USDA Natural Resources
Conservation Service

Ecological site DX032X01A145
Saline Upland Sandy (SUS) Big Horn Basin Core

Last updated: 9/16/2020
Accessed: 05/19/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

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

032X – 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

32X01 (WY): This LRU is the core of the Big Horn Basin, comprised of the eroded basin floor. As the LRU shifts toward the 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 to 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 MLRAs and LRUs based on elevation, landform, and biological references.

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

Temperature Regime: Mesic
Dominant Cover: Rangeland, with saltbush flats as 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 < 30%.
• Soils are:
o saline or saline-sodic.
o Shallow, Moderately deep, deep, or very deep
o With < 3% stone and boulder cover and < 20% cobble and gravel cover.
o Not skeletal (<35% rock fragments) within 20” (51 cm) of mineral soil surface.
o Textures usually range from sand to sandy loam in mineral soil surface 4” (10 cm). Clay content is less than 18%.
o Average particle size class is less than 18% clay.

The concept of this site is based on soils that are well drained formed in alluvium and residuum of sodic or alkaline sandstone parent materials. Originally,Saline Upland, spanned sandy through clayey soils grouping them based on chemical similarities. After closer review, it appears that as soil texture shifts from a loamy soil profile towards sandy or clayey, the response to management and climate changes, and there is a shift in plant communities. So the original Saline Upland Ecological Site will be divided into: Saline Upland, Loamy; Saline Upland, Sandy, and Saline Upland, Clayey.

There may also be a need to separate those saline/sodic soils that are gypsic or calcic once lab samples can be processed to support the need. Until such time, these communities will be documented within the respective textural breaks of the Saline Upland site.

Associated sites

DX032X01A146	**Sands (Sa) Big Horn Basin Core** The Sands ecological site has a distinct grass and forb composition as well as sagebrush rather than Gardner's saltbush. The Sands site occurs in wind blown areas on the landscape or directly associate with sandstone outcrops, but is lacking the salt characteristics.
DX032X01A166	**Shallow Sandy (SwSy) Big Horn Basin Core** The Shallow Sandy ecological site is also found adjacent to sandstone outcrops, and is lacking the salt characteristics catering to sagebrush dominated communities. There will be small pockets of Saline Upland Sandy intermixed with the Shallow Sandy site.
DX032X01A150	**Sandy (Sy) Big Horn Basin Core** The Sandy ecological site will be be similar in composition with Wyoming big sagebrush rather than saltbush. There is a difference in the forb composition as well as production between the Sandy and Saline Upland Sandy sites. Sandy will appear intermixed with small pockets of saline upland along the base of cretaceous sandstone outcrops.
DX032X01A141	**Saline Upland Loamy (SUL) Big Horn Basin Core** See Similar Sites.
DX032X01A122	**Loamy (Ly) Big Horn Basin Core** As move away from the sandstone outcrops, loamy soils tend to increase on the landscape. The loamy textures and lack of salts provides for a more productive sagebrush dominated community.
DX032X01A176	**Very Shallow (VS) Big Horn Basin Core** Very shallow sites will occur with rock outcrop and then as move away from the exposed rock as the soil profile becomes deeper, the Saline Upland Sandy occurs.

Similar sites

DX032X01A143	**Saline Upland Clayey (SUC) Big Horn Basin Core** The Saline Upland Clayey ecological site has the same Gardner's saltbush dominance and similar concept, however, the site has heavier textures and will respond to management slower and with a different community shift than the Saline Upland Sandy ecological site.
DX032X01A141	**Saline Upland Loamy (SUL) Big Horn Basin Core** The Saline Upland Loamy ecological site has overlapping plant communities, however, the site has heavier textures and will respond to management slower and with a different community shift than the Saline Upland Sandy ecological site.
DX032X01W140	**Saline Lowland Drained (SLDr) Big Horn Basin Wet** The Saline Lowland, Drained site is responsive to the additional moisture that is received from overland flow, and in areas with sandstone parent material will be very similar to the Saline Upland Sandy, however the drained site has prominent greasewood where the upland site should only have incidental occurrences of greasewood.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex gardneri* (2) *Atriplex confertifolia*
Herbaceous	(1) *Achnatherum hymenoides* (2) *Elymus elymoides*

Legacy ID

R032XA145WY

Physiographic features

The Saline Upland Sandy ecological site generally occurs on slopes ranging from nearly level to 30 percent. It has been documented that most of these soils are found on toe slopes and terraces below cretaceous sandstone outcrop. The inter-bedded and dissected geology of Big Horn Basin has a mixture of soils creating a wide range of saline-driven communities. Sandy 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.

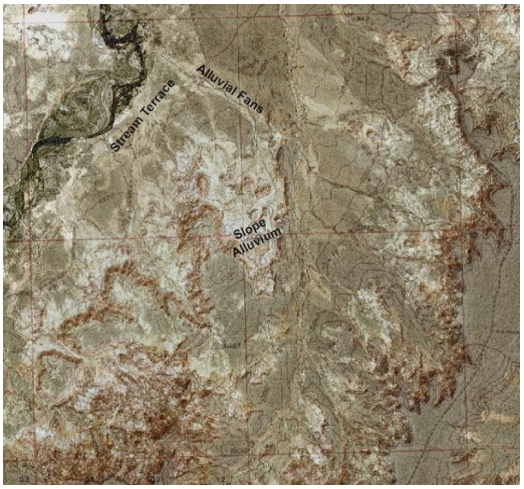


Figure 1. Aerial image of a set of landforms where Saline Upland ecological sites are commonly found.

Table 2. Representative physiographic features

Landforms	(1) Intermontane basin > Alluvial fan (2) Intermontane basin > Stream terrace (3) Intermontane basin > Erosion remnant
Runoff class	Negligible to medium
Elevation	1,052–1,463 m
Slope	0–30%
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. The noted peaks account for approximately 50 percent of the mean annual precipitation. Much of the moisture that falls in the latter part of the summer time is lost by evaporation and much of the moisture that falls during the winter months is lost by sublimation.

Average snowfall in the Big Horn Basin Core 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 the summer and winter months 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 time and bring rapid rises in temperature. Extreme storms may occur during the winter months, but most severely affect ranch operations during the late winter and spring months. High winds generally are blocked from the basin by high mountains but can occur in conjunction with an occasional thunderstorm.

Growth of native cool-season plants begins approximately on April 1st and continues through to July 1st. Cool weather and moisture in September may produce some green-up of cool-season plants that will continue to late October. For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/. Basin, Emblem, Greybull, Lovell, Worland FAA AP and Worland are the representative weather stations for LRU A. The following graphs and charts are a collective sample representing the averaged normals and 30-year annual rainfall data for the selected weather stations from 1981 to 2010.

Table 3. Representative climatic features

Frost-free period (characteristic range)	110-115 days
Freeze-free period (characteristic range)	131-142 days
Precipitation total (characteristic range)	178-203 mm
Frost-free period (actual range)	105-119 days
Freeze-free period (actual range)	130-150 days
Precipitation total (actual range)	152-203 mm
Frost-free period (average)	112 days
Freeze-free period (average)	138 days
Precipitation total (average)	178 mm

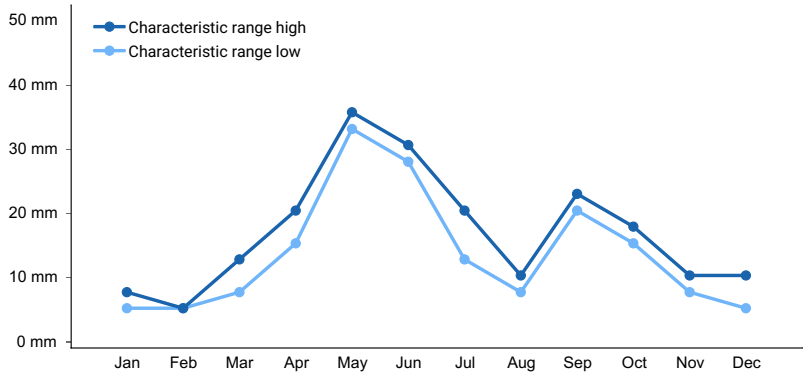


Figure 2. Monthly precipitation range

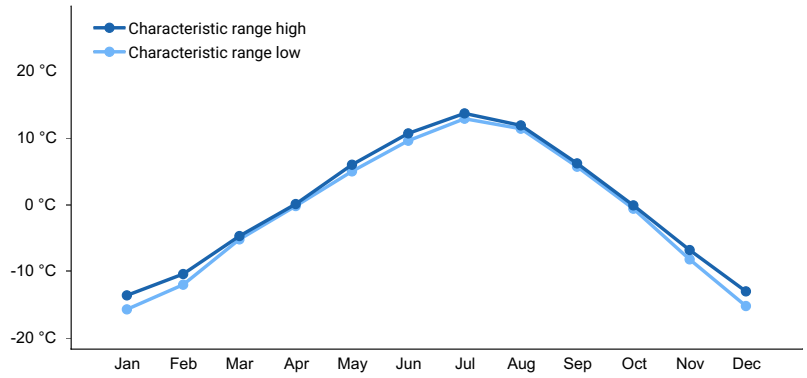


Figure 3. Monthly minimum temperature range

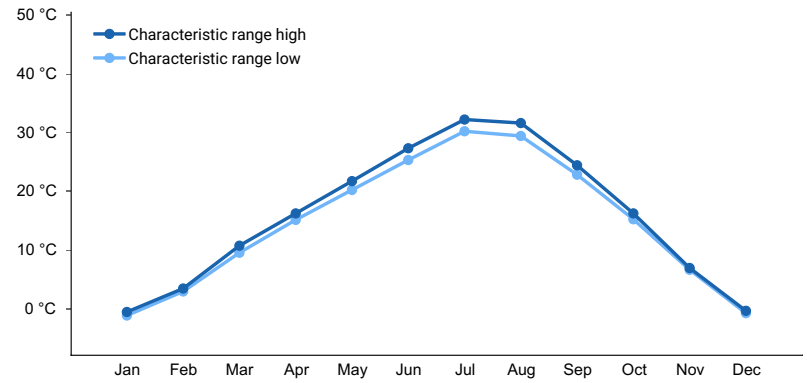


Figure 4. Monthly maximum temperature range

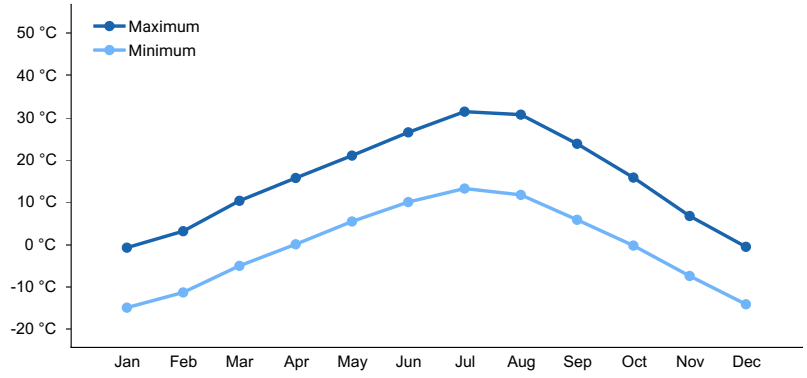


Figure 5. Monthly average minimum and maximum temperature

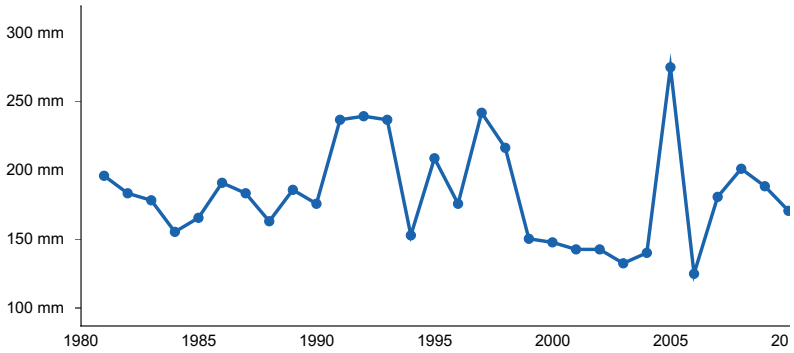


Figure 6. Annual precipitation pattern

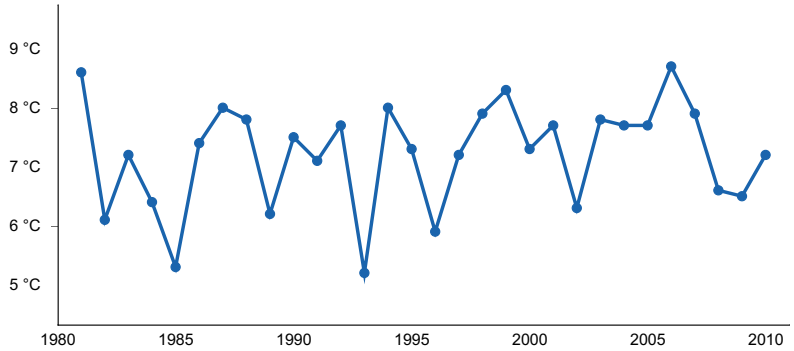


Figure 7. Annual average temperature pattern

Climate stations used

- (1) EMBLEM [USC00483031], Burlington, WY
- (2) LOVELL [USC00485770], Lovell, WY
- (3) WORLAND [USW00024062], Worland, WY
- (4) BASIN [USC00480540], Basin, WY
- (5) GREYBULL [USC00484080], Greybull, WY
- (6) WORLAND [USC00489770], Worland, 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 or overland flow. There may be isolated features that are affected by snowpack that persists longer than surrounding areas due to position on the landform (shaded or protected pockets). No streams are classified within this Saline Upland Sandy ecological site.

Soil features

The soils for Saline Upland Sandy are shallow to very deep (greater than 10 inches (25 cm) to bedrock), 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. These soils often contain more soluble salts deep in the soil profile or immediately on 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 coarse 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: Enos-like and Wallson

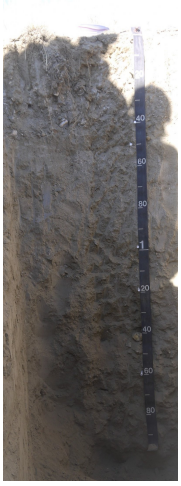


Figure 8. Backhoe pit excavated in a Saline Upland Sandy ecological site.

Table 4. Representative soil features

Parent material	(1) Slope alluvium–interbedded sedimentary rock (2) Residuum–sandstone (3) Colluvium
Surface texture	(1) Gravelly, channery loamy sand (2) Sandy loam (3) Loam
Family particle size	(1) Coarse-loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderate to very rapid
Depth to restrictive layer	25 cm
Soil depth	51 cm
Surface fragment cover <=3"	0–20%
Surface fragment cover >3"	0–15%
Available water capacity (Depth not specified)	3.05–16 cm
Calcium carbonate equivalent (Depth not specified)	0–5%
Electrical conductivity (Depth not specified)	2–16 mmhos/cm
Sodium adsorption ratio (25.4-101.6cm)	13–40
Soil reaction (1:1 water) (Depth not specified)	7.8–10
Subsurface fragment volume <=3" (Depth not specified)	0–25%
Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological dynamics

Salt-tolerant and sand-adapted plant species are dominant on this site; specifically, drought-tolerant low shrub species and mid-stature cool-season perennial bunchgrasses. The potential composition is 45% grasses, 15% forbs, and 40% shrubs (woody species). Bare ground is elevated compared to sites without salt influences, due to the soil capping that occurs with the reaction of the salts and soil moisture. The lowered permeability and infiltration rates reduce the ability for plant persistence. The composition and production will vary naturally due to fluctuation in timing and intensity of precipitation. Historic use has shifted the vigor and plant community, removal of sheep and

introduction to cattle has altered the natural selection on this site. Fire frequency is not factor due to the lack of fine fuels necessary to sustain a fire.

As this site deteriorates, the cool season grasses decrease (Indian Ricegrass, Bottlebrush Squirreltail, and needle and thread), in both frequency and production and this allows a slight increase in woody species (Gardner's saltbush, fourwing saltbush, shadscale, and possibly Greasewood). Finally, weedy annuals will begin to invade, including halogeton and cheatgrass.

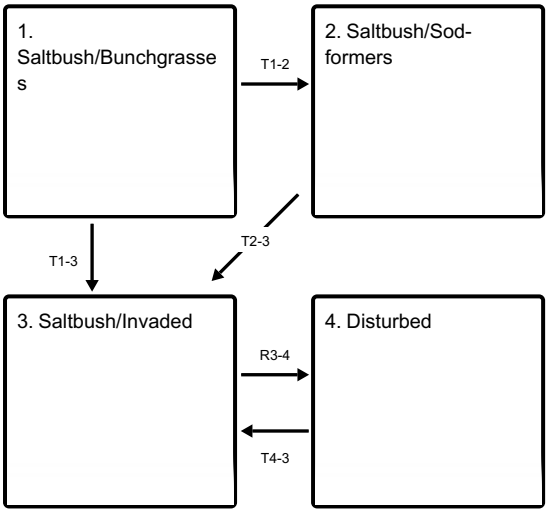
The reference community (description follows the state and transition diagram) has been determined by study of rangeland relic areas, or areas protected from excessive disturbance. Trends in plant communities going from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts 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 - State 1 or better illustrated by State 1

State and transition model

Ecosystem states



T1-2 - Drought or shifts in timing of precipitation alone, or with frequent and/or severe grazing, will transition this site from a bunchgrass dominated to a tillering grass dominated community.

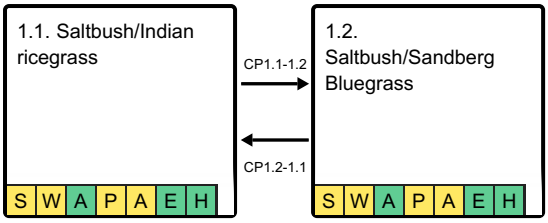
T1-3 - Ground disturbances, with a seed source present, open this canopy to invasive species such as cheatgrass. Drought and frequent and severe grazing can expedite the transition.

T2-3 - Ground and canopy disturbances with a seed source present allow the establishment of invasive species in the community. Disturbances can include drought, continuous season-long grazing, and/or recreation.

R3-4 - Integrated pest management (weed control), seedbed preparation and seeding, with long term management post treatment are needed to restore the invaded community so a near reference community.

T4-3 - Drought, frequent and severe grazing, with on going ground disturbances with introduction of a seed source can revert this state to an invaded state.

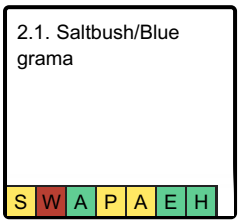
State 1 submodel, plant communities



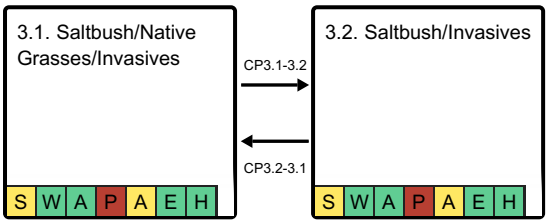
CP1.1-1.2 - Moderate to severe season-long grazing with drought will shift the plant community from mid-stature to more short-stature bunchgrasses.

CP1.2-1.1 - Implementation of a long-term grazing management system including rest or deferred rotation allows for recovery of the key herbaceous plant species.

State 2 submodel, plant communities



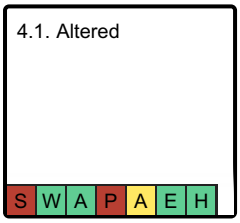
State 3 submodel, plant communities



CP3.1-3.2 - Continued disturbance compounded by drought leave this community susceptible to further invasion, especially when no weed management or change in management occurs.

CP3.2-3.1 - An early response to weed infestation with a shift in management and application of weed control will assist the remnant population of native herbaceous species to recover in the community.

State 4 submodel, plant communities



State 1
Saltbush/Bunchgrasses

The Reference Communities (1.1 and 1.2) for this State have developed under moderate use throughout the year by large ungulates. Although the Saline Upland Sandy ecological site does 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.

Characteristics and indicators. This state is characterized by a dominance of Gardner's saltbush and a mixture of mid-stature bunchgrasses and some rhizomatous species. A variety of forbs are present in these communities.

Resilience management. The Saltbush/Bunchgrasses State is easily shifted when disturbance occurs and is hard to re-establish once disturbed. However, the ecological site is well adapted to the climatic conditions, allowing quick recovery from drought, making it sustainable.

Community 1.1
Saltbush/Indian ricegrass

Figure 9. Community with a healthy population of alkali sacaton and Indian ricegrass on a Saline Upland Sandy ecological site.

Equal composition of Gardner's saltbush and perennial grasses with a minor component of perennial forbs is the signature characteristic of the reference plant community for the Saline Upland Sandy ecological site. The dominant plant community can be found on areas that are properly managed with prescribed grazing including short periods of rest/deferment. Potential vegetation is about 45% grasses or grass-like plants, 15% forbs, and 40% woody plants. Gardner's saltbush dominates the site with shadscale and bud sagebrush, Indian ricegrass, needle and thread, and prairie junegrass being sub-dominate. Common species include other potential salt tolerant shrubs, spiny hopsage, bottlebrush squirreltail, blue gramma, and sand dropseed. The total annual production (air-dry weight) of this community is about 250 pounds per acre, but it can range from about 125 lbs./acre in unfavorable years to about 350 lbs./acre in above average years.

Resilience management. This state is fragile, but well adapted to the climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community but is difficult to re-establish when damaged, in reference to site/soil stability, watershed function, and biologic integrity.

Dominant plant species

- Gardner's saltbush (*Atriplex gardneri*), shrub
- shadscale saltbush (*Atriplex confertifolia*), shrub
- fourwing saltbush (*Atriplex canescens*), shrub
- spiny hopsage (*Grayia spinosa*), shrub
- Indian ricegrass (*Achnatherum hymenoides*), grass
- needle and thread (*Hesperostipa comata*), grass
- prairie Junegrass (*Koeleria macrantha*), grass
- alkali sacaton (*Sporobolus airoides*), grass
- little larkspur (*Delphinium bicolor*), other herbaceous
- scarlet globemallow (*Sphaeralcea coccinea*), other herbaceous
- evening primrose (*Oenothera*), other herbaceous
- tansyaster (*Machaeranthera*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Wind erosion
- Aggregate instability
- Naturally available moisture use
- Plant productivity and health
- Plant structure and composition
- Feed and forage imbalance

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	84	168	224
Grass/Grasslike	50	84	112
Forb	6	28	56
Total	**140**	**280**	**392**

Table 6. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	0%
Grass/grasslike basal cover	0%
Forb basal cover	0%
Non-vascular plants	0%
Biological crusts	0-5%
Litter	10-20%
Surface fragments >0.25" and <=3"	0-30%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	30-50%

Table 7. Canopy structure (% cover)

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

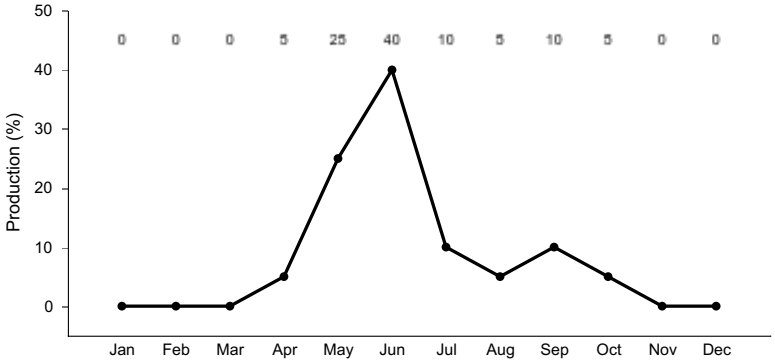


Figure 11. Plant community growth curve (percent production by month). WY0701, 10-14E upland sites.

Community 1.2
Saltbush/Sandberg Bluegrass

Figure 12. Community at-risk of crossing the threshold between Community 1.2 and 2.1 due to significant increase in blue grama.

Gardner’s saltbush and Sandberg bluegrass are the major species comprising this community. Grass species that are common on the site include prairie junegrass, sand dropseed, blue grama, and needle and thread. Forbs commonly found in this plant community include granite prickly phlox, scarlet gaura, low larkspur, tansyaster, and evening primrose. This plant community maintains diversity, but lacks the structure for cover and wildlife habitat. When compared to the Reference Community, Sandburg bluegrass and blue grama have increased and plains pricklypear cactus has invaded. Indian ricegrass has decreased and may occur in only trace amounts within the patches of plains pricklypear. Saltbush/Sandberg Bluegrass plant community is found under moderate, season-long grazing by livestock. Prolonged drought will move a reference community to this community phase, and together with continuous season-long grazing this transition can happen more readily. This community responds to the wet and dry growing seasons with an exaggerated shift in production. The fire threat is minimal because of the lack of fine fuels; however, in wet early springs or late fall, bluegrass response may provide the cover and fuels to increase the risk of fire. This plant community is still dominated by Gardner's saltbush and cool-season grasses, while short warm-season grasses and miscellaneous forbs account for the balance of the understory. Under continued drought or intense grazing, this community is at-risk of shifting to a sod-forming, warm-season dominated grass community. The total annual production (air-dry weight) of this state is about 200 pounds per acre, but it can range from about 100 lbs./acre in unfavorable years to about 350 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 the climatic variability and grazing. The herbaceous component is mostly intact and plant vigor and replacement capabilities are sufficient. Water flow patterns and litter movement may be occurring but only on steeper slopes. Incidence of pedestalling is minimal. Soils are mostly stable and the surface shows minimum soil loss. The watershed is functioning, and the biotic community is intact.

Dominant plant species

- Gardner's saltbush (*Atriplex gardneri*), shrub
- shadscale saltbush (*Atriplex confertifolia*), shrub
- fourwing saltbush (*Atriplex canescens*), shrub
- Sandberg bluegrass (*Poa secunda*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- blue grama (*Bouteloua gracilis*), grass
- scarlet globemallow (*Sphaeralcea coccinea*), other herbaceous
- woolly plantain (*Plantago patagonica*), other herbaceous
- plains pricklypear (*Opuntia polyacantha*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Ephemeral gully erosion
- Aggregate instability

- Plant productivity and health
- Plant structure and composition
- Feed and forage imbalance

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	84	112	224
Grass/Grasslike	22	84	112
Forb	6	28	56
Total	**112**	**224**	**392**

Table 9. Soil surface cover

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

Table 10. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	10-30%	10-20%	0-10%
>0.15 <= 0.3	–	0-10%	0-10%	0-5%
>0.3 <= 0.6	–	0-5%	0-5%	0-5%
>0.6 <= 1.4	–	–	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

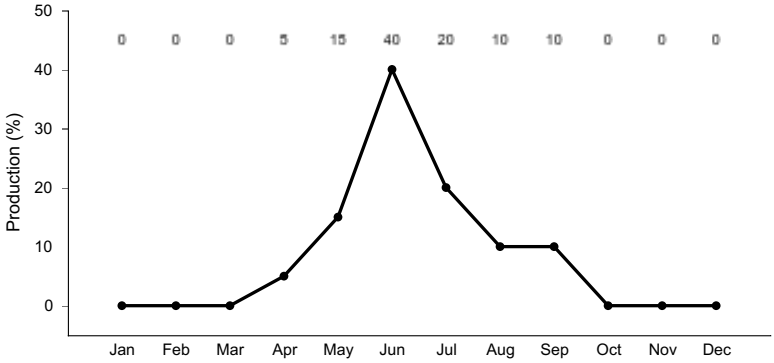
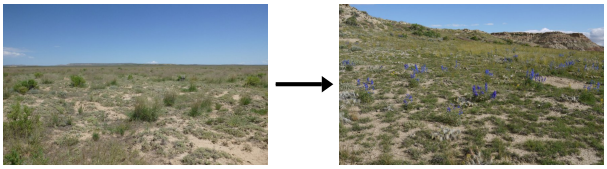


Figure 14. Plant community growth curve (percent production by month). WY0601, 15-19E all upland sites.

Pathway CP1.1-1.2
Community 1.1 to 1.2

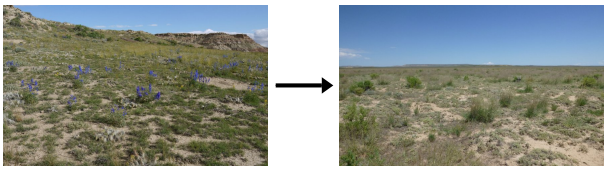


Saltbush/Indian ricegrass **Saltbush/Sandberg Bluegrass**

Moderate Continuous Season-long Grazing, Drought - Gardner's saltbush is tolerant to and so resilient under slight and moderate grazing pressures over a period of time. The herbaceous component, however, is weakened under constant use. Indian ricegrass will decrease initially. As the pressure persists, the vigor and frequency of needle and thread, prairie junegrass, and Indian ricegrass will decrease while Sandberg bluegrass and blue grama increase. The transition into community phase 1.2 can be reversed with shifts in management and climatic improvements.

Context dependence. Bottlebrush squirreltail and sand dropseed will fluctuate more in response to specific soil characteristics and climate than to use. 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/Sandberg Bluegrass **Saltbush/Indian ricegrass**

Prescribed Grazing or Long-term Prescribed Grazing - Given there is a viable seed source in close proximity, and with the appropriate rest and recovery time between grazing periods, Indian ricegrass and needle and thread can re-establish. The recovery process is slow because of the variable climate and the limiting soil environment. Recovery may take several years (10-30 years) for recovery with no outside inputs. At this stage, seeding or other mechanical treatments are not suggested. Ground disturbance provides for a higher risk potential for erosion and invasive species.

Conservation practices

Prescribed Grazing
Planned Grazing System
Prescribed Grazing

State 2

Saltbush/Sod-formers

State 2, Saltbush/Sod-formers State, is a prominant plant community group on the landscape. There are several working theories as to why, but the blue grama sod that is the indicator for this plant community is the key to this State. Blue grama forms in small but dense clumps or patches on the ground, altering hydrology and limiting the productivity of the site. The intermixed populations of forbs and Gardner's saltbush with plains pricklypear are the other components to this plant community.

Characteristics and indicators. Low-stature warm-season grasses, commonly blue grama and sand dropseed have increased in composition, reducing the diversity. Although the state is stable with approximately 30% ground cover by Gardner's Saltbush or salt tolerant shrubs, the production is slightly reduced. The trend noted during sampling was an increase of annual forbs with the decrease of Indian ricegrass and Bottlebrush squirreltail.

Resilience management. A combination of environmental and utilization disturbances has reduced the flexibility of the plant community leading to the shift from the Saltbush/Sod-formers State (State 2). Current and historic data has documented extreme swings in productivity between years (on an 8-10 year pattern) for Sandberg Bluegrass and Gardner's Saltbush specifically, but also for many of the species present. (Based on a 50 year data set). This swing in production can provide a false sense that a threshold has been crossed, when in actuality, it is a natural response to drought/climatic changes.

Community 2.1
Saltbush/Blue grama

Figure 15. Blue grama dominated community on the Saline Upland Sandy ecological site.

This plant community is the result of frequent and severe year-long grazing, which has adversely affected the mid-stature cool season grasses. Drought and long-term changes in precipitation patterns also contribute to this shift. Unlike other communities, the shrub component is less affected, but a change in vigor and stature will occur with continued pressure. The droughty nature of the sod is a response to the thick shallow mat of roots that are unable to reach the moisture as it quickly moves down in the soil profile, and channelizing runoff between established clumps or patches of vegetation. The lack of structure to hold moisture, compounded by drought can reduce the stability of the soil, making erosion a more significant problem. When compared to the Reference Plant Community (1.1), blue grama has increased. Prickly pear cactus has invaded. All cool-season mid-stature grasses and forbs have been greatly reduced. Production has been significantly decreased. The total annual production (air-dry weight) of this state is about ___ lbs./acre, but it can range from about ___ lbs./acre in unfavorable years to about ___ lbs./acre in above average years.

Resilience management. Rangeland Health Implications/Indicators: This community is resistant to change and the removal of grazing does not seem to affect the plant composition or structure. The biotic integrity of this community is not functional and plant diversity is extremely low. The plant vigor and replacement capabilities are limited due to the reduced number of cool-season grasses. The sod-bound nature of this plant community is resistant to water infiltration, however the open dissected nature of the "patches" of the site only has a minimal impact on infiltration. Sodded areas are protected by root structure, but impacts off-site areas with excessive runoff that can cause rills and gully erosion. Water flow patterns are obvious in areas of bare ground and pedestalling is apparent along the

sod edges. The watershed may or may not be functioning, as runoff may affect adjoining sites.

Dominant plant species

- Gardner's saltbush (*Atriplex gardneri*), shrub
- shadscale saltbush (*Atriplex confertifolia*), shrub
- blue grama (*Bouteloua gracilis*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- scarlet globemallow (*Sphaeralcea coccinea*), other herbaceous
- plains pricklypear (*Opuntia polyacantha*), other herbaceous
- Wilcox's woollystar (*Eriastrum wilcoxii*), other herbaceous
- woolly plantain (*Plantago patagonica*), other herbaceous

Dominant resource concerns

- Wind erosion
- Ephemeral gully erosion
- Aggregate instability
- Naturally available moisture use
- Feed and forage imbalance

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	0-2%
Litter	10-20%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-15%
Bedrock	0%
Water	0%
Bare ground	30-50%

Table 12. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	20-40%	10-30%	0-5%
>0.15 <= 0.3	–	0-5%	0-5%	0-5%
>0.3 <= 0.6	–	0-2%	0-2%	0-2%
>0.6 <= 1.4	–	–	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

State 3
Saltbush/Invaded

The Saline Upland site has proven to be more resistant to invasion by many of the aggressive weedy species threatening the rangelands today. However, there are a few species that still present issues as more land is disturbed by development, continued drought, and shifts in use patterns. Cheatgrass (downy brome) poses the greatest threat, with halogeton, and a variety of annual forbs holding their niches in the community. The persistence, resistance and resilience of specific communities within this state will be discussed further below.

Characteristics and indicators. Gardner's saltbush is fairly constant in the community with shifts in productivity of individual plants under different stress conditions. The composition of native and invasive herbaceous species is the indicator for this community. A threshold of 5% composition of a non-native invader species was established to mark when a community has crossed into this State. As this community continues to degrade, the invasive species will increase.

Resilience management. Once non-native species, specifically cheatgrass, invades the saltbush community, it is difficult to remove, and successful eradication without significant alteration has not been achieved at this time. As the invasive species become dominant in the community, the state becomes resistant to change and is very resilient to further disturbance.

Community 3.1
Saltbush/Native Grasses/Invasives

This Community Phase will resemble the Reference State communities (1.1 and 1.2) but will have the presence (5% or greater) of invasive species such as cheatgrass. The herbaceous species structural and functional groups still exist, but are decreasing in vigor and composition. If managed, the weed invasion can be minimal and further slowed. Degradation of the site could be exacerbated by prolonged drought conditions or other disturbances. Fire risk is minimal, however, the added fuels created by cheatgrass, can provide the needed conditions for fire. The fire frequency is rare and is not considered a major risk to Gardner's saltbush. The variability in composition commonly found with cheatgrass limit the ability to estimate the production of these sites, so at this time, sufficient data has not been collected to provide an average production figure. Site specific analysis is recommended for planning.

Resilience management. The plant community 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. The weedy species that encroach into this community determine the benefits or risks associated. Invasive species, in general, are able to colonize in the inter-spaces of the community, reducing bare ground, increasing water infiltration, and ultimately creating a more stable soil.

Dominant plant species

- Gardner's saltbush (*Atriplex gardneri*), shrub
- shadscale saltbush (*Atriplex confertifolia*), shrub
- needle and thread (*Hesperostipa comata*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- blue grama (*Bouteloua gracilis*), grass
- cheatgrass (*Bromus tectorum*), grass
- scarlet globemallow (*Sphaeralcea coccinea*), other herbaceous
- plains pricklypear (*Opuntia polyacantha*), other herbaceous
- flatspine stickseed (*Lappula occidentalis*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Aggregate instability
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Feed and forage imbalance

Community 3.2
Saltbush/Invasives

As annuals or other invasive species increase, native grasses are reduced and eventually removed from the community. The Saltbush/Invader community retains Gardner's saltbush as the dominant species with an invasive partner. Cheatgrass is the common threat to the ecological site; however, as other invasive species are brought into the Basin, the dynamics of this site will vary depending on the specific species. At this time, there has been no production data collected on this isolated and small stature community, so no productivity is estimated for this community.

Resilience management. The resistance to change increases as the stand becomes more decadent. Continued frequent and severe (continuous, season-long) grazing or no grazing does not seem to affect the plant composition or structure of the 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.

Dominant plant species

- Gardner's saltbush (*Atriplex gardneri*), shrub
- shadscale saltbush (*Atriplex confertifolia*), shrub
- cheatgrass (*Bromus tectorum*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- plains pricklypear (*Opuntia polyacantha*), other herbaceous
- flatspine stickseed (*Lappula occidentalis*), other herbaceous
- Russian thistle (*Salsola*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Aggregate instability
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Feed and forage imbalance

Pathway CP3.1-3.2
Community 3.1 to 3.2

Drought, Non-Use, Disturbance, or Frequent or Severe (Continuous, Season-long) Grazing – After crossing the threshold into an invaded state, the community will continue to degrade if disturbance continues or no weed management is implemented. Drought and non-use can leave soils dispersed and susceptible to invasion and loss of perennial grasses. Once an invasive species has gained a niche within a community and is able to begin to establish and propagate, the transition from the initial phase in this state to a more degraded phase may happen quickly when multiple factors are influencing the community. However, the transition can be stable and resistant to further degradation in many management situations. Proactive early detection and rapid response can be an effective tool at this stage to prevent this transition.

Pathway CP3.2-3.1
Community 3.2 to 3.1

Integrated Pest Management with Prescribed Grazing – The native grasses displaced by the invasive species generally will persist in remnant populations within the crowns of the Gardner's saltbush and plains pricklypear, or scattered in small pockets on the landscape. If a site is addressed in the preliminary stages of the transition to this phase, 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.

Conservation practices

Prescribed Grazing
Heavy Use Area Protection
Integrated Pest Management (IPM)

State 4
Disturbed

The surface extent of the Saline Upland Sandy ecological site is small. The majority of identified impacts have been caused by mechanical means (roads/trails), including recreational vehicles and farming activity or significant erosional events (weather induced). The level and extent of disturbance varies between this ecological site and its finer textured counterparts. Climate, degree of disturbance, type of disturbance and the resources surrounding each location must be considered with this state. The size of the community is generally small in extent limiting the need to focus reclamation efforts specifically on this ecological site. However, site specific details may determine a different level of priority.

Characteristics and indicators. This state is to capture areas where surface disturbance has removed the native vegetation. These disturbances can be historic or current activity. The end result of the disturbance is the dominance of non-native composition. The non-native species considered in this description are not invasive or weedy species, however they can be aggressive introduced/seeded species.

Resilience management. Climatic conditions and soil limitations restrict the feasibility of manipulating the native vegetation or degraded sites with much success.. The coarse soil textures make this ecological site susceptible to erosion, by wind especially, reducing the viability of seeds and seedlings in the early stages of establishment. Intensity and timing of precipitation has proved risky and nearly impossible to achieve a high level of success

Community 4.1
Altered

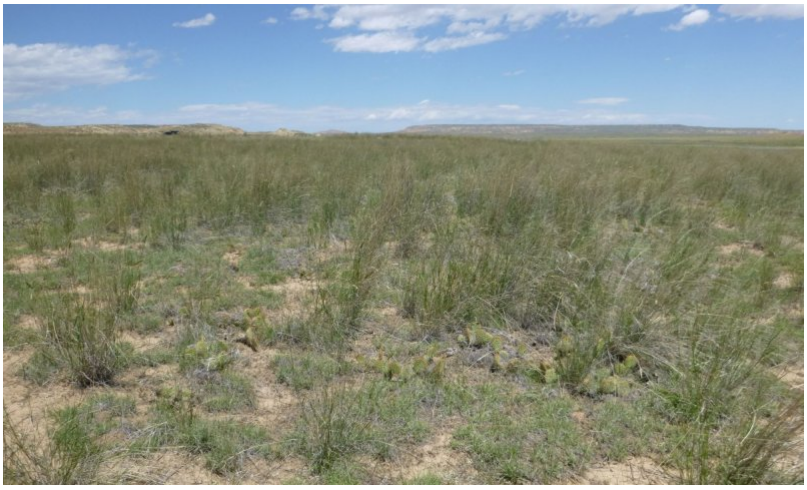


Figure 16. Crested wheatgrass planting from the 1960s, completed as a community improvement trial on blue grama dominated communities.

Small acres of abandoned lands have been created over an extended period of time. Changes in irrigation systems or land use, land management/ownership, and shifts in the drought cycles have proven to transition plant communities to a degraded state. The location and isolated occurrence of this ecological site lends the site to be an incidental "taking" in management or use of the landscape. Once the soil has been tilled or mechanically worked, the structure and function of the site is altered. These changes prevent the site from returning to a true Reference State. Many times the disturbances are due to mining, farming, or recreational activities. Over time the saltbush is degraded and possibly removed from the site. Oil and gas development remove all vegetation to create pad sites, leaving raw and compacted soils susceptible to weeds. Many times when these locations are left to recover by natural forces, they become weed dominated or slowly transition through several stages of primary succession, creating a community that is variable with productivity related closer to the disturbance rather than to the communities that existed prior to disturbance. In select locations introduced seedings were completed and then were left to adapt to the climate. Many of these sites are still visible on the landscape with a distinctive community

or a row pattern in the vegetation. Crested wheatgrasses and/or Russian wildrye were the primary species utilized in the seedings during the late 1940s to the early 1980s. The persistence of these species help to quickly identify these locations. The susceptibility to wind erosion on these sites has quickly removed or hidden the otherwise evidence of drill rows or furrows on this soil. 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, estimation or average production has not been attempted. The selected growth curve is a typical for the climate, not taking into consideration the variety of plant species that are present. Site specific evaluation needs to be completed to accurately capture the potential productivity and growth curves.

Resilience management. The climatic challenges (low amount, high intensity, scattered rainfall and variable spring temperatures) with the soil limitations (coarse textures prone to erosion and salt/sodium/gypsum content) make seeding or re-establishing vegetation challenging. There are new cultivars that will tolerate the conditions, but the cost and risk analysis must be considered in the reclamation process. No known trials on this ecological site have been identified.

Dominant plant species

- Gardner's saltbush (*Atriplex gardneri*), shrub
- prairie Junegrass (*Koeleria macrantha*), grass
- needle and thread (*Hesperostipa comata*), grass
- Indian ricegrass (*Achnatherum hymenoides*), grass
- crested wheatgrass (*Agropyron cristatum*), grass
- evening primrose (*Oenothera*), other herbaceous
- little larkspur (*Delphinium bicolor*), other herbaceous
- granite prickly phlox (*Linanthus pungens*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Wind erosion
- Aggregate instability
- Naturally available moisture use
- Plant productivity and health
- Plant structure and composition
- Feed and forage imbalance

Transition T1-2
State 1 to 2

Drought, Frequent or Severe Grazing – Extended periods of drought have the ability to weaken the plant community's resilience, forcing the community over the threshold into the next state. Drought with added stress of frequent or severe (continuous, season-long) grazing can expedite the process, removing the key species (Indian ricegrass, needle and thread), leaving the site dominated by tillering grass species (blue grama). Review of long term exclosure data also shows a natural shift to blue grama that is correlating with shifts in the precipitation occurring later in the season with warming spring temperatures. This is still under review to determine other factors influencing this transition.

Constraints to recovery. The mat-forming blue grama alters hydrology and creates a difficult environment for other natives to compete. The dense root system also makes blue grama highly tolerable to grazing and hoof impacts, making it difficult to remove or effectively reduce its composition in the community.

Transition T1-3
State 1 to 3

Frequent and Severe Grazing, Drought, Non-Use, or Ground Disturbance (with Seed Source Present) – Halogeton, cheatgrass (downy brome), and many of the invasive weeds that are present in the Big Horn Basin are drought tolerant and able to establish in poor soils and growing conditions. The barren, open canopy that is typical with Saline Upland landscapes are a prime target for these invaders. Given any level of disturbance, whether it is from heavy and frequent grazing use, drought or other ground disturbances, if there is a seed source present, these

invaders will find a niche for establishment. The dispersed nature of salt affected soils, especially in the absence of compaction by hoof action or traffic, allows for any variety of invasive species to quickly transition the reference state into an invaded state.

Constraints to recovery. The inability to eradicate most invasive species, specifically cheatgrass, block the recovery of this state to another state without major soil disturbances, seeding and high intensity weed management. A successful trial has not occurred on these soil-limited communities.

Transition T2-3
State 2 to 3

Drought, Ground Disturbance, Frequent or Severe Grazing or Non-use with a seed source present – The vulnerability of this state to transition to an invaded state is increased as the canopy is opened with further disturbance, drought or grazing use. If the seed source is present (in the area), drought or abnormal precipitation patterns provide the opportunity for invasive species to establish. Many of the sources of disturbance (recreational vehicles, animals, and development activities) provide a source to bring invasive species into an area.

Constraints to recovery. The difficulty of removing or reducing the composition of the non-native or invasive species and encouraging the establishment of native species is the major factor limiting the ability to return the invaded community back to the previous state.

Restoration pathway R3-4
State 3 to 4

Integrated Pest Management, Grazing Land Mechanical Treatment, or Rangeland Seeding with Prescribed Grazing – Once a community has degraded to an invaded state, especially if cheatgrass is dominant; eradication is not a feasible option, preventing restoration to a Reference state. An invaded site, however, can be restored to a functional plant community through intensive and integrated pest management and grazing land mechanical treatments. Removal of or reducing existing populations and establishment of forage species that are desirable and able to tolerate/compete with the invasive species helps to improve the function of the landscape. When a community has been significantly invaded, losing all of the key grazing 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 salt-affected soil conditions is minimal, but small scale projects have been achieved with marginal success.

Conservation practices

Critical Area Planting
Prescribed Grazing
Grazing Land Mechanical Treatment
Range Planting
Upland Wildlife Habitat Management
Native Plant Community Restoration and Management
Integrated Pest Management Plan - Written

Transition T4-3
State 4 to 3

Drought, Severe and Frequent Grazing, Ground Disturbance, or Non-Use with seed source present – Loose soils as a result of no hoof action during non-use or the decrease in key herbaceous species due to severe and frequent grazing, drought or disturbance opens the canopy and provides opportunity for invasive species to establish. With continued stress or addition of undesirable species will weaken this community even further.

Constraints to recovery. Weed removal or control is the main constraint to recovery for this community and state.

Additional community tables

Table 13. 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**			28–84	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	11–56	5–15
	needle and thread	HECO26	*Hesperostipa comata*	11–56	5–15
2	**Short-stature Cool-season Bunchgrasses**			0–28	
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–22	0–5
	Sandberg bluegrass	POSE	*Poa secunda*	0–22	0–5
	squirreltail	ELEL5	*Elymus elymoides*	0–22	0–5
3	**Tillering Grasses/Grass-likes**			0–56	
	alkali sacaton	SPAI	*Sporobolus airoides*	0–56	0–10
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–22	0–5
	blue grama	BOGR2	*Bouteloua gracilis*	0–22	0–5
	threadleaf sedge	CAFI	*Carex filifolia*	0–22	0–5
4	**Miscellaneous Grasses**			0–28	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–28	0–5
	Grass, perennial	2GP	*Grass, perennial*	0–28	0–5
Forb					
5	**Perennial Forbs**			0–56	
	little larkspur	DEBI	*Delphinium bicolor*	0–22	0–5
	granite prickly phlox	LIPU11	*Linanthus pungens*	0–22	0–5
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–11	0–5
	Forb, perennial	2FP	*Forb, perennial*	0–11	0–5
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–11	0–5
	milkvetch	ASTRA	*Astragalus*	0–11	0–5
	prairie thermopsis	THRH	*Thermopsis rhombifolia*	0–11	0–5
	evening primrose	OENOT	*Oenothera*	0–11	0–5
Shrub/Vine					
6	**Dominant Shrubs**			56–224	
	Gardner's saltbush	ATGA	*Atriplex gardneri*	56–224	20–40
7	**Miscellaneous Shrubs**			0–112	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–22	0–5
	spiny hopsage	GRSP	*Grayia spinosa*	0–22	0–5
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–22	0–5
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–22	0–5
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–22	0–5

Table 14. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Mid-stature Cool-season Bunchgrasses**			0–22	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–22	0–5
	needle and thread	HECO26	*Hesperostipa comata*	0–22	0–5
2	**Short-stature Cool-season Bunchgrasses**			22–112	
	Sandberg bluegrass	POSE	*Poa secunda*	22–112	5–20
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–56	0–10
	squirreltail	ELEL5	*Elymus elymoides*	0–22	0–5
3	**Tillering Grasses/Grass-likes**			0–28	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–22	0–5
	blue grama	BOGR2	*Bouteloua gracilis*	0–22	0–5
	threadleaf sedge	CAFI	*Carex filifolia*	0–22	0–5
4	**Miscellaneous Grasses**			0–56	
	Grass, perennial	2GP	*Grass, perennial*	0–28	0–5
Forb					
5	**Perennial Forbs**			0–56	
	little larkspur	DEBI	*Delphinium bicolor*	0–56	0–5
	evening primrose	OENOT	*Oenothera*	0–22	0–5
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–22	0–5
	granite prickly phlox	LIPU11	*Linanthus pungens*	0–22	0–5
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–22	0–5
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–22	0–5
	Forb, perennial	2FP	*Forb, perennial*	0–22	0–5
6	**Annual Forbs**			0–28	
	flatspine stickseed	LAOC3	*Lappula occidentalis*	0–11	0–5
	woolly plantain	PLPA2	*Plantago patagonica*	0–11	0–5
	tansymustard	DESCU	*Descurainia*	0–11	0–5
	madwort	ALYSS	*Alyssum*	0–11	0–5
	Wilcox's woollystar	ERWI	*Eriastrum wilcoxii*	0–11	0–5
	Forb, annual	2FA	*Forb, annual*	0–11	0–5
Shrub/Vine					
7	**Dominant Shrubs**			56–224	
	Gardner's saltbush	ATGA	*Atriplex gardneri*	56–224	20–40
8	**Miscellaneous Shrubs**			0–84	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–22	0–5
	spiny hopsage	GRSP	*Grayia spinosa*	0–22	0–5
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–22	0–5
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–22	0–5

Animal community

1.1 - Saltbush/Bunchgrasses: The predominance of woody plants in this plant community provides winter grazing for mixed feeders, such as elk, an 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/Sandberg Bluegrass: Decreased diversity and change in phenology of grasses and forbs reduces the value for the large grazers, but still provides forage. Thermal and escape cover suitable for large animals is still very limited due to the low quantities of tall woody plants. Areas with sagebrush-dominated states 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.

2.1 - 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/Nativel Grasses/Invasives: The unpalatable nature of many of the invasive species would reduce the value of this plant community for large grazers; however, there would still be forage available depending on the community composition. 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/Invasives: 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.

4.1 - Disturbed: 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 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 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* Acre/AUM*
Below Ave. Normal Above Ave.
1.1 Reference: Saltbush / Bunchgrasses 125-350 0.07 14.6
1.2 Saltbush / Sandberg Bluegrass
2.1 Saltbush / Sod-formers
3.1 Saltbush / Native Grasses / Invasives ** ** ** **
3.2 Saltbush / Invasives ** ** ** **
4.1 Disturbed ** ** ** **

* - 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. Supplementation of livestock may be necessary during the dormant season (protein/minerals) if the quality does not meet minimum livestock requirements.

Distance to water, terrain, slope/slope length, access, shrub density, fencing, and management can affect carrying capacity (grazing capacity) within a management unit as well as kind, class, and breeds of livestock. 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).

Hydrological functions

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

Rills and gullies should not typically be present. Water flow patterns should be barely distinguishable if at all present. Pedestals are only slightly present in association with bunchgrasses. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non- existent. Cryptogrammic crusts are present, but only cover 1-2 percent 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, especially along the drainages that typically dissect these landforms. 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 are loose when dry 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 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.

Ornamentals Species: The flowering forbs of this site have been found useful in landscaping and xeriscaping. The shrub component has cultivated species that have been used in conservation plantings and in more natural landscaping schemes.

Inventory data references

Information presented in this site description was derived from NRCS inventory data. Field observations from range trained personnel were also used. Those involved in the development of the new concept for Saline Upland Sandy ecological site include: Blaise Allen, Area Range Management Specialist, NRCS; and Marji Patz, Ecological Site Specialist, NRCS.

Quality control and quality assurance completed by: Dan Mattke, Area Resource Soil Scientist, NRCS; Daniel Wood, MLRA Soil Survey Leader, NRCS; John Hartung, Wyoming State Rangeland Management Specialist, NRCS; Jeff Goats, Wyoming State Soil Scientist, NRCS; Scott Woodall, Regional Quality Assurance Ecological Site Specialist, NRCS.

For specific data inquiries, contact the Powell, Wyoming Soil Survey Office (USDA-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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Contributors

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Approval

Scott Woodall, 9/16/2020

Rangeland health reference sheet

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

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Date	04/16/2020
Approved by	Scott Woodall
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

3. **Number and height of erosional pedestals or terracettes:** Not evident on slopes less than 6%, but erosional pedestals will be present with terracettes at debris dams on slopes greater than 6%.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground will range from 25 to 45%, occurring as small openings between plants.

5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present, except in concentrated water flow pattern zones on steeper slopes (>20% slope).

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

7. **Amount of litter movement (describe size and distance expected to travel):** Herbaceous litter movement expected to move only small amounts (to leeward side of shrubs) due to wind. May see minor litter damming between shrubs on steeper slopes along water flow areas.

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 average at 3 in the interspaces, and 5 under plant canopy. Average values should be 3.0 or greater.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Typically the surface is comprised of an A-Horizon of 1-4 inches (2-10 cm) with medium platy structure parting to granular structure and color hues of 10YR or 5Y, values of 5-7 and chromas of 2-4. Organic matter typically ranges from 0.5-2%.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The evenly distributed, clustered plant community provides 30-60% foliar cover, with minimal basal footprint. The tendency for the surface to seal slows infiltration rates and results in slight to moderate runoff. The lack of basal cover (less than 5%) does little to effect runoff from this site.

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 exists, but some soil crusting in dry conditions is typical. The soil structure may appear platy in nature due to the dispersion of particles from salts in the soil. The caps of the natric horizon may be platy parting to granular structure, and could be mistaken as a compaction layer.

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: Low Growing Perennial Shrubs > Mid-stature Grasses

Sub-dominant: Perennial Forbs

Other: 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):** Minimal or very low incidence of decadence is expected, but minor loss is seen.

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14. **Average percent litter cover (%) and depth (in):** Litter ranges from 5-15% of total canopy cover with the total litter (including beneath the plant canopy) from 15-35%. Herbaceous litter depth is typically shallow ranging from 2-7 mm. Woody litter depth ranges from from 0.1 to 0.25 of an inch (2-6 mm).

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** The average total above ground production on a normal year is 250 lbs./acre (kg/ha); ranging from 125 to 350 lbs/acre (kg/ha) in poor to above average years.

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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:** Greasewood, sand dropseed, woolly plantain, low larkspur, native annual mustards and pepperweeds and a variety of other native annual forbs will invade the site as it degrades. Invasive species that are common include but are not limited to: halogeton, cheatgrass, and Russian thistle. 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:** All species are capable of reproducing, but are limited due to effective soil moisture and seed/soil contact. The lack of perennial canopy with the dispersal tendencies of the soil create a crusting effect from rain drop impact/wetting and drying of the soil. The weak structure of these soils are easily disturbed and provide areas for seeds to catch and germinate. Drought inhibits seed viability as well as reduces the root propagation potential.
