USDA Natural Resources Conservation Service

Ecological site DX032X01A143
Saline Upland Clayey (SUC) Big Horn Basin Core

Last updated: 3/04/2025
Accessed: 05/21/2025

General information

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

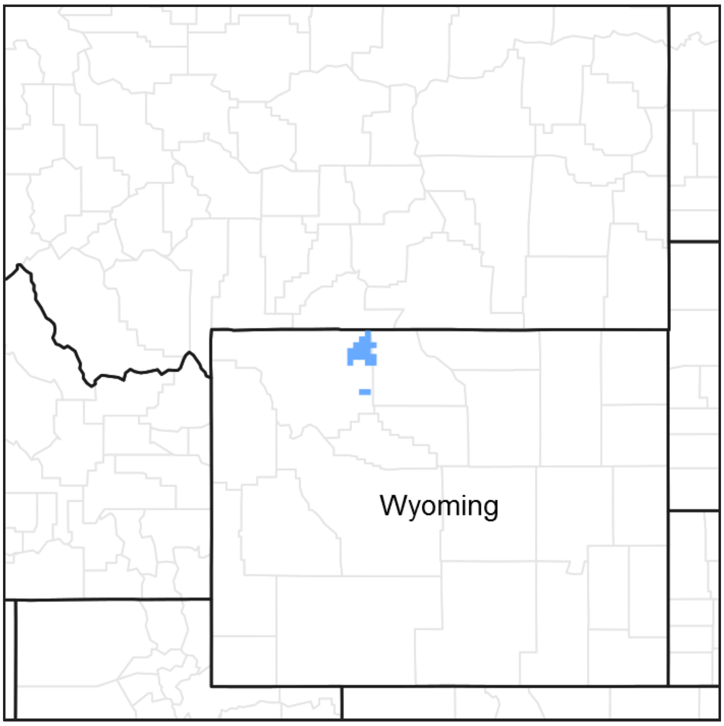


Figure 1. Mapped extent

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

MLRA notes

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

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 single these two basins out.

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

LRU notes

Land Resource Unit (LRU):

32X01A (WY): This LRU is the Big Horn Basin within MLRA 32. This LRU is lower in elevation, slightly warmer and receives slightly less overall precipitaiton than the Wind River Basin (LRU 02). This LRU was originally divided into two LRU's - LRU A which was the core and LRU B which was the rim. With the most current standards, this LRU is divided into two Subsets. This subset is Subset A, referred to as the Core, which is warm, dry eroded basin floor. As the LRU shifts outer edges, aspect and relation to the major bodies of water and taller landforms create minor shifts in soil chemistry influencing the variety of ecological sites and plant interactions. The extent of soils currently correlated to this ecological site does not fit within the digitized boundary. Many of the noted soils are provisional and will be reviewed and corrected in mapping update projects. Other map units are correlated as small inclusions within other MLRA's/LRU's based on elevation, landform, and biological references. Older ESD's will refer to LRU A. LRU A and LRU 01 in MLRA 32X are synonymous.

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

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

Classification relationships

Relationship to Other Established Classification Systems:

National Vegetation Classification System (NVC):
3 Xeromorphic Woodland, Scrub & Herb Vegetation Class
3.B Cool Semi-Desert Scrub & Grassland Subclass
3.B.1 Cool Semi-Desert Scrub & Grassland formation
3.B.1.NE Western North American Cool Semi-Desert Scrub & Grassland Division
M169 Great Basin Saltbush Scrub Macrogroup
G301 Atriplex corrugate – Artemisia pedatifida – Picrothamnus desertorum Dwarf-Scrub Group
CEGL001438 Atriplex gardneri 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.g Big Horn Salt Desert Shrub Basin

Ecological site concept

• Site does not receive any additional water.
• Slope is <25%
• Soils are:
- saline, sodic, or saline-sodic
- shallow, moderately deep, deep, or very deep
- <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 ranges from loam to clay in mineral soil surface 4” (10 cm) Clay content is 20% or greater
-Particle size control section has greater than 35% clay

The site concept is based on well-drained soils derived from sodic or alkaline shale. The original Saline Upland range site spanned all textures of soils grouping them based only by the chemical similarities. After closer review, as soils transition from a loamy soil profile towards sandy or clayey, the response to precipitation and management shift. A corresponding shift in plant communities also occurs. The outcome is a division of the Saline Upland ecological site into: Saline Upland, Loamy; Saline Upland, Sandy; and Saline Upland, Clayey. A separation may be warranted based on soils with salts/sodium as well as high levels of gypsum or calcium carbonate accumulations; laboratory data is necessary to make this determination. Until such time, these communities will be documented within the respective textural breaks of the Saline Upland site.

Associated sites

DX032X01A122	**Loamy (Ly) Big Horn Basin Core** Loamy sites are found adjacent to Saline upland sites. Generally are in depressional or concave areas on the dorsal edge of the landform, allowing a mixture of parent materials and time and moisture to flush salts lower in the profile.
R032XY104WY	**Clayey (Cy) 5-9” Big Horn Basin Precipitation Zone** The Clayey site is a mod deep to deep soil with similar soil texture characteristics but lacking the soil chemistry. These sites tend to have Wyoming Big Sagebrush and Western Wheatgrass plant communities.
R032XY118WY	**Impervious Clay (IC) 5-9” Big Horn Basin Precipitation Zone** Impervious Clay sites typically are found at the base of shale outcrops that are low or have minimal salts. They are Birdfoot sagebrush dominant site with only trace amounts of Gardner saltbush.
R032XY154WY	**Shale (Sh) 5-9” Big Horn Basin Precipitation Zone** Shale sites typically are found at the base of shale outcrops and are the very shallow component of the Saline Upland site. As they transition down slope soils gain depth to restrictive layer, increasing in vegetation and productivity
R032XY176WY	**Very Shallow (VS) 5-9” Big Horn Basin Precipitation Zone** Very Shallow sites typically are found at the base of rock outcrops and are the very shallow component of the Saline Upland site. These sites do not have the soil chemistry or soil content to carry much vegetation. As they transition down slope soils gain depth to restrictive layer, increasing in vegetation and productivity

Similar sites

R032XY144WY	**Saline Upland (SU) 5-9” Big Horn Basin Precipitation Zone** This site was the original description that ranged or included all textural classes of this site. This description also uses a wider area of interest, stretching precipitation further up into the foothills region of the Big Horn Basin.
R032XY244WY	**Saline Upland (SU) 5-9” Wind River Basin Precipitation Zone** This site is located in the Wind River Basin, has similar characteristics but due to varied climatic conditions, historically has been written as its own ecological site.
R032XY344WY	**Saline Upland (SU) 10-14" East Precipitation Zone** This site is the foothills higher precipitation version of the original description. Production is higher.

Table 1. Dominant plant species

Tree	Not specified

Shrub	(1) *Atriplex gardneri*
Herbaceous	(1) *Achnatherum hymenoides* (2) *Elymus elymoides*

Legacy ID

R032XA143WY

Physiographic features

These sites generally occur on slopes ranging from nearly level to 25%. It has been documented that most of these soils are found on the bottom of drainages in enclosed basins or where marine shales outcrop. They are also found to occupy soils of eroded shale outcrops along the toe of the foothills with lower precipitation. The inter-bedded and dissected Big Horn Basin has a mixture of these soils creating a wide range of saline-driven communities. Clayey sites are found closer to the originating parent material, Loamy along the central portions of the landforms or following both clayey and sandier parent material sources, and Saline Upland Sandy sites follow the lowest portion of the landscape or at the base of the salt laden sandstones or inter-bedded sandstone and shale.

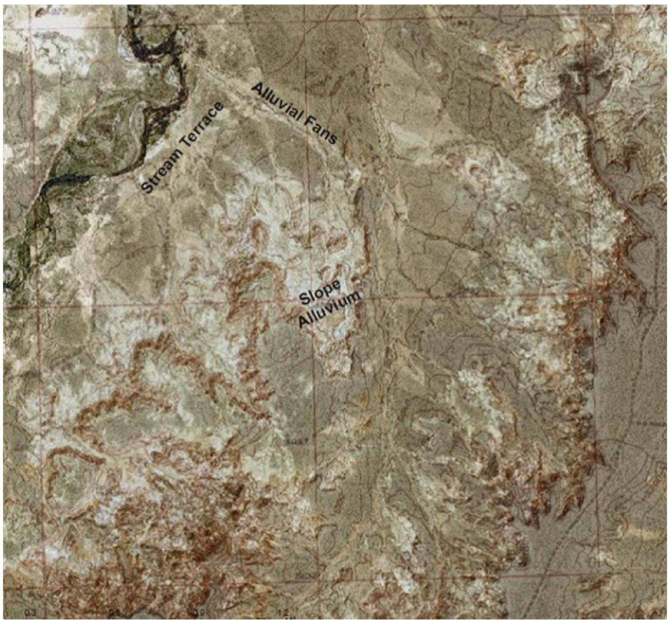


Figure 2. Aerial Imagery depicting landscape positions

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Stream terrace (3) Basin-floor remnant
Elevation	3,610–6,500 ft

Slope	0–25%
Ponding depth	0 in
Water table depth	48 in
Aspect	Aspect is not a significant factor

Climatic features

Annual precipitation ranges from 5 to 9 inches of relative effective annual precipitation. 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. Temperatures show a wide range between summer and winter and between daily maximums and minimums, due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures.

Chinook winds may occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring. High winds are generally blocked from the basin by high mountains, but can occur in conjunction with an occasional thunderstorm. Growth of native cool-season plants begins approximately April 1st and continues through July 1st. Cool weather and moisture in September may produce some green up of cool season plants that will continue to late October.

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

Table 3. Representative climatic features

Frost-free period (average)	125 days
Freeze-free period (average)	149 days
Precipitation total (average)	8 in

Climate stations used

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

Influencing water features

None Present. The lack of water table above 48 in (122 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.

Soil features

The soils for Saline Upland, Clayey are shallow to very deep (greater than 10" (25 cm) to bedrock), somewhat poorly to well-drained soils with slow to moderate permeability. The distinctive characteristic of the soils is their moderately to strongly saline and/or alkaline properties. The surface soil will vary from 1 to 6 inches (2-15 cm) in thickness. Some soils may contain more soluble salts in the sub-surface than in the surface. The soil characteristics that have the most influence on the plant community are the high quantity of soluble salts within the profile compounded by the heavy clay textures.

Several soils sampled were found to have significant amounts of visible gypsum crystals and masses within the profile, especially lower depths of 20-40 inches (50-100 cm) below the mineral soil surface. Many times the gypsum accumulations were not fully captured in the assigned series.

Major Soil Series correlated to this site include: Bributte, Cadoma, Cestnik, Chipeta, Deaver, Deaver-like, Finnerty - saline, Sayles, Stutzman, Stutzman-like, and Torchlight.

Typical Pedon: Torchlight Soil Series
TAXONOMIC CLASS: Fine, smectitic, calcareous, mesic Vertic Torriorthents. Typically, Torchlight soils have very friable granular A horizons and gypsiferous, very strongly alkaline fine textured C horizons. Well-drained; rapid runoff; slow permeability. Torchlight silty clay loam - grassland (Colors are for dry soil unless otherwise noted.)
GEOGRAPHIC SETTING: The Torchlight soils are on gently to moderately sloping alluvial fans and valley filling sideslopes below exposures of olive and gray highly gypsiferous and very alkaline shale. Slope gradients typically range from 0 to 10 percent. The soils formed in highly alkaline saline and gypsiferous parent sediments derived as alluvial fan sediments from sedimentary rock. At the type location the average annual precipitation is about 8 inches, approximately 6 inches of which falls during the months of April through

September. The mean annual soil temperature is 48 degrees F. and the mean summer soil temperature is 68 degrees F.

A1-- 0 to 4 inches; light brownish gray (2.5Y 6/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate and strong, very fine granular structure; soft, very friable; calcareous; strongly alkaline (pH 9.0); abrupt smooth boundary. (3 to 6 inches thick)
Range in Characteristics: The organic carbon content of the A horizon ranges from .5 to 1 percent and organic carbon decreases uniformly with depth. The A horizon has hue of 5YR through 10YR, chroma of 1 through 3 and value of 6 or 7 dry and 4 or 5 moist. It is soft to slightly hard. This horizon is strongly to very strongly alkaline (pH 8.8 to 10) and contains 15 to 25 percent exchangeable sodium.

Clca-- Clca--4 to 8 inches; Grayish brown (2.5Y 5/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate and strong fine angular blocky structure; very hard, very friable; weak to moderate secondary calcium sulfate and calcium carbonate accumulation occurring as crystals and small concretions; calcareous; strongly alkaline (pH 9.0); gradual smooth boundary. (3 to 6 inches thick)
Range in Characteristics: See Below.

C2cs-- 8 to 60 inches; light brownish gray (2.5Y 6/2 dry) heavy silty clay loam, dark grayish brown (2.5Y 4/2 moist); massive; hard, very friable; visible secondary calcium sulfate and calcium carbonate occurring as crystals, as small concretions, and in thin seams and streaks; calcareous; strongly alkaline (pH 9.0). (Several feet thick).
Range in Characteristics: The Ccs horizon has hue of 5Y through 10YR. It is strongly to very strongly alkaline (pH 8.8 to 10) and has approximately 2 to 10 percent CaC03 equivalent spread rather uniformly throughout the control section and not concentrated in any particular horizon. This horizon contains 15 to 25 percent exchangeable sodium.

RANGE IN CHARACTERISTICS:
These soils are calcareous throughout. Conductivity of the control section ranges from approximately 2 to 8 millimho and exchangeable sodium ranges from 15 to 25 percent throughout most of the control section. Cation exchange capacity ranges from approximately 60 to 90 millequivalents per 100 grams of clay. The control section is typically heavy silty clay loam or light silty clay with clay ranging from 35 to 50 percent, silt from 20 to 50 percent, and sand from 10 to 40 percent with typically less than 15 percent fine sand or coarser. Content of coarse fragments ranges from 0 to 15 percent but is typically less than 3 percent and consists mostly of shale chips. Calcium sulfate accumulation is moderate throughout the control section but is not concentrated in one horizon sufficiently to constitute a gypsic horizon.

TYPE LOCATION: Bighorn County, Wyoming; approximately 276 feet north and 252 feet east of the junction of the Basin-Gardner road and the old airport access road, in the SW quarter of the SE quarter of sec. 10, T.51N., R.93W.

Figure 7. Soils Profile Image.—Soil Profile for Saline Uplan

Table 4. Representative soil features

Parent material	(1) Residuum–shale
Surface texture	(1) Loam (2) Silty clay loam (3) Clay loam
Family particle size	(1) Clayey
Drainage class	Somewhat poorly drained to well drained
Permeability class	Slow to moderate
Soil depth	10–60 in
Surface fragment cover <=3"	0–25%
Surface fragment cover >3"	0–5%
Available water capacity (0-40in)	0.8–8.3 in
Calcium carbonate equivalent (0-40in)	0–14%
Electrical conductivity (0-40in)	4–16 mmhos/cm
Sodium adsorption ratio (0-40in)	13–40
Soil reaction (1:1 water) (0-40in)	7.4–10
Subsurface fragment volume <=3" (Depth not specified)	0–30%

Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological dynamics

This site presents as a sparsely vegetated landscape, dominated by salt tolerant plant species, especially woody species. The expected potential is low with composition consisting of 15% grasses, 10% forbs, and 75% shrubs (woody species). The grasses tend be "patchy" in nature finding depressions or concave landscape positions to occupy where the forbs are more evenly dispersed. The sporadic timing and quantity/intensity of storm events/precipitation with the fine textures of this site create a natural variation in production and composition.
Historic perception of these sites as "wastelands" and the in ceding lack of management on these sites has led to a shift in community vigor and composition. Fire is not a factor in these communities because of the lack of fine fuels to carry a fire, a stark contrast to the associated sagebrush communities.
Deterioration of this site is not as acute on the landscape as many communities, species such as halogeton, Russian thistle, and weedy annuals will become dominant as the grass and native forbs are reduced or completely removed from the site. The reference plant community (description follows the state and transition diagram) has been determined by study of rangeland relic areas, or areas protected from excessive disturbance. Trends in plant communities going from heavily grazed to lightly grazed, seasonal use pastures and historical accounts have also been used.
The following is a State and Transition Model (STM) Diagram for this ecological site. An STM has five fundamental components: states, transitions, restoration pathways, community phases and community pathways. The state, designated by the bold box, is a single community phase or suite of community phases. The reference state is recognized as State 1. It describes the ecological potential and natural range of variability resulting from the natural disturbance regime of the site. The designation of alternative states (State 2, etc) in STMs denotes changes in ecosystem properties that cross a certain threshold. Transitions are represented by the arrows between states moving from a higher state to a lower state (State 1 -> State 2) and are denoted in the legend as a “T” (T1-2). They describe the variables or events that contribute directly to loss of state resilience and result in shifts between states. Restoration pathways are represented by the arrows between states returning back from a lower state to a higher state (State 2 -> State1 or better illustrated by State 1 <- State 2) and are denoted in the Legend as an “R” (R2-1). They describe the management actions required to recover the state. Remediation is included.

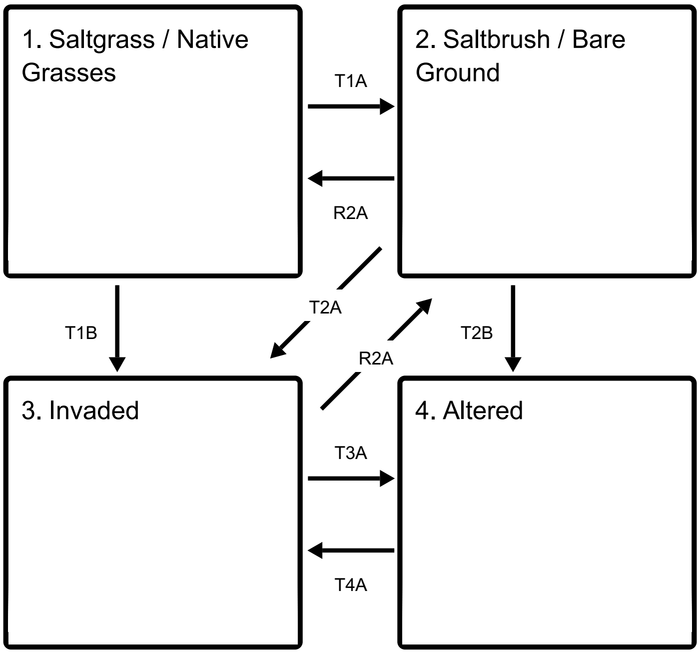
Community phases, small boxes within the bold state boxes, generally have important management or ecological significance. Collectively, the community phases represent the range of variation within a state, including conditions that place the state at risk for transition. Community pathways are represented by the lighter arrows moving between community phases and are labeled with “CP” (CP1.1-1.2). They describe the causes of shifts between community phases. The community phases captured in this STM may not represent every possibility, but are the most prevalent and repeatable plant communities.

The specific ecological processes and community variability will be discussed in more detail in the plant community narratives following the diagram. The plant composition tables, shown within each community phase narrative, have been developed from the best available knowledge at the time of this revision. As more data is collected, some of these plant communities may be revised or removed, and new ones may be added.

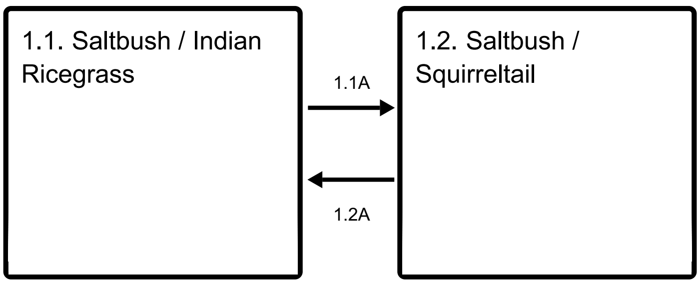
No plant communities should necessarily be thought of as “Desired Plant Communities”. According to the USDA NRCS National Range and Pasture Handbook, Desired Plant Communities (DPC’s) will be determined by the decision-makers and will meet minimum quality criteria established by the NRCS. The main purpose for including any description of a plant community here is to capture the current knowledge and experience at the time of this revision.

State and transition model

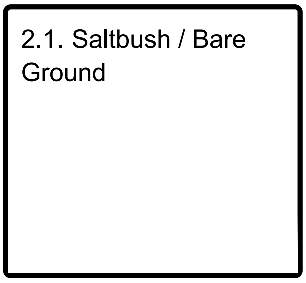
Ecosystem states



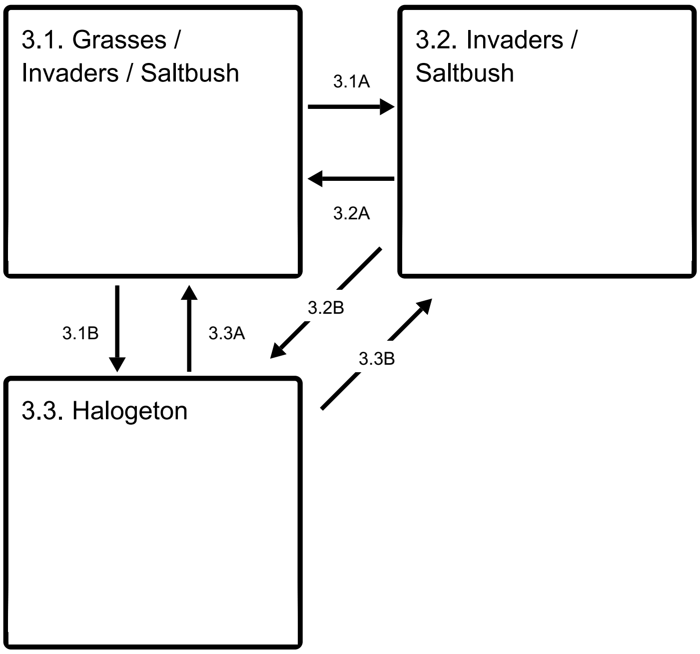
State 1 submodel, plant communities



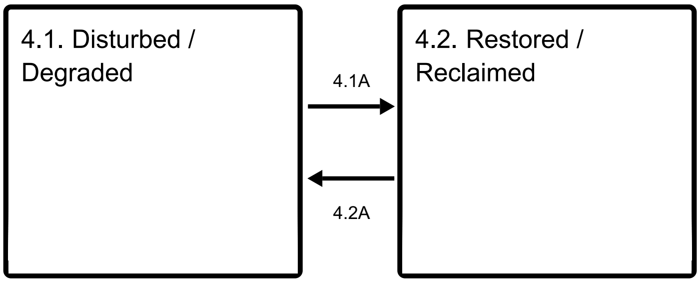
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Saltgrass / Native Grasses

The interpretive plant communities or Reference Communities (1.1 and 1.2) for this State have developed under moderate use throughout the year by large ungulates. Although these sites do not provide a large quantity of forage, the value of the saltbush and the interspersed grasses provides a food source for spring and fall grazing when other sites are sensitive. This State is fragile, but is well adapted to the climatic conditions of the Northern Intermountain Desertic Basins, and can respond and recover quickly to drought, is sustainable, but hard to re-establish once disturbed.

Community 1.1

Saltbush / Indian Ricegrass

Figure 8. Saline Upland Clayey Reference Community 1.1

Community phase 1.1, Saltbush/Indian Ricegrass is described as the Reference plant community. This community evolved under moderate grazing by large ungulates and with very droughty soil conditions due to the slower infiltration rates and salt content of the soil. Gardner saltbush and Indian ricegrass are the dominant desired species on this site. Other salt tolerant, drought resistant plants are Bottlebrush squirreltail and Birdfoot sagebrush; they are a minor component that can contribute significantly to the production of the site. A small variety of forbs are found on this site, and are listed on the plant community tables below. This site is at-risk of transitioning to community phase 1.2. Although well adapted to the climatic conditions, Indian Ricegrass is easily pressured out of the community with grazing and extended drought. The diversity in plant species allows for high drought resistance. This is a sustainable plant community in relation to soil stability, watershed function, and biologic integrity. The total annual production (air-dry weight) of this state is about 200 pounds per acre, but it can range from about 75 lbs./acre in unfavorable years, to about 350 lbs/acre in above average years.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	55	110	225
Grass/Grasslike	15	75	100
Forb	5	15	25
Total	**75**	**200**	**350**

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

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

Community 1.2
Saltbush / Squirreltail

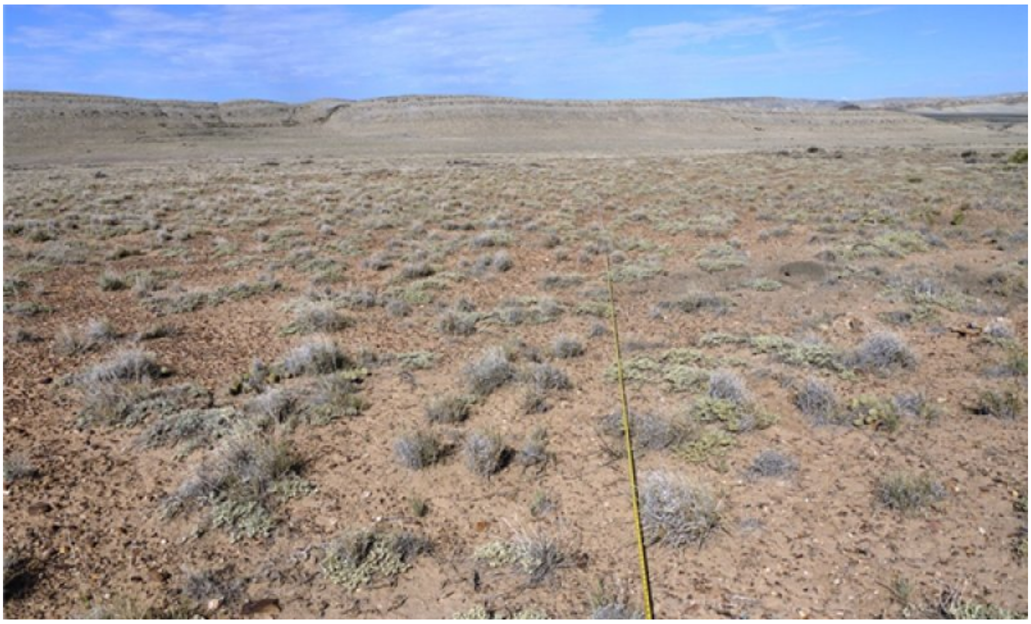


Figure 11. Community 1.2, Saltbush and Squirreltail community

Bottlebrush squirreltail will persist as Indian ricegrass delines under moderate, season-long grazing by large ungulates. Prolonged drought can play an important role and will exacerbate these conditions. Gardner's saltbush and Bottlebrush squirreltail are the major components of this plant community. Cool-season grasses make up the majority of the understory with the balance made up with annual cool-season grasses and miscellaneous forbs. Forbs commonly found on this site are Wild Onion, Biscuitroot, Smooth woodyaster, Leafy wildparsley, and Plains prickly pear. When compared to the Reference Community (1.1), Birdfoot sagebrush may have increased, Indian ricegrass has been removed from the community or may occur only in trace amounts. Alkali seepweed may have established within the site. The total annual production (air-dry weight) of this state is about 155 pounds per acre, but it can range from about 60 lbs./acre in unfavorable years, to about 300 lbs/acre in above average years. Rangeland Health Indicators: This plant community is relatively resistant to change. The herbaceous species are well adapted to grazing; however, species composition can be altered through long-term overgrazing. The herbaceous component is mostly intact and plant vigor and replacement capabilities are sufficient. Water flow patterns and litter movement may occur, but is 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.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	50	100	210
Grass/Grasslike	10	40	60
Forb	3	15	30
Total	**63**	**155**	**300**

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	0-2%
Litter	10-30%
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 (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	10-20%	–	1-5%
>0.5 <= 1	–	–	5-10%	–
>1 <= 2	–	–	–	–
>2 <= 4.5	–	–	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

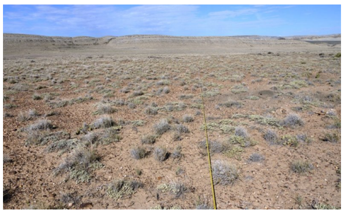
Figure 13. Plant community growth curve (percent production by month).

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

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

Pathway 1.1A
Community 1.1 to 1.2

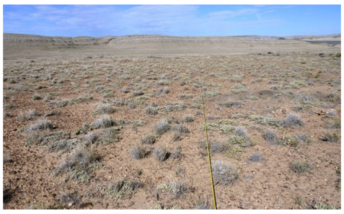
Saltbush / Indian Ricegrass



Saltbush / Squirreltail

Drought; Moderate, Continuous Season-long Grazing – Prolonged drought will stress Indian ricegrass beyond tolerance, reducing and possibly removing this from the community especially when conditions are exacerbated by moderate, continuous season-long grazing. The loss of production in Indian ricegrass is initially compensated by Bottlebrush squirreltail, and a flush of annual grasses may occur.

Pathway 1.2A
Community 1.2 to 1.1



Saltbush / Squirreltail

Saltbush / Indian Ricegrass

Long-term Prescribed Grazing, Rest - With long-term prescribed grazing including rest and rotation of use, Indian ricegrass will recover on the site. The small shift in Birdfoot sagebrush and Alkali seepweed will not disappear, but will be a very minor component on the site.

Conservation practices

Upland Wildlife Habitat Management
Prescribed Grazing

State 2
Saltbrush / Bare Ground

The loss of perennial grass species leaves an at-risk community that is vulnerable to invasive species, but is resilient and resistant to change. The resistance to change and low productivity of the land, diminish the ability and desire to improve or “manage” these landscapes. If managed properly, saltbush can be a great spring or fall food source for livestock and wildlife, with high sustainable protein availability throughout the year. The low stature (lack of structure) within this community limit snow catch and cover.

Community 2.1
Saltbush / Bare Ground

Figure 14. Community 2.1, Monoculture of Gardner Saltbush

The persistence and resilience of Gardner's Saltbush helps to create a stable plant community. Gardner’s saltbush is dominant, and in some cases may comprise 100% of the plant community. Perennial grasses and forbs have been reduced and more often removed from the community after being subjected to historic continuous year-long grazing. The interspaces between plants have expanded significantly leaving the amount of bare ground prevalent and the soil surface exposed to erosional elements. Pedestaling is more pronounced with the increased soil exposure, and litter persists mainly within the canopy of the Gardner's saltbush. Surface cracks and sealing may be prevalent. With the lack of competition this site is vulnerable to invasion by noxious weed species such as Russian knapweed and Halogeton. The crusting tendency of this site helps to hinder weed establishment, but will not prevent invasive species from finding a community niche. Halogeton is the most significant threat to this community, and will be discussed in further detail within the Invaded State. When compared to the Reference Community 1.1, plant production is greatly diminished due to the excessive amount of bare ground. The total annual production (air-dry weight) of this community is about 215 pounds per acre, but it can range from about 50 lbs./acre in unfavorable years, to about 350 lbs/acre in above average years. Rangeland Health Indicators: This plant community is resistant to change as the stand becomes more decadent. Fire is not a factor with the lack of fine fuels. Continued frequent and severe grazing, or the removal of grazing, does not seem to affect the plant composition or structure. Plant diversity is extremely low. The plant vigor is diminished and replacement capabilities are severely reduced due to the decrease in the number of cool-season grasses. Plant litter is noticeably less when compared to the Reference State (communities 1.1 and 1.2). Soil erosion is accelerated because of increased bare ground. Water flow patterns and pedestalling are obvious. Infiltration is reduced and runoff is increased. Rill channels may be noticeable in the interspaces and gullies may be establishing where rills have concentrated down slope.

Table 9. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	50	200	310
Forb	0	10	30
Grass/Grasslike	0	5	10
Total	**50**	**215**	**350**

Figure 16. Plant community growth curve (percent production by month). WY0501, 5-9BH Upland sites. Monthly percentages of total annual growth for all upland sites with dominantly C3 Cool season plants..

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

State 3
Invaded

The major invasive species that are moving into the Big Horn Basin are: Cheatgrass, Halogeton, Russian Knapweed, Whitetop, and a variety of thistles. Cheatgrass and Halogeton are the major threats found to occur within the Basin. The potential risk of becoming a monoculture of Cheatgrass has been minimal, with Halogeton being the more dominant and adapted species on these sites. Many areas of saline soils are used frequently by recreationalists for 4-wheeling, shooting, etc due to the open barren nature. With the increased “traffic” and corresponding increase in soil disturbance provides for a more prevalent and abundant seed source as well as improved seedling establishment created by the loosening of the soil surface.

Community 3.1
Grasses / Invaders / Saltbush

Figure 17. Halogeton enroachment with native community

The Grasses/Invaders/Saltbush community phase (plant community 3.1) will resemble the reference state communities (1.1 and 1.2) but will have the presence of invasive species such as Halogeton, Cheatgrass, or Knapweeds. All the structural components still exist, but are beginning to be reduced in vigor and composition. If managed aggressively, the weed invasion can be kept at a minimal level and could possibly be eradicated. If left unmanaged, change of this site may occur very slowly or could be exacerbated to a more degraded state by prolonged drought conditions. The total annual production of this state is about 185 pounds per acre, but it can range from about 70 lbs./acre in unfavorable years to about 350 lbs./acre in above average years. Rangeland Health Indicators: This Community phase (3.1) is relatively resistant to change; however, the invasive species will continue to increase if not managed. The other herbaceous species are well adapted to grazing and drought conditions. The plant composition is mostly intact and plant vigor and replacement capabilities are reduced but sufficient. Water flow patterns and litter movement may occur, but is not extensive. Instances 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.

Table 10. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	50	110	225
Grass/Grasslike	10	45	75
Forb	10	30	50
Total	**70**	**185**	**350**

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

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

Community 3.2
Invaders / Saltbush

As annuals or other invasive species increase the native grasses are weakened and eventually removed from the community. The resulting invader/saltbush dominated community is resistant and resilient against change. Cheatgrass may be a common threat, but unlike sagebrush communities, the Gardner's saltbush is able to maintain and prevent the dense monoculture stands of Cheatgrass. The corresponding fire risk of cheatgrass continues to be muted by the reduced fine fuels. Halogeton, however, has the ability to remove saltbush from a community; especially in the fine textured soils of this site. As other invasive species are brought into the Basin, the dynamics of this site will vary depending on the specific species. Due to the variable productivity and the extent of interaction with saltbush it is difficult to identify the potential productivity without completing a site specific evaluation. Rangeland Health Indicators: This plant community is resistant to change as the stand becomes more decadent. Continued frequent and severe grazing, or the removal of grazing, does not seem to affect the plant composition or structure of this plant community. Plant diversity is greatly altered and the herbaceous component is not intact. Recruitment of perennial grasses is not occurring and the replacement potential is minimal. The biotic integrity is missing.

Figure 20. Plant community growth curve (percent production by month). WY0501, 5-9BH Upland sites. Monthly percentages of total annual growth for all upland sites with dominantly C3 Cool season plants..

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

Community 3.3
Halogeton

Trials in the Red Desert of southern Wyoming provided evidence of the slow shift in composition of Gardner's saltbush communities. Halogeton is slowly overtaking many areas of Gardner Saltbush, with encroachment noted across multiple levels of disturbance. Drought is a known factor influencing this shift. Remnants of Gardner's saltbush will respond with timely precipitation, so overall composition will fluctuate with climatic patterns to some extent. These trials documented this shift within long-term established ex-closures that were a monoculture stand of healthy Gardner's saltbush. Halogeton has been able to move in and remove or severely reduce vigor of Gardner's saltbush within a period of 10-20 years. This plant community, Halogeton dominated or monoculture, can also be caused by severe ground disturbance. Halogeton is an aggressive weed that can persist when seemingly no other plants are able to establish.

Halogeton, and bare ground are the major part of this community. Small remnants of Bottlebrush sqirreltail and Gardner's saltbush will persist. Other sporadic annual forbs will make up the balance on this community. The total annual production (air-dry weight) of this community is about 75 pounds per acre, but it can range from about 50 lbs./acre in unfavorable years to about 150 lbs./acre in above average years. Rangeland Health Indicators: This community phase is vulnerable to excessive erosion. The biotic integrity of this plant community is at risk, depending on the severity of the shift in plant composition towards Halogeton and annual forbs. The watershed is at risk as bare ground increases.

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

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

Pathway 3.1A
Community 3.1 to 3.2

No Use/Management, Persistent Drought, Frequent and Severe Grazing, Further Disturbance – Once invasive species have gained a niche in a community no use is comparable to no management or over use. Drought on its own can force a community to change very quickly and with disturbances such as energy development, mining, or recreation, the supply of seeds and the open seedbed to initiate the invasive establishment work to spread the problem quickly across the landscape.

Pathway 3.1B
Community 3.1 to 3.3

Frequent, Severe Grazing; No-Use/Management; Persistent Drought; Further Disturbance – If a site is being grazed year-long repeatedly (frequent, severe) and with the constant pressure of drought, the herbaceous component as well as the Gardner's saltbush can be significantly impacted leaving a Halogeton dominated site.

Pathway 3.2A
Community 3.2 to 3.1

Integrated Pest Management/Invasive Species Control with Long-term Prescribed Grazing – In areas where remnant populations of cool season perennial grasses persist, weed control and grazing management tools are effective ways to preserve the perennial grass species, providing this site the potential to improve slightly.

Conservation practices

Integrated Pest Management (IPM)

Upland Wildlife Habitat Management
Prescribed Grazing
Invasive Plant Species Control

Pathway 3.2B
Community 3.2 to 3.3

Drought, No-Use/Management, Severe or Frequent Grazing, Disturbance – Prolonged periods of persistent drought will weaken and possibly remove Gardner's saltbush from the community. By opening the canopy, the plant composition will transition to nearly pure Halogeton community. The extremes of No use or no management (over-use) can expedite the process. Disturbances or removal of the perennial canopy will leave the community vulnerable, and most likely the first invader to establish in the community will be Halogeton.

Pathway 3.3A
Community 3.3 to 3.1

Integrated Pest Management/Invasive Species Control, Long-term Prescribed Grazing – The recovery process for this community will be slow and dependent on an active and aggressive weed control/management plan. Grazing and Weed management will help to encourage growth of the Gardner's saltbush and perennial grasses. This community may require assistance by inter-seeding of desired species, but seedling establishment is generally poor and cost prohibitive.

Conservation practices

Integrated Pest Management (IPM)
Upland Wildlife Habitat Management
Prescribed Grazing
Invasive Plant Species Control

Pathway 3.3B
Community 3.3 to 3.2

Integrated Pest Management/Invasive Species Control, Long-term Prescribed Grazing – Controlled grazing, Integrated pest management/weed control, and favorable precipitation will allow Gardner's saltbush to respond and improve in productivity. Long-term weed management plan as well as grazing management plan will be required to address the Halogeton over unfavorable years and a maintenance plan in favorable years to move the condition of this community to a positive trend. Full recovery from the invaded state is not expected, and presumed to be impossible.

Conservation practices

Integrated Pest Management (IPM)
Upland Wildlife Habitat Management
Prescribed Grazing
Invasive Plant Species Control

State 4
Altered

Climatic conditions and soil limitations restrict the feasibility of manipulating the native vegetation or degraded sites with much success. Additional inputs to help improve soil quality as well as artificial watering systems to assist in seedling establishment have been costly, and troublesome. Irrigating/watering these sites has created issues with surface crusting, inhibiting seedling emergence. Intensity and timing of natural precipitation has proved risky and nearly impossible to achieve a high level of success. However, areas have had acceptable establishment with introduced or improved plant varieties. Large landscapes of this ecological concept have been identified surrounding or intermixed with active bentonite mines, oil/gas developments, or have been used for recreational vehicles. The level and extent of disturbance varies greatly between uses. These are all factors considered in the following Community descriptions.

Community 4.1
Disturbed / Degraded

Small acres of abandoned lands have been created over an extended period of time. Changes in irrigation systems or in land management/ownership, to drought cycles have proven to shift large expanses of these soils to a degraded state. Irrigation of these sites is difficult, and many times attempts are short lived, but the change to the soil or plants are long-lasting. Once the soil has been tilled or mechanically worked the structure, function and possibly hydrology is altered. These changes, no matter how insignificant, prevent the site from returning to a true Reference State. Many times the disturbances are due to vehicle traffic from mining, farming, or recreation. Over time the saltbush is degraded and then removed. Oil and gas development process removes all vegetation to create pads and rig sites, leaving raw and compacted soils that are susceptible to weeds. Many times when left to recover by natural forces, areas will remain barren and exposed; or will progress slowly through primary succession and persist in a weed dominated condition. Successional processes create a highly variable community with productivity corresponding to the disturbance rather than to the community composition. In select locations introduced seedings were completed and then were left to adapt to the climate. Many of these plantings are still visible on the landscape with a distinctive row pattern in the vegetation. Crested wheatgrasses and/or Russian wildrye were the varieties seeded during the trials. The persistence of these species and the furrows or drill rows help to quickly identify these locations. In other instances, the edge of the pad site, or edge effect of fields, roads, etc are still visible on aerial photography. Because of the noted variability in community composition within this community phase, productivity and percent composition have not been developed. The growth curve was selected based on the reference community, and does not correlate to an expected composition of this community phase. Site specific evaluation needs to be completed to accurately capture the potential productivity and growth curves.

Figure 22. Plant community growth curve (percent production by month). WY0501, 5-9BH Upland sites. Monthly percentages of total annual growth for all upland sites with dominantly C3 Cool season plants..

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

Community 4.2
Restored / Reclaimed

Sustained increases in land values and shifts in ownership to less traditional land uses, are encouraging landowners to attempt improvement of the landscapes. The effects of land manipulation during the Bureau of Land Management contour furrow trials in the 1960's are still visible today. The seedings were comprised of non-native species and the furrows were designed to alter the hydrologic function of the location. These alteration to the plants and soils have prevented the community from being considered or compared to the Reference State. Incorporating wood chips or other organic substances into the soil will increase infiltration rates of the heavy textures and aid in reducing the chemistry of the soil by increasing the movement of salts. These amendments have been attempted with minimal success, and substantial cost. Reclamation/restoration to a preferred community on a small scale and over time has been accomplished. However, success rates are highly variable and site specific. Due to the lack of published studies in the area documenting native seeding trials, no production data has been collected at this time. The variability of this data is better determined on a site specific survey. The growth curve was selected to represent the native community; the curve will vary depending on the exact seeding mix selection.

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..

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

Pathway 4.1A
Community 4.1 to 4.2

Grazing Land Mechanical Treatment, Seeding with Long-term Prescribed Grazing, and

Integrated Pest Management – Locations that have been compacted by vehicle traffic, over-burden stock piles, etc may need to be remediated to reduce compaction and soil crusting. The severity or extent of mechanical manipulation will depend on the type of impact incurred. But mechanically working or preparing a seedbed, selecting a seed source that is tolerant to the soil characteristics and then seeding when conditions are optimal is difficult. The plant species available are generally not native and so may require approval by federal land managers if it is on federal lands. On the private scale, many of these species may be difficult to find or are expensive. Seeding rates will be higher and success is generally lower than is preferred. The site will need to have a long-term grazing system incorporated to establish and maintain the seeding. And due to the risk for weed invasion, weed control or integrated pest management is crucial.

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
Invasive Plant Species Control

Pathway 4.2A
Community 4.2 to 4.1

Failed Practices, No-use or Lack of Management, Further Disturbance – In the instance that a seeding fails, or conditions become unfavorable, a site may become eroded or gullied. Areas that are abandoned or have no management occurring tend to shift to a more degraded phase or become invaded with weeds. Many times, people will return to a site causing further disturbance, especially if reclamation/restoration has failed, or is in a preliminary stage.

Transition T1A
State 1 to 2

Frequent, Severe Grazing and Drought – When these communities are used year-long with no recovery and multiple uses per the growing season, the mid-stature cool season grasses will be removed or reduced to a very trace composition on the site. If this is again exacerbated with prolonged drought, the community will become a saltbush dominant or monoculture stand.

Transition T1B
State 1 to 3

Drought, Disturbance or Over-use with Seed Source present - When drought or a disturbance such as over-use by grazers occurs the vulnerability of the state is opened and when there is a seed source present, invasive species can gain a foot hold quickly due to the open canopy and low plant density.

Restoration pathway R2A
State 2 to 1

Long-term Prescribed Grazing - seeding with no to only minimal ground disturbance, cultural seeding practices – With extended grazing management, allowing rest and rotation, these sites may be prevented from further degradation, and will see a return to a reference state composition over very extended periods. Trials have been completed on an informal basis of broadcast seeding sites in the fall/winter, and then feeding hay over seeded area. Hoof action will incorporate organic material into the soil, increasing infiltration, improving nutrient availability and assisting to slow or prevent erosion, allowing an increased chance of seedling establishment. Although the scientific studies have not addressed this in the Basin, it has been seen to have a small success in isolated areas.

Conservation practices

Range Planting
Upland Wildlife Habitat Management
Prescribed Grazing

Transition T2A
State 2 to 3

Disturbance with Seed Source present, Drought – Ground disturbance from recreation, energy development or other activities provides a means to introduce a seed source into an already vulnerable community with the high bare ground and open canopy. Drought provides further stress on the saltbush, reducing vigor, and allowing species such as Halogeton and Cheatgrass to gain a foothold in the community.

Transition T2B
State 2 to 4

Mechanical Grazing Land Treatment (Furrowing/Pitting), Seeding – Several locations throughout the Big Horn Basin have been contour furrowed with a range plow with a 5 foot interval. In some areas non-native seedings were implemented while others had no seedings completed. The furrows assisted in catching and holding more moisture and provided a zone where establishment could take place. Overall improvements were seen to persist on these treated locations for over 20 years. However the process is quite expensive with low returns (long-term species response).

Restoration pathway R2A
State 3 to 2

Integrated Pest Management, Invasive Weed Control, Long-term Prescribed Grazing - As was mentioned above, it is known that with favorable weather and management, Gardner’s saltbush will respond and gain productivity, if a presence is there before treatments begin. The process is very slow and will require continual maintenance of the site to prevent Halogeton from returning.

Conservation practices

Integrated Pest Management (IPM)
Upland Wildlife Habitat Management
Prescribed Grazing
Invasive Plant Species Control

Restoration pathway T3A
State 3 to 4

Integrated Pest Management/Invasive Species Control, Grazing Land Mechanical Treatment, Seeding – With the improved varieties of plant materials that are available for salt-affected soils, seeding sites has become a more feasible solution. However, control of the invasive species with long-term grazing management as well as mechanical preparation and seeding will be required to have any level of success. Success will still be minimal due to the limiting climatic conditions that exist within the Big Horn Basin.

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
Invasive Plant Species Control

Transition T4A
State 4 to 3

Continued Disturbance or Lack of Use/Management with Seed Source present - Repeated misuse or abused by recreational traffic is common on the raw or "disturbed" appearance of reclaimed or manipulated areas. These at-risk locations are vulnerable to weed encroachment, especially by aggressive invasive species that are persistent within the Big Horn Basin. Knapweed and Halogeton, as well as Cheatgrass has seed sources readily available and easily transported on tires, undercarriages, animals, and humans. With continued presence of activity or movement through disturbed or establishing communities, the risk of transitioning to an invaded state increases.

Additional community tables

Table 11. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1				10–100	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	5–75	10–25
	squirreltail	ELEL5	*Elymus elymoides*	5–25	5–15
2				0–25	
	Grass, perennial	2GP	*Grass, perennial*	0–10	0–5
	Sandberg bluegrass	POSE	*Poa secunda*	5–10	2–5
	western wheatgrass	PASM	*Pascopyrum smithii*	0–5	0–1
Forb					
3				5–25	
	plains pricklypear	OPPO	*Opuntia polyacantha*	1–20	1–5
	woodyaster	XYLOR	*Xylorhiza*	0–10	0–5
	Forb, perennial	2FP	*Forb, perennial*	0–5	0–2
	textile onion	ALTE	*Allium textile*	0–5	0–2
	aster	ASTER	*Aster*	0–5	0–2
	desertparsley	LOMAT	*Lomatium*	0–5	0–2
Shrub/Vine					
4				50–210	
	Gardner's saltbush	ATGA	*Atriplex gardneri*	50–210	5–20
5	**Miscellaneous Shrubs**			0–25	
	birdfoot sagebrush	ARPE6	*Artemisia pedatifida*	0–25	0–5
	Shrub, other	2S	*Shrub, other*	0–10	0–5
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–5	0–2

Table 12. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1				10–45	

	squirreltail	ELEL5	*Elymus elymoides*	10–45	5–15
2				5–30	
	Grass, perennial	2GP	*Grass, perennial*	0–10	0–5
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	1–10	1–5
	Sandberg bluegrass	POSE	*Poa secunda*	5–10	2–5
	western wheatgrass	PASM	*Pascopyrum smithii*	0–5	0–1
Forb					
3				3–30	
	plains pricklypear	OPPO	*Opuntia polyacantha*	1–20	1–5
	woodyaster	XYLOR	*Xylorhiza*	0–10	0–5
	Forb, perennial	2FP	*Forb, perennial*	0–5	0–2
	textile onion	ALTE	*Allium textile*	0–5	0–2
	aster	ASTER	*Aster*	0–5	0–2
	desertparsley	LOMAT	*Lomatium*	0–5	0–2
4	**Annual Forbs**			0–20	
	flatspine stickseed	LAOC3	*Lappula occidentalis*	1–10	0–5
	threadleaf phacelia	PHLI	*Phacelia linearis*	0–5	0–2
	madwort	ALYSS	*Alyssum*	0–5	0–2
Shrub/Vine					
5				50–210	
	Gardner's saltbush	ATGA	*Atriplex gardneri*	50–210	5–20
6	**Miscellaneous Shrubs**			0–100	
	birdfoot sagebrush	ARPE6	*Artemisia pedatifida*	0–100	0–10
	Shrub, other	2S	*Shrub, other*	0–10	0–5
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–10	0–5
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	0–10	0–1
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–5	0–2

Table 13. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)

Grass/Grasslike					
1				0–5	
	squirreltail	ELEL5	*Elymus elymoides*	0–5	0–2
	western wheatgrass	PASM	*Pascopyrum smithii*	0–5	0–1
	alkali sacaton	SPAI	*Sporobolus airoides*	0–5	0–1
2				0–5	
	Grass, perennial	2GP	*Grass, perennial*	0–5	0–2
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–5	0–2
	Sandberg bluegrass	POSE	*Poa secunda*	0–5	0–1
Forb					
3				0–30	
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–10	0–3
	woodyaster	XYLOR	*Xylorhiza*	0–5	0–2
	Forb, perennial	2FP	*Forb, perennial*	0–5	0–2
	textile onion	ALTE	*Allium textile*	0–5	0–2
	desertparsley	LOMAT	*Lomatium*	0–5	0–1
	aster	ASTER	*Aster*	0–2	0–1
4				0–20	
	flatspine stickseed	LAOC3	*Lappula occidentalis*	0–10	0–5
	woolly plantain	PLPA2	*Plantago patagonica*	0–10	0–2
	threadleaf phacelia	PHLI	*Phacelia linearis*	0–5	0–2
	Forb, annual	2FA	*Forb, annual*	0–5	0–2
Shrub/Vine					
5				50–300	
	Gardner's saltbush	ATGA	*Atriplex gardneri*	50–300	10–20
6				0–100	
	birdfoot sagebrush	ARPE6	*Artemisia pedatifida*	0–100	0–10
	Shrub, other	2S	*Shrub, other*	0–10	0–2
	seepweed	SUAED	*Suaeda*	0–2	0–1

Table 14. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1				15–45	
	squirreltail	ELEL5	*Elymus elymoides*	10–30	5–15
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	5–25	1–5
2				5–30	
	Grass, perennial	2GP	*Grass, perennial*	0–10	0–5
	Sandberg bluegrass	POSE	*Poa secunda*	5–10	2–5
3	**Annual Grasses**			1–10	
	cheatgrass	BRTE	*Bromus tectorum*	0–10	0–5
	annual wheatgrass	ERTR13	*Eremopyrum triticeum*	0–10	0–5
Forb					
4				0–25	
	plains pricklypear	OPPO	*Opuntia polyacantha*	1–20	1–5
	woodyaster	XYLOR	*Xylorhiza*	0–10	0–5
	Forb, perennial	2FP	*Forb, perennial*	0–5	0–2
	textile onion	ALTE	*Allium textile*	0–5	0–2
	aster	ASTER	*Aster*	0–5	0–2
	desertparsley	LOMAT	*Lomatium*	0–5	0–2
5	**Annual Forbs**			0–50	
	saltlover	HAGL	*Halogeton glomeratus*	5–25	1–5
	flatspine stickseed	LAOC3	*Lappula occidentalis*	1–10	0–5
	threadleaf phacelia	PHLI	*Phacelia linearis*	0–5	0–2
	madwort	ALYSS	*Alyssum*	0–5	0–2
Shrub/Vine					
6				50–150	
	Gardner's saltbush	ATGA	*Atriplex gardneri*	50–150	5–20
7	**Miscellaneous Shrubs**			0–100	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	birdfoot sagebrush	ARPE6	*Artemisia pedatifida*	0–100	0–10
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–10	0–5
	Shrub, other	2S	*Shrub, other*	0–10	0–5
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	0–10	0–1
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–5	0–2

Animal community

Animal Community – Wildlife Interpretations

1.1 - Saltbush/Indian Ricegrass: 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/Squirreltail: 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 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.

2.1 - 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 as a wildlife habitat management objective. 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.

3.1 - Saltbush/Annuals/Perennial Grasses: 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.

3.2 - Saltbush/Annuals: 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.

3.3 - 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.

4.1 - Disturbed/Degraded and 4.2 - Restored/Reclaimed: Depending on the stage of succession of these sites or the selected seed mixture planted, 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 under normal growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of the conservation planning process. Often, the current plant composition does not entirely match any particular pant 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.

The Carrying capacity is calculated as the production for a normal year X.25 efficiency factor / 912.5 #/AUM to calculate the AUM's/Acre.

Plant Community Production
Plant Community Description/Title Lbs./Acre AUM/Acre*
Below Ave. Normal Above Ave.
1.1 Reference: Saltbush / Indian Ricegrass 75 200 350 0.04
1.2 Saltbush / Squirreltail 60 155 300 0.04
2.1 Saltbush / *Bare Ground* 50 215 350 0.05
3.1 Grasses / Invaders / Saltbush 70 185 350 0.05
3.2 Invaderes / Saltbush ** ** ** **
3.3 Halogeton 50 75 150 0.02
4.1 Disturbed/Degraded ** ** ** **
4.2 Restored/Reclaimed ** ** ** **

* - Continuous, Season-long grazing by cattle under average growing conditions.
** - Production and Carrying Capacity is dependent on the species mixture that is present and the stage of succession that each community is at. Site specific investigation is necessary due to the highly variable composition.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide year-long forage for cattle, sheep, or horses. During dormant period, generally, the forage for livestock use needs to be supplemented with protein because the quality does not meet minimum livestock requirements. However, if Gardner's saltbush is utilized, need to supplement during the dormant season may be reduced.

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 an 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 marginal hunting opportunities for upland game species. Because of the raw nature of these sites, cultural artifacts can be found or viewed in the area of these sites especially along the drainages that dissect the area. The

extent of this ecological site is found within three different wild
horse ranges: Pryor Mountain, McCullough Peaks, and 15 Mile. Wild Horse/Wildlife
Excursions are found as recreational venues for BLM lands and State
Lands within the Big Horn Basin. This ecological site, 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 this site.

Other products

Herbs: There are a select few forb species that are found on this site that have medicinal characteristics and/or are edible. These species have been used by the Native Americans in this area, and currently are used by the naturopathic profession and enthusiasts.

Ornamental Species: The flowering forbs of this site have been found useful in landscaping and xeriscaping. The shrub component has been cultivated to serve as a conservation planting and in more natural landscaping schemes.

Inventory data references

Information presented here has been derived from NRCS inventory data, Field observations from range trained personnel, and the existing range site descriptions. Those involved in developing the Loamy range site include: Chris Krassin, Range Management Specialist, NRCS and Everet Bainter, Range Management Specialist. Those involved in the development of the Saline Upland Loamy Ecological site include: Ray Gullion, Area Range Management Specialist, NRCS; Jim Wolf, Resource Manager, USDI-BLM; Jack Mononi, Range Management Specialist, USDI-BLM; Daniel Wood, MLRA Soil Survey Leader, NRCS; Jane Karinen, Soil Data Quality Specialist, NRCS; and Marji Patz, Ecological Site Specialist, NRCS.

Data references were taken from the following publication:
H.G. FIsser, D.C. Trueblood, and D.D. Samuelson. 1979. "Soil-Vegetation Relationships on Rangeland Exclosures in the Grass Creek Planning Unit of North Central Wyoming". University of Wyoming Cooperative Research Report to the Bureau of Land Management. 280 pp.

Type locality

Location 1: Big Horn County, WY	
Township/Range/Section	T52N R94W S19
UTM zone	N
UTM northing	4927536
UTM easting	723121
Latitude	44° 28′ 0″
Longitude	108° 11′ 41″
General legal description	647m N, 263m W, NE Corner of sec. 4.1 mi E. of Emblem, WY on Hwy 16, S. 1.5 mi Cty Rd. 14. 6.3 mi E. Bench Canal Rd. 3.75 mi E. Utility Access Rd. 108 m S. of Rd.

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Contributors

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Approval

Kirt Walstad, 3/04/2025

Rangeland health reference sheet

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

Author(s)/participant(s)	Marji Patz, Ray Gullion, Everet Bainter
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Date	01/16/2015
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills should not be present.

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

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3. **Number and height of erosional pedestals or terracettes:** Not evident on slopes less than 9%, but erosional pedestals will be present with terracettes at debris dams on slopes greater than 9%.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** *Bare Ground* is between 45 and 70%, occurring in small openings throughout the site.

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5. **Number of gullies and erosion associated with gullies:** Active gullies restricted to concentrated water flow patterns.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None

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7. **Amount of litter movement (describe size and distance expected to travel):** Little to no

plant litter movement. Plant litter remains in place and is not moved by erosional forces. As site increases in slope greater than 9% will see movement increase with slope.

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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):** Plant cover and littler average 30% or greater of the soil surface and maintains soil surface integrity. The soil stability class is found to average 3.2 ranging from 1 to 6.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The soil surface structure is moderate moderate granular (moderate fine subangular 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:** Sparse plant canopy, the finer soil textures, and the high amount of bare ground contribute to slow to moderate infiltration rates. The amount of bare ground and slow infiltration rates result in a naturally higher runoff rate even in reference state.

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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 or soil surface crusting should be present.

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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: Shrubs > Mid-stature Grasses

    Sub-dominant: Mid-stature Grasses > Forbs

    Other: Forbs = Short-stature Grasses

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very Low, but some plant mortality and decadence is expected.

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14. **Average percent litter cover (%) and depth (in):** Litter cover ranges from 5 to 20% with an average of 10% litter cover between plants; reaching a high of 30 under plants. Herbaceous litter depth typically ranges from 3-10 mm, and woody litter ranges from 2-6 mm.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Average Annual Production is 200 lbs. (91 kg) ranging from 75 to 350 lbs. (34-159 kg) production.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Birdfoot Sagebrush, Greasewood, Annual False Wheatgrass, False Buffalowgrass, Sandberg bluegrass, Woody aster, and a variety of native annual forbs will invade the site as it degrades. Invasive species that are common include but are not limited to: Halogeton, Cheatgrass, Knapweeds and Thistles. For a current and more complete list consult the County and State Weed and Pest Noxious Weed List.

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17. **Perennial plant reproductive capability:** May be limited due to effective moisture and seed/soil contact.
