–11 | |
| | woolly plantain | PLPA2 | *Plantago patagonica* | 0–11 | 0–5 |
| | flatspine stickseed | LAOC3 | *Lappula occidentalis* | 0–11 | 0–5 |
| | Wilcox's woollystar | ERWI | *Eriastrum wilcoxii* | 0–11 | 0–5 |
| | madwort | ALYSS | *Alyssum* | 0–11 | 0–5 |
| **Shrub/Vine** | | | | | |
| 8 | **Dominant Shrubs** | | | 45–202 | |
| | Gardner's saltbush | ATGA | *Atriplex gardneri* | 45–202 | 10–45 |
| 9 | **Miscellaneous Shrubs** | | | 0–45 | |
| | birdfoot sagebrush | ARPE6 | *Artemisia pedatifida* | 0–22 | 0–5 |
| | bud sagebrush | PIDE4 | *Picrothamnus desertorum* | 0–22 | 0–5 |
| | greasewood | SAVE4 | *Sarcobatus vermiculatus* | 0–22 | 0–5 |
| | Shrub, other | 2S | *Shrub, other* | 0–22 | 0–5 |
| | winterfat | KRLA2 | *Krascheninnikovia lanata* | 0–22 | 0–5 |

| | | | | | |
|---|---|---|---|---|---|
| | winterfat | KRLA2 | *Krascheninnikovia lanata* | 0–22 | 0–5 |
| | shadscale saltbush | ATCO | *Atriplex confertifolia* | 0–22 | 0–5 |

**Table 28. Community 2.2 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Mat-forming (Tillering), Warm-season Grasses** | | | 28–84 | |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 28–84 | 10–30 |
| | alkali sacaton | SPAI | *Sporobolus airoides* | 0–11 | 0–5 |
| 2 | **Short-stature, Cool-season Bunchgrasses** | | | 0–28 | |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–28 | 0–10 |
| | squirreltail | ELEL5 | *Elymus elymoides* | 0–17 | 0–5 |
| 3 | **Miscellaneous Grasses and Grass-likes** | | | 0–17 | |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–17 | 0–5 |
| | Grass-like (not a true grass) | 2GL | *Grass-like (not a true grass)* | 0–17 | 0–5 |
| 4 | **Mid-stature, Cool-season Bunchgrasses** | | | 0–17 | |
| | Indian ricegrass | ACHY | *Achnatherum hymenoides* | 0–17 | 0–5 |
| | needle and thread | HECO26 | *Hesperostipa comata* | 0–17 | 0–5 |
| 5 | **Rhizomatous, Cool-season Grasses** | | | 0–17 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 0–17 | 0–5 |
| **Forb** | | | | | |
| 6 | **Perennial Forbs** | | | 0–22 | |
| | tansyaster | MACHA | *Machaeranthera* | 0–17 | 0–5 |
| | yellow salsify | TRDU | *Tragopogon dubius* | 0–17 | 0–5 |
| | textile onion | ALTE | *Allium textile* | 0–17 | 0–5 |
| | cous biscuitroot | LOCO4 | *Lomatium cous* | 0–17 | 0–5 |
| | leafy wildparsley | MUDI | *Musineon divaricatum* | 0–17 | 0–5 |
| | pale bastard toadflax | COUMP | *Comandra umbellata ssp. pallida* | 0–17 | 0–5 |
| | Missouri milkvetch | ASMI10 | *Astragalus missouriensis* | 0–17 | 0–5 |
| | plains pricklypear | OPPO | *Opuntia polyacantha* | 0–17 | 0–5 |
| | smooth woodyaster | XYGL | *Xylorhiza glabriuscula* | 0–17 | 0–5 |
| | Forb, perennial | 2FP | *Forb, perennial* | 0–17 | 0–5 |
| 7 | **Annual Forbs** | | | 0–11 | |
| | Forb, annual | 2FA | *Forb, annual* | 0–11 | 0–5 |
| | flatspine stickseed | LAOC3 | *Lappula occidentalis* | 0–11 | 0–5 |
| | woolly plantain | PLPA2 | *Plantago patagonica* | 0–11 | 0–5 |
| | madwort | ALYSS | *Alyssum* | 0–11 | 0–5 |
| | Wilcox's woollystar | ERWI | *Eriastrum wilcoxii* | 0–11 | 0–5 |
| **Shrub/Vine** | | | | | |
| 8 | **Dominant Shrubs** | | | 28–112 | |
| | Gardner's saltbush | ATGA | *Atriplex gardneri* | 28–112 | 5–30 |
| 9 | **Miscellaneous Shrubs** | | | 0–45 | |
| | birdfoot sagebrush | ARPE6 | *Artemisia pedatifida* | 0–22 | 0–5 |

| | | | | | |
|---|---|---|---|---|---|
| | birdfoot sagebrush | ARPE6 | Artemisia pedatifida | 0–22 | 0–5 |
| | winterfat | KRLA2 | *Krascheninnikovia lanata* | 0–22 | 0–5 |
| | greasewood | SAVE4 | *Sarcobatus vermiculatus* | 0–22 | 0–5 |
| | Shrub, other | 2S | *Shrub, other* | 0–22 | 0–5 |
| | shadscale saltbush | ATCO | *Atriplex confertifolia* | 0–22 | 0–5 |

**Table 29. Community 3.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Rhizomatous, Cool-season Grasses** | | | 11–22 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 11–22 | 5–10 |
| 2 | **Short-stature, Cool-season Bunchgrasses** | | | 0–11 | |
| | squirreltail | ELEL5 | *Elymus elymoides* | 0–11 | 0–5 |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–11 | 0–5 |
| 3 | **Mat-forming (Tillering), Warm-season Grasses** | | | 0–11 | |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 0–6 | 0–3 |
| | alkali sacaton | SPAI | *Sporobolus airoides* | 0–6 | 0–2 |
| 4 | **Mid-stature, Cool-season Bunchgrasses** | | | 0–6 | |
| | needle and thread | HECO26 | *Hesperostipa comata* | 0–6 | 0–3 |
| | Indian ricegrass | ACHY | *Achnatherum hymenoides* | 0–6 | 0–2 |
| 5 | **Miscellaneous Grasses and Grass-likes** | | | 0–6 | |
| | Grass-like (not a true grass) | 2GL | *Grass-like (not a true grass)* | 0–6 | 0–2 |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–6 | 0–2 |
| **Forb** | | | | | |
| 6 | **Perennial Forbs** | | | 6–17 | |
| | plains pricklypear | OPPO | *Opuntia polyacantha* | 0–6 | 0–5 |
| | Forb, perennial | 2FP | *Forb, perennial* | 0–6 | 0–5 |
| | textile onion | ALTE | *Allium textile* | 0–6 | 0–5 |
| | tansyaster | MACHA | *Machaeranthera* | 0–6 | 0–5 |
| | smooth woodyaster | XYGL | *Xylorhiza glabriuscula* | 0–6 | 0–5 |
| | cous biscuitroot | LOCO4 | *Lomatium cous* | 0–6 | 0–5 |
| | leafy wildparsley | MUDI | *Musineon divaricatum* | 0–6 | 0–5 |
| | pale bastard toadflax | COUMP | *Comandra umbellata ssp. pallida* | 0–6 | 0–5 |
| | Missouri milkvetch | ASMI10 | *Astragalus missouriensis* | 0–6 | 0–5 |
| 7 | **Annual Forbs** | | | 0–6 | |
| | flatspine stickseed | LAOC3 | *Lappula occidentalis* | 0–6 | 0–5 |
| | mustard | BRASS2 | *Brassica* | 0–6 | 0–5 |
| | woolly plantain | PLPA2 | *Plantago patagonica* | 0–6 | 0–5 |
| | madwort | ALYSS | *Alyssum* | 0–6 | 0–5 |
| | Forb, annual | 2FA | *Forb, annual* | 0–6 | 0–5 |
| **Shrub/Vine** | | | | | |
| 8 | **Dominant Shrubs** | | | 22–168 | |
| | Gardner's saltbush | ATGA | *Atriplex gardneri* | 22–168 | 10–40 |

| | | | | | |
|---|---|---|---|---|---|
| 9 | **Miscellaneous Shrubs** | | | 0–45 | |
| | birdfoot sagebrush | ARPE6 | *Artemisia pedatifida* | 0–22 | 0–5 |
| | greasewood | SAVE4 | *Sarcobatus vermiculatus* | 0–22 | 0–5 |
| | Shrub, other | 2S | *Shrub, other* | 0–22 | 0–5 |
| | shadscale saltbush | ATCO | *Atriplex confertifolia* | 0–22 | 0–5 |
| | winterfat | KRLA2 | *Krascheninnikovia lanata* | 0–22 | 0–5 |

## Animal community

Animal Community – Wildlife Interpretations:

1.1 - Saltbush/Bunchgrasses: The predominance of woody plants in this plant community provides winter grazing for mixed feeders, such as elk, and antelope. Suitable thermal and escape cover for these animals are limited due to the low quantities of tall woody plants. When found adjacent to sagebrush-dominated states, this plant community may provide lek sites for sage grouse. Other birds that would frequent this plant community include western meadowlarks, horned larks, and golden eagles. Some grassland obligate small mammals would occur here.

1.2 - Saltbush/Rhizomatous Wheatgrasses: The combination of shrubs, grasses, and forbs can provide a forage source for large grazers, such as wild horses, deer and antelope. Suitable thermal and escape cover for these animals is limited due to the low quantities of tall woody plants. When found adjacent to sagebrush communities, this plant community may provide lek sites for sage grouse. Other birds that would frequent this plant community include western meadowlarks, horned larks and golden eagles. Some grassland obligate small mammals would occur here.

2.1 - Saltbush/Bluegrass: Decreased diversity and change in phenology of grasses and forbs reduces the value for the large grazers, but still has a forage source for them. Thermal and escape cover suitable for large animals is still very limited due to the low quantities of tall woody plants. Areas with sagebrush communities adjacent to this plant community may provide lek sites for sage grouse, and in productive years provides better cover for birds and some of the grassland obligate small mammals.

2.2 - Saltbush/Sod-formers: Forage value for large grazers has shifted to provide a late spring early summer source of green forage, although less accessible due to low growth stature. Cover is essentially non-existent, but when adjacent to sagebrush-dominated states, this plant community provides lek sites for sage grouse.

3.1 - Saltbush/*Bare Ground*: This Plant community exhibits a low level of plant species diversity. It may have forage value for antelope and deer, but in most cases is not a desirable plant community due to the lack of cover and selectivity by the wildlife. It is not, for most cases, a desirable plant community to select for in wildlife habitat management. Due to the open and exposed nature of this community, it may be a location for sage grouse leks, if there is edge effect provided by a sagebrush site surrounding the saltbush community.

4.1 – Native/Invasives/Saltbush: The unpalatable nature of many of the invasive species would reduce the value of this plant community for large grazers; however, species dependent, there would still be forage available. Suitable thermal and escape cover is very limited and highly variable. Seeds from invasive species would serve as a forage source for sage grouse and other birds as well as small mammals.

4.2 – Invasives/Saltbush: This plant community exhibits a low level of plant species diversity. It is not a desirable plant community to select as a wildlife habitat management objective. However, seeds produced by many of the invasive species serve as a forage source for sage grouse and other birds as well as grassland obligate small mammals. Knapweeds provide good cover for small mammals and birds as well.

4.3 - Halogeton: This plant community exhibits a low level of plant species diversity. It is not a desirable plant community to select as a wildlife habitat management objective. No known benefit to wildlife is known.

5.1/5.2 – Altered (Disturbed and Restored/Reclaimed): Depending on the stage of succession, or selected seed mixture, locations may vary widely on value for wildlife habitat management.

Animal Community – Grazing Interpretations:

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

Plant Community Production Carrying Capacity*

The Carrying capacity is calculated as the production (normal year) X .25 efficiency factor / 912.5 # / AUM to calculate the AUM's/Acre.
Plant Community Description/Title Lbs./Acre AUM/Acre*
Below Ave. Normal Above Ave.
1.1 Reference: Saltbush / Bunchgrasses 200 300 400 0.08
1.2 Saltbush / Rhizomatous Wheatgrasses 150 240 350 0.07
2.1 Saltbush / Bluegrass 75 200 300 0.05
2.2 Saltbush / Blue Grama 25 150 200 0.04
3.1 Saltbush / *Bare Ground* 50 90 150 0.02
4.1 Natives / Invasives / Saltbush ** ** ** **
4.2 Invasives / Saltbush ** ** ** **
4.3 Halogeton ** ** ** **
5.1 Disturbed/Degraded ** ** ** **
5.2 Restored/Reclaimed ** ** ** **

* - Carrying Capacity is figured for continuous, season-long grazing by cattle under average growing conditions.
** - Sufficient data for invaded and reclaimed communities has not be collected or evaluated, at this time, so no projection of a stocking rate recommendation or production range will be established at this time.

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

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

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

## Hydrological functions

Water and salinity are the principal factors limiting forage production on this site. Soils in the hydrologic group B and C dominate this site, with localized areas of hydrologic group D. Infiltration ranges from slow to moderate. Runoff potential for this site varies from moderate to high 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 may be present. Cryptogamic crusts are present, but only cover 1-2% of the soil surface.

## Recreational uses

This site provides limited hunting opportunities for upland game species. Because of the raw nature of these sites, cultural artifacts can be viewed in the area of these sites especially along the drainages that dissect the area. And the locations are general close or include a diverse geology that offers a chance to explore the unique and varied geology of the area. The extent of this ecological site is found within the Boysen State Park and the Wind River Indian Reservation. These entities have served to protect and provide cultural significance to this ecological site. This ecological site, however, proves to be limited in association with roadways and trails in relation to erosion potential and functionality. The soils will be sticky or slick when wet and are more erosive than other associated ecological sites. Need to take these soils into consideration when crossing the area with trails or roadways. The site is generally rough as well and provides no soft cover for camping or resting.

## Wood products

No appreciable wood products are present on the site.

## Other products

Herbs: There are a select few forb species that are found on this site, that have medicinal characteristics and have been used by the Native Americans in this area, and currently are in use by the naturopathic profession. There are several of the species that offered a food source to the Native Americans, but there are others that are toxic to some livestock and humans.

Ornamentals Species: The flowering forbs, specifically smooth woodyaster, of this site have been found useful in landscaping and xeriscaping. The shrub component has lent value in creating cultivated species that have been used in conservation plantings and in more natural landscaping schemes (including four-wing saltbush, shadscale, and spiny hopsage). Transplanting containerized stock is the most successful means of propagating these species. Seed collection and germination has some challenges. For more information consult the NRCS (Plant Materials Centers) plant guides for specific details.

Rare and Sensitive Species: Species of concern for barren soils along clay, silty, or redbed slopes are noted below. None of these species are noted specifically for saline sites, but do exist on soils that are associated with, adjacent to, or could have the same characteristics as the saline upland soils. Although these species are not endangered, they are generally found to be rare due to their isolated habitat ranges. One good example of this is Porter’s sagebrush. This species was thought to be endangered, but it is abundant where the soils are specific to its habitat. But the soil type is rare across this MLRA. These are still species to keep in mind as surveying a site.

Artermisia porteri – Porter’s Sagebrush: found on sparsely vegetated badlands of ashy or tufaceous mudstones and clay slopes.
Astragalus gilviflorus var. pupureus – Dubois Milkvetch: found on barren shale, bedrock, limestone, and redbed slopes and ridges.
Astragalus nelsonianus – Nelson’s Milkvetch: found on barren shale, badlands, limestone, and redbed slopes and ridges fringing the saline upland items.
Physaria saximontana var. saximontana – Rocky Mountain Twin Pod: found on sparsely-vegetated rocky slopes of limestone, sandstone, or clay.
Yermo xanthocephalus – Desert Yellowhead: found on barren outcrops of white silty clay, may be on fringes of the saline upland site.
Oxytropis besseyi var. obnapiformis – Maybell Locoweed: found on dry sandy, silty, chalky, or redbed clay slopes, hills, and ridges in sparsely vegetated cushion plant communities.

## Inventory data references

Information presented in the original site description was derived from NRCS inventory data. Field observations from range trained personnel were also used. Those involved in developing the original site include: Chris Krassin, Range Management Specialist, NRCS and Everet Bainter, Range Management Specialist. Other sources used as references include USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, USDI and USDA Interpreting Indicators of Rangeland Health Version 3, and USDA NRCS Soil Surveys from various counties.

Information presented here has been derived from NRCS inventory data, Field observations from range trained personnel, and the existing range site descriptions. Those involved in developing the Saline Upland range site include: Chris Krassin, Range Management Specialist, NRCS and Everet Bainter, Range Management Specialist.

Those involved in the development of the new concept for Saline Upland Ecological site include: Ray Gullion, Area Range Management Specialist, Jim Haverkamp, Area Range Management Specialist, NRCS; Mandi Hirsch, Range Management Specialist, Popo Agie Conservation District; Jim Wolf, Resource Manager, USDI-BLM; John Likins, Range Management Specialist, Retired USDI-BLM; Jeremy Artery, Rangeland Management Specialist, USDI-BLM; Leah Yandow, Wildlife Biologist, USDI-BLM; Daniel Wood, MLRA Soil Survey Leader, NRCS; Jane Karinen, Soil Data Quality Specialist, NRCS; and Marji Patz, Ecological Site Specialist, NRCS.

Quality control and quality assurance completed by: John Hartung, State Rangeland Management Specialist, NRCS; Brian Jensen, State Wildlife Biologist, NRCS; Scott Woodall, Regional Quality Assurance 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 (over story and understory captured with soil cover). Height of herbaceous and woody cover is collected every three feet along established transect.)
• Continuous Line Intercept (Woody Canopy Cover, with minimum gap of 0.2 of a foot for all woody species and succulents. Intercept height collected at each measurement.),
• Gap Intercept (Basal Gap measured with a minimum gap requirement of 0.7 foot.),
• 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, WY).
• Soil Stability (Slake Test – surface and subsurface samples collected and processed according to the soil stability guidelines provided by the Jornada Research Center, NM.)

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### Approval

Scott Woodall, 2/22/2019

### Rangeland health reference sheet

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

| | |
|---|---|
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| Composition (Indicators 10 and 12) based on | Annual Production |

### Indicators

1. **Number and extent of rills:** Rare to non-existent.

2. **Presence of water flow patterns:** Barely observable.

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground averages between 35 and 45% in reference conditions.

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

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

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7. **Amount of litter movement (describe size and distance expected to travel):** Herbaceous litter not expected to move.

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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 average values should be 4.0 or greater.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Refer to soil series description and map unit for specific information. The soil surface structure is fine moderate granular (moderate fine sub-angular or angular blocky parting to granular) with a surface depth of 2 to 7 inches (5- 15 cm). The dry surface Colors are generally in the 10YR to 7.5YR range with a Hue of 6 and a Chroma of 3. Organic matter in the surface ranges from 0.5 to 1.0.

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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 (30-45%) and litter plus slow to moderate 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. Canopy cover with basal cover is sufficient to reduce raindrop impact and reduce runoff.

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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):** No compaction layer should be present. Slight crusting may be visible, but friable and does not impede infiltration rates.

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Cool-season, Mid stature Grasses Shrubs

    Sub-dominant: Shrubs Short stature Grasses

    Other: Short stature Grasses Perennial Forbs

    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.

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14. **Average percent litter cover (%) and depth ( in):** Litter ranges from 5-20% of total canopy measurement with total litter (including beneath the plant canopy) from 30-50% expected. Herbaceous litter depth typically ranges from 3 - 5 mm. Woody litter can be 2-6 mm.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** English: 200 - 400 lbs/ac (300 lbs/ac average); Metric: 224 - 448 kg/ha (336 kg/ha average).

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:** Greasewood, Birdfoot Sagebrush, Flatspine Stickseed, Mustards, and Woolly Plantain, Annual false wheatgrass, false buffalograss are native species that increase with stress; invasive species such as, but not limited to: halogeton, cheatgrass (downy brome), thistles, knapweed, kochia, Russian thistle are also found on this site. Other common noxious weeds can be found on the Noxious Weed List for Wyoming and Fremont County.

17. **Perennial plant reproductive capability:** All species are capable of reproducing.