USDA Natural Resources
Conservation Service

Ecological site DX032X02W142
Saline Subirrigated (SS) Wind River Basin Wet

Last updated: 9/07/2023
Accessed: 04/19/2024

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 further individualize these two basins.

For 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

32X02W (WY): This LRU is the Wind River Basin within MLRA 32X. This LRU tends to be just a fraction higher in elevation, slightly cooler (by 1-degree Celsius), and snowpack tends to persist longer into the spring than the Big Horn Basin (LRU 01).
This LRU was originally divided into two LRU's - LRU C which was the core and LRU D which was the rim. With the most current standards, this LRU is divided into three subsets. This subset is the "wet" subset of the Wind River Basin and is comprised of drainages, floodplains, floodplain steps, and stream terraces. This subset is driven by hydrology and the connectivity or disconnection from the water table, and significant periods of surface flow, that affects the soil chemistry, influencing the variety of ecological sites and plant interactions.

The wet subset includes all of the core subset and extensions into the rim subset. The hydrology factor is the driving factor over precipitation in this subset. Because of this and historic mapping, the extent of soils currently correlated to this ecological site does not fit within the current subset or LRU boundary. Many of the map unit components are correlated to ecological sites outside of this MLRA, but will be reviewed and corrected during mapping update projects.

Moisture Regime: typic aridic or ustic aridic
Temperature Regime: Mesic
Dominant Cover: Rangeland, with sagebrush steppe intermixed with saltbush flats, is the dominant vegetative cover.
Representative Value (RV) Effective Precipitation: 9-12 inches (229
– 305 mm)
RV Frost-Free Days: 85-115 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

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

National Hierarchical Framework of Ecological Units (USFS):
300 Dry Domain
340 Temperate Desert Division
342 Intermountain Semi-Desert Province
342A Bighorn Basin
342Ad Big Horn Basin

Ecological site concept

• Site influenced by a water table within 30 to 100 cm of the soil surface during the growing season, and water may move over the surface from run-in but only for short periods.
• Slope is <6%
• Soils are:
- Saline, sodic, or saline-sodic, gypsic
- Moderately deep, deep, or very deep (depth to restrictive layer is greater than 20” (50 cm).
- Poorly to somewhat poorly drained
- Textures usually range from loamy sand to clay loam, and may be stratified throughout the profile.
- Clay content is < 60% in mineral soil surface 4”.
- With an average particle size class < 40% clay

Associated sites

R032XY374WY	**Subirrigated (Sb) 10-14" East Precipitation Zone** The Subirrigated ecological site is very similar in characteristics to the Saline Subirrigated. The major difference is the lack of influencing salt characteristics that cause a significant shift in plant species and minor shifts in production. The two sites will occur in alternating pockets along drainages in response to interbedded sedimentary materials.
R032XY228WY	**Lowland (LL) 5-9” Wind River Basin Precipitation Zone** The Lowland ecological site occurs in complex with Saline Subirrigated and Saline Lowland. Lowland is similar to Saline lowland, but lacking salts and allowing a shift in vegetation away from salt tolerant species.
R032XY238WY	**Saline Lowland (SL) 5-9” Wind River Basin Precipitation Zone** The Saline Lowland ecological site occurs in complex with Saline Subirrigated, with Saline Lowland being drier of the two ecological sites, gaining woody and some upland herbaceous vegetation as shift outward from the main water source.
R032XY278WY	**Wetland (WL) 5-9” Wind River Basin Precipitation Zone** The wetland ecological site occurs in complex with Saline Subirrigated, with wetland being the most wet/inundated ecological site, becoming drier and gaining woody vegetation as shift outward.

Similar sites

DX032X01W142	**Saline Subirrigated (SS) Big Horn Basin Wet** Saline Subirrigated Big Horn Basin Wet is very similar to this site. However, the differences in storm patterns, and topographical divides shifts timing of green up and maturity, site stability, and how the two basins respond under management.
R032XY342WY	**Saline Subirrigated (SS) 10-14" East Precipitation Zone** Saline Subirrigated 10-14
R032XY278WY	**Wetland (WL) 5-9" Wind River Basin Precipitation Zone** Wetland 5-9
R032XY374WY	**Subirrigated (Sb) 10-14" East Precipitation Zone** Subirrigated 10-14

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Sporobolus airoides* (2) *Puccinellia nuttalliana*

Legacy ID

R032XW142WY

Physiographic features

This site occurs on gently sloping to level bottoms of drainageways or floodplains of active streams.

Table 2. Representative physiographic features

Landforms	(1) Intermontane basin > Flood plain (2) Intermontane basin > Stream terrace (3) Intermontane basin > Drainageway
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	Rare to occasional
Ponding duration	Brief (2 to 7 days)
Ponding frequency	None to frequent
Elevation	4,500–6,600 ft
Slope	0–6%
Ponding depth	0–3 in
Water table depth	12–40 in
Aspect	Aspect is not a significant factor

Climatic features

Although not the primary driver, climate is a factor in the overall ecology of this subset. Annual precipitation and modeled relative effective annual precipitation ranges from 9 to 12 inches (229–305 mm). The normal precipitation pattern shows peaks in May and June and a secondary peak in September. This amounts to about 50 percent 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 totals about 20 inches annually. Wide fluctuations may occur in yearly precipitation and result in more dry years than those with more than normal precipitation.

Average temperatures show a wide range between summer and winter and between daily maximums and minimums, due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air

outbreaks from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring. High winds 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 about April 1st and continues until about July 1st. Cool weather and moisture in September may produce some green-up of cool-season plants that will continue through late October.

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

For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/. Riverton, Shoshoni, Boysen Dam, Pavillion, and Diversion Dam are the representative weather stations within LRU 02W. 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)	90-112 days
Freeze-free period (characteristic range)	118-137 days
Precipitation total (characteristic range)	8-9 in
Frost-free period (actual range)	87-112 days
Freeze-free period (actual range)	111-138 days
Precipitation total (actual range)	8-9 in
Frost-free period (average)	99 days
Freeze-free period (average)	126 days
Precipitation total (average)	9 in

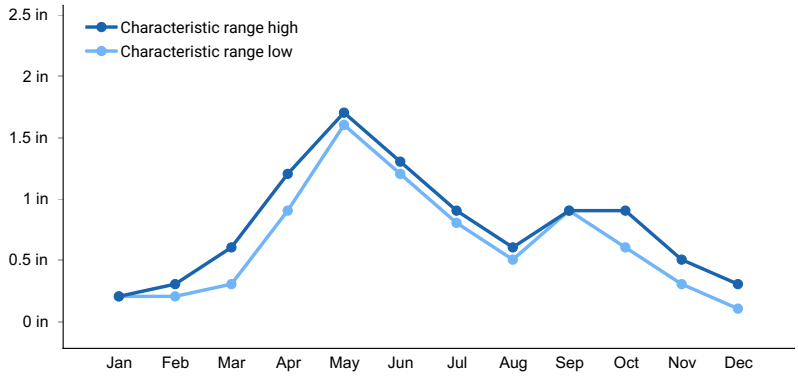


Figure 1. Monthly precipitation range

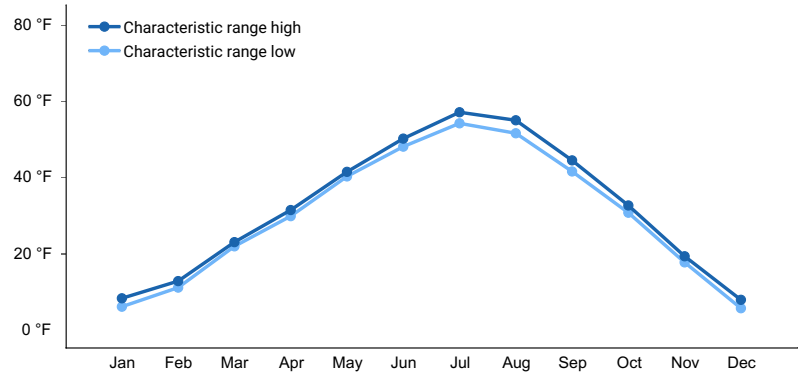


Figure 2. Monthly minimum temperature range

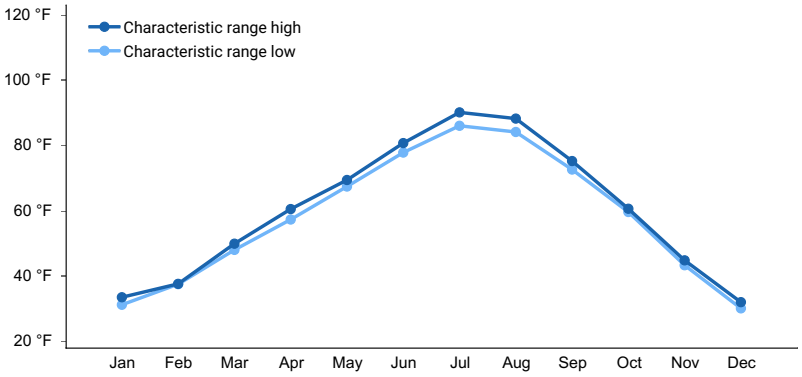


Figure 3. Monthly maximum temperature range

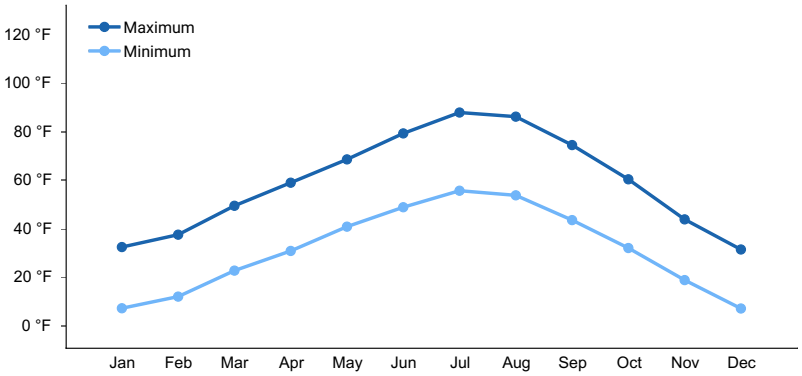


Figure 4. Monthly average minimum and maximum temperature

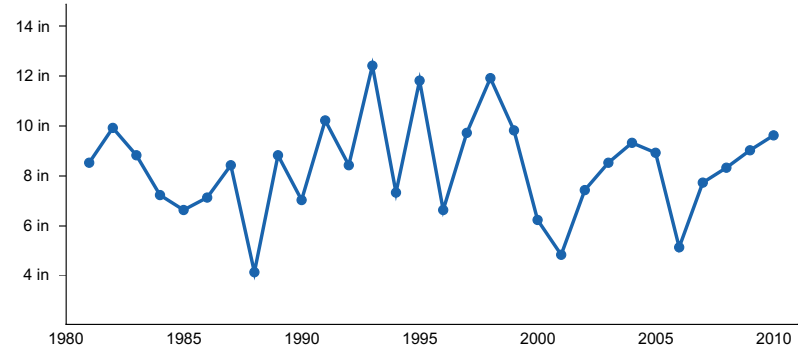


Figure 5. Annual precipitation pattern

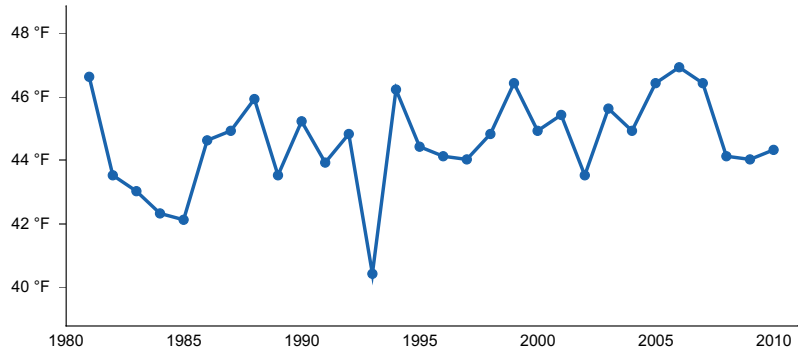


Figure 6. Annual average temperature pattern

Climate stations used

- (1) RIVERTON [USC00487760], Riverton, WY
- (2) RIVERTON [USW00024061], Riverton, WY
- (3) SHOSHONI [USC00488209], Shoshoni, WY
- (4) PAVILLION [USC00487115], Pavillion, WY
- (5) BOYSEN DAM [USC00481000], Riverton, WY
- (6) DIVERSION DAM [USC00482595], Kinnear, WY

Influencing water features

Saline Subirrigated ecological site occurs within the influence of a fluctuating water table and overland flow from intermittent or perennial waterways that are influenced by salts. The water concentrates the salts, which precipitate and influence the ecological site. A water table will occur above 100 cm (fluctuating between 30 and 100 cm) of the soil surface, and has the potential to occur above the soil surface for very short periods of time . Woody species rarely persist on the site and encourages a limited number of hydrophytic plants. In some instances the water influence for this ecological site is due to irrigation conveyance seep and irrigation runoff.

Wetland description

Stream Type: C (Rosgen).
These sites would classify as a wetland, and is associated with and a major component to the wetland ecological site. Saline Subirrigated supports wetland vegetation.

Soil features

The soils of this site are moderately deep to very deep (greater than 20 inches to bedrock), poorly drained to moderately well drained soils formed in alluvium. Water table is present within the upper 100 cm of the soil profile throughout the growing season. These areas may experience periodic inundation from flooding or ponding. The soil characteristics having the most influence on the plant community are depth to a water table during the growing season and the amount of soluble salts.

Major Soil Series correlated to this site include: Fluvaquents

Figure 7. Soils profile of the Saline Subirrigated ecological site demonstrating the water table during the typical "high water table" period.

Table 4. Representative soil features

Parent material	(1) Alluvium–interbedded sedimentary rock (2) Igneous, metamorphic and sedimentary rock
Surface texture	(1) Loam (2) Clay loam (3) Silt loam (4) Fine sandy loam (5) Clay (6) Loamy sand (7) Silty clay loam (8) Sandy clay loam (9) Sandy loam
Family particle size	(1) Fine-loamy (2) Fine (3) Coarse-loamy (4) Sandy or sandy-skeletal
Drainage class	Poorly drained to somewhat poorly drained
Permeability class	Moderately slow to moderately rapid
Soil depth	20–60 in
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0–20%
Available water capacity (0-40in)	2.8–6.2 in
Calcium carbonate equivalent (0-40in)	0–40%
Electrical conductivity (0-40in)	0–16 mmhos/cm
Sodium adsorption ratio (0-40in)	0–40
Soil reaction (1:1 water) (0-40in)	7.4–10
Subsurface fragment volume <=3" (0-40in)	0–10%
Subsurface fragment volume >3" (0-40in)	0–20%

Ecological dynamics

Plants that can tolerate soils which are saline and alkaline and have a water table near the surface for most of the growing season, dominate the potential vegetation on this site. The expected potential composition for this site is about 80 percent grasses, 10 percent forbs and 10 percent woody plants. The composition and production will vary naturally due to historical use and fluctuating precipitation, or more specifically fluctuating water tables.

As this site deteriorates, species such as inland saltgrass and greasewood increase and species such as Russian olive, saltcedar, foxtail barley, and a host of weedy forbs invade the site. Grasses such as alkali sacaton, Nuttall's alkaligrass, and basin wildrye will decrease in frequency and production.

There are instances where the ecological site may shift due to a shift in the hydrology. Vegetation will transition slower than hydrologic changes, so use sound scientific reasoning in these instances. When channel morphological process complete a cycle, there will be saline subirrigated sites that transition to saline lowland sites or may transition to upland sites, thus becoming the Saline Lowland Drained ecological site. Initially after loss of hydrology, the ecological site may appear very similar. However, with time the difference will become very obvious with shifts in species dominance, bare ground, and production.

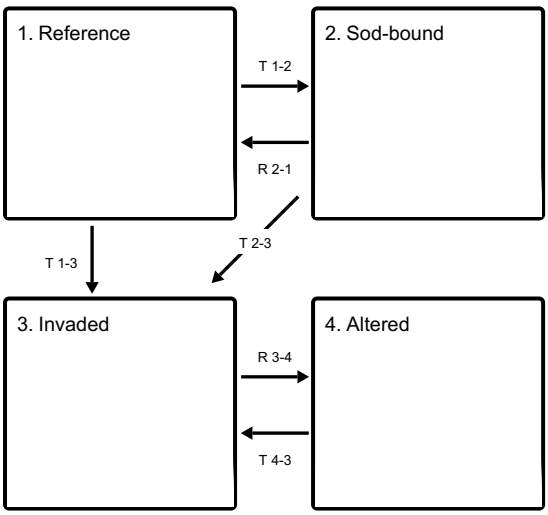
The reference community (description follows the state and transition diagram) has been determined by study of rangeland relic areas, or areas protected from excessive disturbance. Trends in plant communities going from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts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



T 1-2 - Repeated year-long and season-long grazing, drought, and compaction leads to the transition to a sod-bound community.

T 1-3 - Soil disturbances, drought, and flooding provide seed sources and opportunity for invasive species to dominate the community.

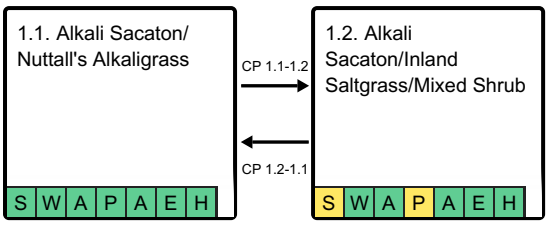
R 2-1 - Prescribed grazing with treatment of greasewood aids in the recovery of this community over time.

T 2-3 - Soil disturbances, flooding, drought, animal and human impacts are all potential sources for seed and provides the opportunity for invasion of undesirable (noxious) species.

R 3-4 - Removal of invasive cover, soil preparations, and seeding create an Altered State.

T 4-3 - Failure of the seeding, failure in management, or continued disturbances provides opportunity when seed source is present for re-invasion.

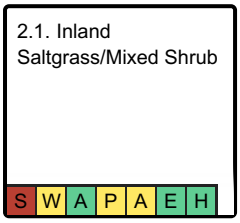
State 1 submodel, plant communities



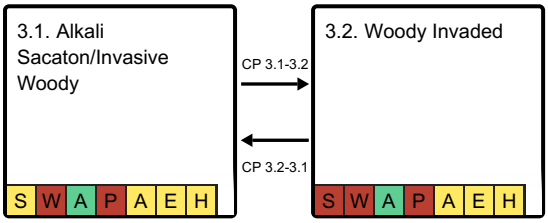
CP 1.1-1.2 - Continuous season-long grazing, especially during drought, will weaken the herbaceous cover in this plant community.

CP 1.2-1.1 - Prescribed grazing and brush control will result in a plant community very similar to the Reference Community Phase (1.1).

State 2 submodel, plant communities



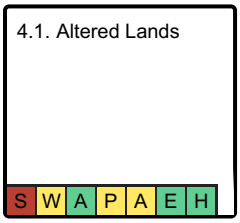
State 3 submodel, plant communities



CP 3.1-3.2 - Repeated continuous season-long or year-long grazing plus encroachment will convert this plant community to a Woody Invaded Community Phase.

CP 3.2-3.1 - Brush management, weed control and prescribed grazing aids in the improvement of the invaded community phases.

State 4 submodel, plant communities



State 1
Reference

Community 1.1
Alkali Sacaton/ Nuttall's Alkaligrass

Figure 8. Alkali sacaton and Nuttall's alkaligrass are prominent species within this Reference community.

Alkali Sacaton/Nuttall's Alkaligrass Community Phase (1.1) is the interpretive plant community for the Saline Subirrigated ecological site, and is also referred to as the Reference Community Phase. This community phase evolved with grazing by large herbivores, supplemental moisture, and saline and/or alkali soils. The major grasses include alkali sacaton, Nuttall's alkaligrass, and basin wildrye. Grasses of lesser importance are Baltic rush, western wheatgrass, alkali cordgrass, inland saltgrass, and tufted hairgrass. Woody plants are minor in this community phase, and are primarily rubber rabbitbrush and greasewood. A variety of forbs also occurs in this state and plant diversity is high. The total annual production (air-dry weight) of this state is about 2400 pounds per acre, but it can range from about 1800 lbs./acre in unfavorable years to about 2800 lbs./acre in above average years.

Resilience management. The community phase is stable and well adapted to the Northern Plains climatic conditions. The diversity in plant species and the reliable water table allow for high drought resistance. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity).

Dominant plant species

- alkali sacaton (*Sporobolus airoides*), grass
- Nuttall's alkaligrass (*Puccinellia nuttalliana*), grass
- alkali cordgrass (*Spartina gracilis*), grass
- silverweed cinquefoil (*Argentina anserina*), other herbaceous
- common plantain (*Plantago major*), other herbaceous
- seaside arrowgrass (*Triglochin maritima*), other herbaceous

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1650	2000	2300
Forb	100	200	250
Shrub/Vine	50	200	250
Total	**1800**	**2400**	**2800**

Table 6. Ground cover

Tree foliar cover	0-2%
Shrub/vine/liana foliar cover	0-10%
Grass/grasslike foliar cover	25-80%
Forb foliar cover	0-10%
Non-vascular plants	0%
Biological crusts	0%
Litter	5-15%

Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0-15%

Table 7. Soil surface cover

Tree basal cover	0-2%
Shrub/vine/liana basal cover	1-10%
Grass/grasslike basal cover	50-80%
Forb basal cover	1-10%
Non-vascular plants	0%
Biological crusts	0%
Litter	30-50%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	5-15%

Table 8. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	0-2%
>0.5 <= 1	–	–	0-10%	5-10%
>1 <= 2	–	0-2%	5-25%	0-5%
>2 <= 4.5	–	1-5%	25-50%	–
>4.5 <= 13	–	0-5%	–	–
>13 <= 40	–	0-2%	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

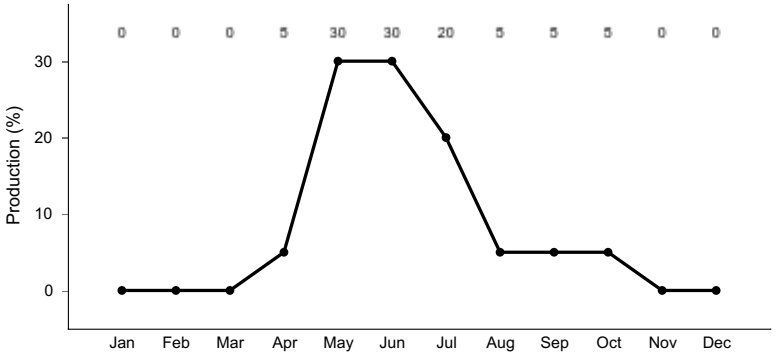


Figure 10. Plant community growth curve (percent production by month). WY0803, 5-9WR free water sites.

Community 1.2
Alkali Sacaton/Inland Saltgrass/Mixed Shrub

Figure 11. Greasewood and other shrubs have increased with inland saltgrass, while basin big sagebrush and Nuttall's alkaligrass has decreased.

Historically, this plant community evolved under moderate grazing by domestic livestock. Currently, this site is normally found under a moderate, season-long grazing regime and in the absence of brush control. Prolonged drought can also play an important role and will exacerbate these conditions. Saline and flood tolerant perennial plants make up the dominant species in this plant community. Dominant grasses include alkali sacaton, inland saltgrass, western wheatgrass, alkali cordgrass, and Baltic rush. Forbs commonly found in this plant community include alkali seepweed, silverweed, American licorice, seaside arrowgrass, and smooth horsetail. Greasewood and rubber rabbitbrush comprises the majority of the woody species and make up less than 25% of the annual production. When compared to the Reference Community Phase, basin wildrye, Nuttall’s alkaligrass, and tufted hairgrass have decreased. Inland saltgrass, forbs, greasewood, and rubber rabbitbrush have increased. Annual herbaceous weedy plants have increased, but occur in small patches. The total annual production (air-dry weight) of this state is about 2000 pounds per acre, but it can range from about 1500 lbs./acre in unfavorable years to about 2500 lbs./acre in above average years.

Resilience management. This community phase is stable and protected from excessive erosion. The herbaceous component is mostly intact and plant vigor and replacement capabilities are sufficient. Only minimal occurrences of water flow patterns and litter movement is evident. 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

- silver buffaloberry (*Shepherdia argentea*), tree
- narrowleaf cottonwood (*Populus angustifolia*), tree
- greasewood (*Sarcobatus vermiculatus*), shrub
- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- alkali sacaton (*Sporobolus airoides*), grass
- saltgrass (*Distichlis spicata*), grass
- alkali cordgrass (*Spartina gracilis*), grass
- American licorice (*Glycyrrhiza lepidota*), other herbaceous
- seaside arrowgrass (*Triglochin maritima*), other herbaceous
- smooth horsetail (*Equisetum laevigatum*), other herbaceous

Dominant resource concerns

- Concentration of salts or other chemicals
- Ponding and flooding
- Salts transported to surface water

Table 9. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1300	1550	1750
Shrub/Vine	100	300	500
Forb	100	150	250
Total	**1500**	**2000**	**2500**

Table 10. Ground cover

Tree foliar cover	0-2%
Shrub/vine/liana foliar cover	5-25%
Grass/grasslike foliar cover	25-65%
Forb foliar cover	0-10%
Non-vascular plants	0%
Biological crusts	0%
Litter	10-15%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	5-15%

Table 11. Soil surface cover

Tree basal cover	0-2%
Shrub/vine/liana basal cover	5-25%
Grass/grasslike basal cover	30-65%
Forb basal cover	5-10%
Non-vascular plants	0%
Biological crusts	0%
Litter	30-50%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	10-20%

Table 12. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	0-5%
>0.5 <= 1	–	–	10-25%	5-10%
>1 <= 2	–	0-2%	5-50%	0-5%
>2 <= 4.5	–	5-25%	10-35%	–
>4.5 <= 13	–	0-10%	–	–
>13 <= 40	–	0-2%	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

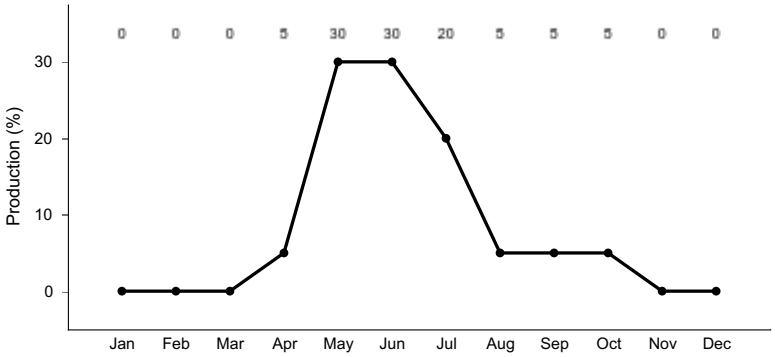
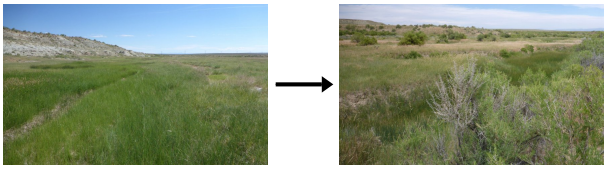


Figure 13. Plant community growth curve (percent production by month). WY0803, 5-9WR free water sites.

Pathway CP 1.1-1.2
Community 1.1 to 1.2

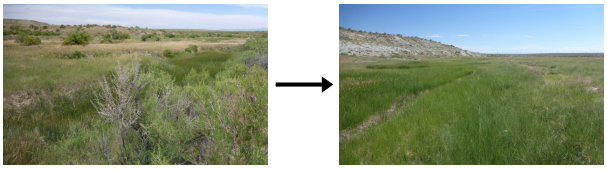


Alkali Sacaton/ Nuttall's Alkaligrass

Alkali Sacaton/Inland Saltgrass/Mixed Shrub

Continuous season-long grazing will convert this plant community to the Alkali Sacaton/Inland Saltgrass/Mixed Shrub Plant Community. Prolonged Drought will exacerbate this transition. Impacting the riparian species during the growing season without a chance for recovery will quickly weaken, and remove, the tall-stature and some mid-stature species. Drought will weaken and remove these species quickly when grazing continues.

Pathway CP 1.2-1.1
Community 1.2 to 1.1



Alkali Sacaton/Inland Saltgrass/Mixed Shrub

Alkali Sacaton/ Nuttall's Alkaligrass

Prescribed grazing and possible long-term prescribed grazing will result in a plant community very similar to the Reference Community Phase (1.1), except that greasewood will persist without some form of brush control. Greasewood and rubber rabbitbrush can prove difficult to remove from the system.

Conservation practices

Brush Management
Critical Area Planting
Stream Habitat Improvement and Management
Prescribed Grazing

State 2
Sod-bound

Degradation of the tall- and mid-stature grasses by herbivory, drought, gullying, and other soils disturbances creates an opportunity for sod-forming (tillering) grasses to increase in the community. With time, the community shifts to a sod-dominant community.

Characteristics and indicators. Inland saltgrass is the major canopy cover in this system. Greasewood and rubber rabbitbrush will persist but is not able to develop into a monocultural stand of shrubs due to the integrity and density of inland saltgrass.

Resilience management. The channeling characteristic of sod-grasses creates open areas of bare ground that are prone to rills and erosion, but the integrity of the sod root structure creates a community resistant to change, as well as resilient to further disturbance. The bare ground does expose risk of invasion by undesirable weeds.

Community 2.1
Inland Saltgrass/Mixed Shrub

This plant community is the result of frequent and severe grazing with periodic overflows and no brush control. This plant community is dominated by a dense short-stature warm-season grass sod and includes a mosaic shrub overstory. Shrubs comprise less than 35 percent of the annual production, and are kept in check by the herbaceous sod understory. The dominant grasses are inland saltgrass, Alkali bluegrass, Baltic rush and Chairmaker's bulrush. Forbs such as seaside arrowgrass, American licorice, curly dock, and smooth horsetail are common. Greasewood and rubber rabbitbrush are the primary overstory species in this plant community. Plant diversity is moderate to poor. When compared to the Reference Community Phases (1.1 or 1.2), the tall- and mid-stature grasses are significantly reduced or absent. Short-stature warm-season grasses are dominant and weedy annuals are common. Shrubs will have increased as a percentage of the total production, but will not dominate as the sod prevents a homogeneous shrub cover. Areas of bare ground may have increased in patches, and total production has decreased as the short grasses have replaced the tall- and mid-stature grasses. The total annual production (air-dry weight) of this state is about 1200 pounds per acre, but it can range from about 800 pounds per acre in unfavorable years to about 1600 pounds per acre in above average years.

Resilience management. The sod component of this plant community is extremely resistant to change and continued frequent and severe grazing or the removal of grazing does not seem to affect the plant composition or structure of the plant community. The biotic integrity of this community phase is generally not functional as plant diversity is poor, especially the amount of herbaceous species. The vegetative structure has shifted as the shrubs and short grasses now occupy the majority of the site. This sod bound plant community is very resistant to water infiltration. While this sod protects the soil within the basal cover, excessive runoff increases erosion on bare ground and can cause rill channels and gully erosion. Water flow patterns are obvious in the bare ground areas and shrubs and sod patches are pedestalled. Rill channels are noticeable in the interspaces and gullies may be establishing where rills have concentrated. The watershed may not be functioning, as runoff is excessive and erosional processes are accelerated.

Dominant plant species

- greasewood (*Sarcobatus vermiculatus*), shrub
- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- saltgrass (*Distichlis spicata*), grass
- Sandberg bluegrass (*Poa secunda*), grass
- mountain rush (*Juncus arcticus ssp. littoralis*), grass

- seaside arrowgrass (*Triglochin maritima*), other herbaceous
- American licorice (*Glycyrrhiza lepidota*), other herbaceous
- smooth horsetail (*Equisetum laevigatum*), other herbaceous
- curly dock (*Rumex crispus*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Ephemeral gully erosion
- Classic gully erosion
- Concentration of salts or other chemicals
- Aggregate instability
- Salts transported to surface water
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Feed and forage imbalance

Table 13. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	500	700	900
Shrub/Vine	250	400	550
Forb	50	100	150
Total	**800**	**1200**	**1600**

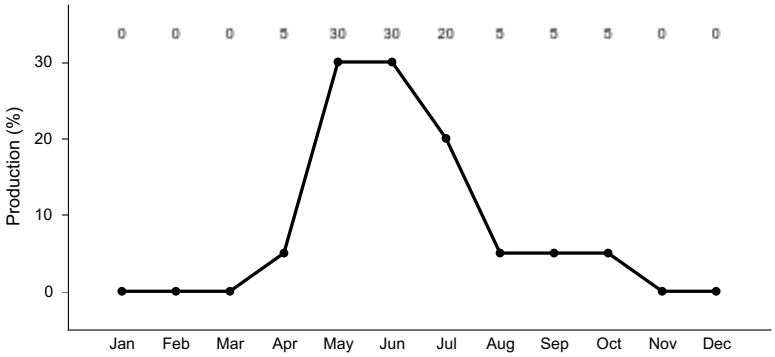


Figure 15. Plant community growth curve (percent production by month). WY0803, 5-9WR free water sites.

State 3
Invaded

Soil disturbance within this ecological site opens the soil and provides the opportunity for invasive species to establish. Woody invasive species are the most dominant invasive species for these communities.

Characteristics and indicators. The presence and dominance of Tamarisk (saltcedar), Russian olive, swainsonpea or Canada thistle is the key indicator of a transition to the Invaded State. Foxtail barley, curly dock, and Russian Thistle are also common weedy invaders that occur in this community.

Resilience management. The Invaded State is resilient following further major disturbances. The extensive seed bank that most invasive species develop makes eradication or maintenance of extent difficult. Degradation of the State will occur with expanding populations of invasive species, most prominently Russian olive and Tamarisk (saltcedar).

Community 3.1
Alkali Sacaton/Invasive Woody

This plant community occurs where saltcedar or Russian olive encroaches into a saline subirrigated ecological site and becomes established. This occurs with or without grazing and is the result of conditions conducive to the colonization of these two plants. Bare ground is likely to increase the potential for colonization. However, areas that have been deferred or removed from grazing and had a healthy stand of alkali sacaton can be infested. Saline and flood tolerant perennial plants make up the dominant understory species in this plant community. Dominant grasses include alkali sacaton, inland saltgrass, western wheatgrass, alkali cordgrass, and Baltic rush. Forbs commonly found in this plant community include alkali seepweed, silverweed, American licorice, seaside arrowgrass, and smooth horsetail. Saltcedar or Russian olive comprise the majority of the woody species and make up less than 35 percent of the annual production. Invasion of saltcedar or Russian olive should be considered serious and should be controlled. When compared to the Reference State, basin wildrye, Nuttall's alkaligrass, and tufted hairgrass have decreased. Inland saltgrass, forbs, saltcedar and Russian olive have increased. Total production is similar to the Alkali Sacaton/Mixed Shrub community phase. The total annual production (air-dry weight) of this state is about 1200 pounds per acre, but it can range from about 800 pounds per acre in unfavorable years to about 1800 pounds per acre in above average years.

Resilience management. This plant community is mostly resistant to change, but species composition can be altered through long-term continuous year-long grazing, high utilization with no rest, and further encroachment of saltcedar and Russian olive. The herbaceous component is stable and plant vigor and replacement capabilities are sufficient. The biotic community is not intact due to the encroachment of these invasive species. Plant diversity is moderate. Soils are mostly stabilized. Only minimal occurrences of water flow patterns and litter movement is evident. Incidence of pedestalling is minimal. Soils are mostly stable and the surface shows minimal soil loss. The watershed may or may not be functional.

Dominant plant species

- tamarisk (*Tamarix*), tree
- Russian olive (*Elaeagnus angustifolia*), tree
- greasewood (*Sarcobatus vermiculatus*), shrub
- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- alkali sacaton (*Sporobolus airoides*), grass
- saltgrass (*Distichlis spicata*), grass
- alkali cordgrass (*Spartina gracilis*), grass
- alkali seepweed (*Suaeda vera*), other herbaceous
- seaside arrowgrass (*Triglochin maritima*), other herbaceous
- smooth horsetail (*Equisetum laevigatum*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Ephemeral gully erosion
- Bank erosion from streams, shorelines, or water conveyance channels
- Concentration of salts or other chemicals
- Ground water depletion
- Naturally available moisture use
- Salts transported to surface water
- Salts transported to ground water
- Sediment transported to surface water
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Feed and forage imbalance
- Inadequate livestock water quantity, quality, and distribution

Community 3.2
Woody Invaded

This plant community evolved under frequent and severe grazing with the encroachment of saltcedar or Russian olive. Saltcedar and Russian olive will comingle or will individually dominate this plant community. Most of the tall- and mid-stature grasses are eliminated and an understory of weedy herbaceous plants are prevalent. The

interspaces between woody plants have expanded leaving more bare ground and more soil surface exposed to erosive elements or invaders. The weedy plants, such as foxtail barley, curly dock, swainsonpea, whitetop, and Russian thistle make up the dominant understory. Saltcedar or Russian olive make up greater than 35 percent of the total annual production. When compared with the Reference State, the annual production is less due to the decrease of the perennial grasses and increase of bare ground. The increase in woody species, however, compensates for some of this loss. The total annual production (air-dry weight) of this state is about 1200 pounds per acre, but it can range from about 800 pounds per acre in unfavorable years to about 1600 pounds per acre in above average years.

Resilience management. This plant community is resistant to change as the stand becomes more dense. Continued frequent and severe grazing or the removal of grazing does not seem to affect the plant composition or structure of the plant community. Saltcedar, Russian olive, annual grasses, weedy species and bare ground compromise the biotic integrity. Plant diversity is poor and the potential for native grasses to reproduce is absent. The shift in the vegetative structure and function is extreme and the biotic integrity is lost. The soil of this community phase is not protected; erosion has 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. The watershed is not functional due to excessive runoff, erosion and bare ground.

Dominant plant species

- tamarisk (*Tamarix*), tree
- Russian olive (*Elaeagnus angustifolia*), tree
- foxtail barley (*Hordeum jubatum*), grass
- mountain rush (*Juncus arcticus ssp. littoralis*), grass
- alkali swainsonpea (*Sphaerophysa salsula*), other herbaceous
- knapweed (*Centaurea*), other herbaceous
- curly dock (*Rumex crispus*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Ephemeral gully erosion
- Classic gully erosion
- Bank erosion from streams, shorelines, or water conveyance channels
- Concentration of salts or other chemicals
- Aggregate instability
- Ground water depletion
- Naturally available moisture use
- Salts transported to surface water
- Salts transported to ground water
- Sediment transported to surface water
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Aquatic habitat for fish and other organisms
- Feed and forage imbalance
- Inadequate livestock water quantity, quality, and distribution

Pathway CP 3.1-3.2
Community 3.1 to 3.2

Repeated continuous season-long or year-long grazing plus encroachment will convert this plant community to a Woody Invaded Community Phase. Invasion of saltcedar or Russian olive should be consider serious and should be controlled. Failure to do so, or failure to continue with control measures will allow the further encroachment of one or both of these species. Other disturbances of the understory or native species by flooding, fire, or soil disturbances will assist with this transition.

Pathway CP 3.2-3.1
Community 3.2 to 3.1

Brush management, weed control, and prescribed grazing aid in the recovery of the herbaceous understory and return to the Alkali sacaton/Woody invader Community Phase (3.1). An integrated approach to treat the overstory and understory invaders. Successional years of treatment is generally required to maintain cover of both saltcedar and Russian olive, as well as many of the herbaceous invader species. Responses to grazing management is more expedient due to the hydrology of the ecological site. Parent material or native seed sources must be available for natural recovery.

Conservation practices

Brush Management
Channel Bank Vegetation
Clearing and Snagging
Prescribed Burning
Critical Area Planting
Riparian Herbaceous Cover
Prescribed Grazing
Grazing Land Mechanical Treatment
Heavy Use Area Protection
Streambank and Shoreline Protection
Integrated Pest Management (IPM)

State 4
Altered

Mining, energy development, irrigation conveyance lines, irrigation, and livestock operating facilities are a few activities that have created a change to this ecological site. The soil disturbance, removal of greasewood and other vegetation, as well as impacts to the hydrology of this ecological site has left scars on the landscape.

Characteristics and indicators. Outside of the visible evidence of soil movement, seeding, or development the altered/disturbed community is comprised of non-native or improved varieties and varying successional species such as weedy annuals (Russian thistle, sunflower or other asters) and foxtail barley.

Resilience management. Frequency of disturbance, species established, level of management, and remaining hydrology determines the resistance and resiliency of the Altered State.

Community 4.1
Altered Lands

Altered lands have been impacted by human settlement and land use advancement. Many areas within the Wind River Basin were farmed during early settlement periods. Water collection structures and conveyance ditches were cut through the channel systems to move water across the landscape for irrigation. Diversion structures, culverts, and intensive use of the riparian systems impacted the water flow and channel stability, causing downcutting and other erosional processes to occur. These alterations with changes in the precipitation and runoff into the system had an impact on the system and over time many ditches and irrigation systems were abandoned. Remnants of old mining towns, farmsteads, and corrals are visible along sections of these drainages today. Mechanical alteration of these areas in conjunction with the introduction of species from hayfields and in attempts to stabilize areas created these altered lands.

Resilience management. The persistence of introduce non-native species is an indicator that identifies this community phase. These non-native species are not invasive, although they may be persistent and aggressive species. Smooth brome, orchardgrass, varieties of wildrye, and hybrid wheatgrasses are a few cultivars that have

been planted that have persisted on the landscape. The preparation of the seedbed as well as any original soil disturbance have altered the soil function and site characteristics. In other instances, the encroachment of these species due to irrigation seepage, or broadcasting have forced the change with an unnatural water source and non-native species. Productivity varies greatly depending on the exact disturbance, age and successional stage of recovery from this disturbance, and what, if any, species were seeded into the site. Composition variability of this plant community limits the ability to provided accurate averages and growth curves, so no production values are provided for this community phase.

Dominant resource concerns

- Sheet and rill erosion
- Ephemeral gully erosion
- Classic gully erosion
- Bank erosion from streams, shorelines, or water conveyance channels
- Concentration of salts or other chemicals
- Aggregate instability
- Surface water depletion
- Ground water depletion
- Naturally available moisture use
- Salts transported to surface water
- Salts transported to ground water
- Sediment transported to surface water
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Aquatic habitat for fish and other organisms

Transition T 1-2
State 1 to 2

Repeated year-long and season-long grazing weakens the tall- and mid-stature grasses providing an advantage for tillering species to establish and increase in dominance in the community. Drought exacerbates this transition. High traffic areas, compaction, aids the speed of the transition as well.

Constraints to recovery. The dense root structure alters the hydrology and increases the erosion potential between vegetative cover reducing the ability for other more preferred species from establishing in the community. The dense root structure also is resilient to continued disturbance as well as removal of pressure, so it is difficult to shift the community without major impacts.

Transition T 1-3
State 1 to 3

Increases in bare ground, drought, and soil disturbances provides a mechanism when invasive seed sources are present to allow weedy species to invade a community. Russian olive and saltcedar are both advantageous species that are quick to establish and out-compete native species for space and resources, as are herbaceous invaders. Soil disturbances by vehicles, animal hoof action, flooding, and other disasters provide opportunity and potential for transport of seed sources to the community. Drought weakens native competitors allowing establishment in the community.

Constraints to recovery. Invasive (noxious) weed control is difficult, time consuming, and costly. In several species, complete eradication and maintenance following removal inhibits the ability to fully recover a community. This inability to completely eradicate all invasive species is the major constraint to recovery. In some instances, the means to eradicate a species may require extensive soil disturbances and seeding of the community, leading to an Altered State.

Restoration pathway R 2-1
State 2 to 1

Reducing the use and pressure on the tall- and mid-stature grasses, allowing alkali sacaton and basin wildrye to recover, with the use of grazing management strategies begins the recovery for this community. incorporating periods of rest during the growing season will allow these species to respond and increase again, will also aid in the stabilization of the channel. Removal or thinning of greasewood and potentially rubber rabbitbrush furthers this process. Care to minimize soil disturbance in the removal of species and weed control is needed to prevent a further degradation of the community.

Conservation practices

Brush Management
Critical Area Planting
Stream Habitat Improvement and Management
Prescribed Grazing
Grazing Land Mechanical Treatment

Transition T 2-3
State 2 to 3

The sod-bound community has increased bare ground and erosion between vegetative patches, increasing the risk for invasion by undesirable species. Intensive use by livestock or wildlife, as well as other soil disturbances including drought and flooding, will open this community further to the pressures of invasion. Animal movement through the community, flood water, wind, and human presence in area are all sources to carry in weedy and invasive species seed sources. Drought will exacerbate this process.

Constraints to recovery. The extreme difficulty, cost, and limitations of weed control, especially eradication, is the major constraint to recovery. Although this is very species specific, the general knowledge is that weed control is costly, requires long term commitment and awareness, and has a high failure rate.

Restoration pathway R 3-4
State 3 to 4

The process of treating or eradicating the invasive species, specifically Russian olive and saltcedar, will require the removal of woody debris and roots. This generally will create extensive soil disturbance, especially in extremely dense cover. The preparation of a seedbed, treatment and removal of invasive and undesirable herbaceous cover, and seeding will physically alter the upper portion of the soil profile and may require deeper ripping and tillage depending on invasive species being dealt with. Improved varieties of species provide the best defense for establishment and competition with weedy species, and offer the best success to outcompete and prevent a re-infestation. This process leads to an Altered State.

Conservation practices

Brush Management
Channel Bank Vegetation
Critical Area Planting
Stream Habitat Improvement and Management
Grazing Land Mechanical Treatment
Range Planting
Heavy Use Area Protection
Integrated Pest Management (IPM)

Transition T 4-3
State 4 to 3

Seeding failure, lack of post-establishment management, or a re-occurrence of a disturbance or on-going disturbances are mechanisms that trigger a re-infestation of invasive species. Although the Saline Subirrigated ecological site provides a better opportunity for successful seedings in this arid and challenging climate. There is an inherent risk, especially in the flood-zone of these riparian areas. When a seeding fails, the bare ground and exposure to possible seed sources (rather imported with equipment and seed, or lasting seedbanks from previous infestations), provides a great opportunity for invasive species to re-establish. If proper timing for establishment and hardening is not provided, grazing impacts can severely weaken or damage a newly established community.

Constraints to recovery. The constraint to recovery is directly associated with the ability to eradicate or out compete the invasive species that establish in the community. Eradication is difficult to unforeseeable. Maintenance length and cost are also inhibiting to this process.

Additional community tables

Table 14. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall-stature, Cool-season Bunchgrass**			120–350	
	basin wildrye	LECI4	*Leymus cinereus*	120–350	5–15
	Canada wildrye	ELCA4	*Elymus canadensis*	0–120	0–5
2	**Mid-stature, Cool-season Bunchgrass**			0–120	
	tufted hairgrass	DECE	*Deschampsia cespitosa*	0–120	0–5
3	**Rhizomatous, Cool-season Grasses**			350–720	
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	350–600	15–25
	alkali cordgrass	SPGR	*Spartina gracilis*	0–120	0–5
	western wheatgrass	PASM	*Pascopyrum smithii*	0–120	0–5
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–120	0–5
4	**Short-stature, Cool-season Bunchgrass**			0–120	
	Sandberg bluegrass	POSE	*Poa secunda*	0–120	0–5
5	**Mid-stature, Warm-season Bunchgrass**			950–1200	
	alkali sacaton	SPAI	*Sporobolus airoides*	950–1200	40–50
	saltgrass	DISP	*Distichlis spicata*	0–120	0–5
6	**Miscellaneous Grass/Grass-likes**			0–120	
	chairmaker's bulrush	SCAM6	*Schoenoplectus americanus*	0–120	0–5
	Grass, perennial	2GP	*Grass, perennial*	0–120	0–5
Forb					
7	**Perennial Forbs**			125–350	
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–120	0–5
	common plantain	PLMA2	*Plantago major*	0–120	0–5
	curly dock	RUCR	*Rumex crispus*	0–120	0–5
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	0–120	0–5
	povertyweed	IVAX	*Iva axillaris*	0–120	0–5
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–120	0–5
	silverweed cinquefoil	ARAN7	*Argentina anserina*	0–120	0–5
	Forb, perennial	2FP	*Forb, perennial*	0–120	0–5
Shrub/Vine					
8	**Dominant Shrubs**			25–250	
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–125	0–5
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–125	0–5
9	**Miscellaneous Shrubs**			0–120	
	narrowleaf cottonwood	POAN3	*Populus angustifolia*	0–120	0–5
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–120	0–5
	Woods' rose	ROWO	*Rosa woodsii*	0–120	0–5

Table 15. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall-stature, Cool-season Bunchgrass**			0–120	
	Canada wildrye	ELCA4	*Elymus canadensis*	0–120	0–5
2	**Mid-stature, Cool-season Bunchgrass**			0–120	
	tufted hairgrass	DECE	*Deschampsia cespitosa*	0–120	0–5
3	**Rhizomatous, Cool-season Grasses**			100–650	
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	50–250	5–10
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	50–250	5–10
	alkali cordgrass	SPGR	*Spartina gracilis*	0–120	0–5
	western wheatgrass	PASM	*Pascopyrum smithii*	0–120	0–5
4	**Short-stature, Cool-season Bunchgrass**			0–120	
	Sandberg bluegrass	POSE	*Poa secunda*	0–120	0–5
5	**Mid-stature, Warm-season Bunchgrass**			400–1150	
	alkali sacaton	SPAI	*Sporobolus airoides*	350–900	15–40
	saltgrass	DISP	*Distichlis spicata*	50–250	5–15
6	**Miscellaneous Grass/Grass-likes**			0–250	
	chairmaker's bulrush	SCAM6	*Schoenoplectus americanus*	0–120	0–5
	Grass, perennial	2GP	*Grass, perennial*	0–120	0–5
Forb					
7	**Perennial Forbs**			100–250	
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–120	0–5
	common plantain	PLMA2	*Plantago major*	0–120	0–5
	curly dock	RUCR	*Rumex crispus*	0–120	0–5
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	0–120	0–5
	povertyweed	IVAX	*Iva axillaris*	0–120	0–5
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–120	0–5
	silverweed cinquefoil	ARAN7	*Argentina anserina*	0–120	0–5
	Forb, perennial	2FP	*Forb, perennial*	0–120	0–5
8	**Annual Forbs**			0–120	
	bog rosemary	ANDRO	*Andromeda*	0–120	0–5
	Forb, annual	2FA	*Forb, annual*	0–120	0–5
Shrub/Vine					
9	**Dominant Shrubs**			100–350	
	greasewood	SAVE4	*Sarcobatus vermiculatus*	100–250	5–10
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–120	0–5
10	**Miscellaneous Shrubs/Short Trees**			0–250	
	narrowleaf cottonwood	POAN3	*Populus angustifolia*	0–120	0–5
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–120	0–5
	Woods' rose	ROWO	*Rosa woodsii*	0–120	0–5

Animal community

Reference - Alkali Sacaton/Nuttall's Alkaligrass: The predominance of grasses in this plant community favors

grazers and mixed-feeders, such as bison, elk, and antelope. Suitable thermal and escape cover for deer may be limited due to the low quantities of woody plants. However, topographical variations could provide some escape cover. This plant community may provide brood rearing/foraging areas for sage grouse. Other birds that would frequent this plant community include western meadowlarks, horned larks, and golden eagles. Many grassland obligate small mammals would occur here.

Alkali Sacaton/Inland Saltgrass/Mixed Shrub: This plant community may be useful for the same large grazers that would use the Reference Community Phase. However, the plant community composition is less diverse, and thus, less apt to meet the seasonal needs of these animals. It may provide some foraging opportunities for sage grouse when it occurs proximal to woody cover. Good grasshopper habitat equals good foraging for birds.

Inland Saltgrass Sod/Mixed Shrub: This plant community may be useful for the same large grazers that would use the Reference Community Phase. However, the plant community composition is less diverse, and thus, less apt to meet the seasonal needs of these animals. It may provide some foraging opportunities for sage grouse when it occurs proximal to woody cover. Good grasshopper habitat equals good foraging for birds.

Alkali Sacaton/Saltcedar and/or Russian Olive: This plant community may be useful for the same large grazers that would use the Reference Community Phase. However, the plant community is less productive, and thus, less apt to meet the seasonal needs of these animals. The shrub cover does provide good thermal and escape cover for both large animals and upland birds. Russian olive may provide a good source of food for some upland game birds and large animals. Many grassland obligate small mammals would occur here.

Dense Saltcedar and/or Russian Olive Stand Plant Community: This plant community can provide important winter cover for mule deer and antelope during that time but little foraging value. The plant community composition is less diverse, and thus less apt to meet the seasonal needs of large grazers. The dense shrub cover does provide good thermal and escape cover for both large animals and upland birds. Russian olive may provide a good source of food for some upland game birds and large animals. Many grassland obligate small mammals would occur here.

Grazing Interpretations:

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

Plant Community Production Carrying Capacity*

The carrying capacity is calculated as the production (normal year) X .25 efficiency factor / 912.5 lbs. /AUM (Animal Unit Month, the amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month) to calculate the
AUMs/Acre.

Plant Community Description/Title lbs./Acre; AUM/Acre*; Acres/AUM*
Below Ave.-Normal-Above Ave.
Reference: Alkali Sacaton/Nuttall's Alkaligrass 1800-2800 1.2
Alkali Sacaton/Inland Saltgrass/Mixed Shrub 1500-2500 1.0
Inland Saltgrass/Mixed Shrub 800-1600 0.6
Alkali Sacaton/Saltcedar and/or Russian Olive 800-1800 0.8
Dense Saltcedar and/or Russian Olive Stand 800-1600 0.2

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

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

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

Hydrological functions

Climate is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group B and C, with localized areas in hydrologic group D. Infiltration ranges from moderately slow to moderately rapid. 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 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. Cryptogamic crusts are present, but only cover 1 to 2 percent of the soil surface.

Recreational uses

This site provides hunting opportunities for upland game species. The wide variety of plants which bloom from spring until fall have an aesthetic value that appeals to visitors. The wet soils are limiting for access and vehicle and foot traffic for most of the growing season.

Wood products

No appreciable wood products are present on the site.

Other products

None noted.

Inventory data references

Information presented in the original site description was derived from NRCS inventory data. Field observations from range trained personnel were also used. Those involved in developing the original site include: Chris Krassin, Range Management Specialist, NRCS and Everet Bainter, Range Management Specialist. Other sources used as references include USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, USDI and USDA Interpreting Indicators of Rangeland Health Version 3 and 5, and USDA NRCS Soil Surveys from various counties.

Those involved in the development of the new concept for Saline Lowland ecological site include: Jim Haverkamp, Area Range Management Specialist, NRCS; John Likins, Range Management Specialist, Retired USDI-BLM; Jeremy Artery, Rangeland Management Specialist, USDI-BLM; Leah Yandow, Wildlife Biologist, USDI-BLM; Daniel Wood, MLRA Soil Survey Leader, NRCS; Jane Karinen, Soil Data Quality Specialist, NRCS; and Marji Patz, Ecological Site Specialist, NRCS.

Quality control and quality assurance completed by: John Hartung, State Rangeland Management Specialist, NRCS; Brian Jensen, State Wildlife Biologist, NRCS; Kirt Walstad, Regional Ecological Data Quality Specialist, NRCS.

Inventory Data References:

Ocular field estimations observed by trained personnel were completed at each site. Then sites were selected where a 100 foot tape was stretched and the following sample procedures were completed by inventory staff. For full sampling protocol and guidelines with forms please refer to the Wyoming ESI Operating Procedures, compiled in 2012 for the Powell and Rock Springs Soil Survey Office, USDA NRCS.
• Double Sampling Production Data (9.6 hoop used to estimate 10 points, clipped a minimum of 3 of these estimated points, with two 21 foot X 21 foot square extended shrub plots).
• Line Point Intercept (over story and understory captured with soil cover). Height of herbaceous and woody cover is collected every three feet along established transect.)
• Continuous Line Intercept (Woody Canopy Cover, with minimum gap of 0.2 of a foot for all woody species and succulents. Intercept height collected at each measurement.),
• Gap Intercept (Basal Gap measured with a minimum gap requirement of 0.7 foot.),
• Sample Point (10 – 1 meter square point photographs taken at set distances on transect. Read using the sample point computer program established by the High Plains Agricultural Research Center, WY).
• Soil Stability (Slake Test – surface and subsurface samples collected and processed according to the soil stability guidelines provided by the Jornada Research Center, NM.)

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Approval

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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 Everet Bainter - original reference sheet
Contact for lead author	marji.patz@usda.gov; 307-271-3130
Date	04/08/2021
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 on this site.

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2. **Presence of water flow patterns:** Water flow patterns are barely observable on the soil. Vegetation may lay over (lodging) following a high flow/overflow event, but soil flow patterns should not be visible.

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3. **Number and height of erosional pedestals or terracettes:** Extreme flow events tend to create very minor pedestals on the bases of herbaceous cover, even in reference condition. However, these do not persist as vegetation recovers, are very slight or are essentially non-existent.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is typically 10 to 20 percent occurring in very small areas throughout site. Patch dynamics of bare ground is minimal in this ecological site, with bare ground patches occurring as less than 6 inches in diameter across the extent.

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

head-cutting may be present, but active or new head-cutting should not be present.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** No evidence of wind scour or blowouts should be present. Minor areas of sediment deposition from spring flooding may be present, but should not bury the current community or persist through a growing season.

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7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement is seer with general precipitation events. Following spring flood events, small debris deposits or dams may be present from off sight locations, but on site litter should show little movement.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Plant cover and litter is at 80 percent or greater of soil surface and maintains soil surface integrity. Soil aggregate stability ratings should typically be is anticipated to be 4 ranging from 2 to 5. Surface organic matter adheres to the soil surface. Soil surfaces peds will typically retain structure indefinitely when dipped in distilled water. Salt burden of soils will reduce the overall aggregate stability of the soil.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 1 to 8 inches; pale brown (10YR 6/3) light clay loam dry, dark brown (10YR 4/3) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; strongly effervescent; very strongly alkaline (pH 9.2); clear smooth boundary. In some instances, the A horizon may not be present or will be very thin, generally on active floodplains of perennial systems.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Grass canopy and basal cover should reduce raindrop impact and slow overland flow providing increased time for infiltration to occur. Healthy deep rooted native grasses enhance infiltration and reduce runoff. Infiltration is moderately slow to moderate.
    The potential vegetation is 80 percent grasses, 10 percent forbs, and 10 percent shrubs. Grass canopy and basal cover should reduce raindrop impact.

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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 physical soil surface crusting should be present. Minor chemical crusting will be evident in barren interspaces as soils dry following extended wet periods.

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

    Dominant: Mid-stature Warm-season Bunchgrasses are the Dominant group, is comprised of 2 species, and accounts for 51% of the composition by production.

    Sub-dominant: Rhizomatous Grasses are the Subdominant group, is comprised of 4 species, and accounts for 24% of the composition by production.

    Other: Perennial Forbs is greater than or equal to Tall-stature Cool-season Bunchgrasses, is greater than Shrubs.

Groups are comprised of 2 and then 1 species each respectively, and account for 25% of the composition by production.

Additional: There are a total of 8 Functional/Structural Groups. (3 are trace). There are 6 dominant and sub-dominant species. Functional/Structural Groups not expected are Introduced annual grasses, perennial introduced and naturalized grasses and annual forbs.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little evidence of decadence or mortality should be visible. Bunchgrasses have strong, healthy centers and shrubs have few dead stems.

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14. **Average percent litter cover (%) and depth (in):** Average plant litter cover is expected to be 25 to 35 percent with depths of 0.2 to 0.5 inches.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Reference Plant Community (CP 1.1) - Annual production ranges from a low of 1800 to a high of 2600 pounds per acre (air dry basis). Normal annual production is 2400 pounds per acre in a year with normal precipitation and weather conditions.
Community Phase 1.2 - Annual production ranges from 1500 to 2500 pounds per acre with average annual production of 2000 pounds per acre.

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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 and inland saltgrass are natives that can be aggressive on this ecological site. Canada thistle, salt cedar, and Russian olive are known invaders. For other possible invaders or new species identified follow the Wyoming Weed and Pest Council website: https://wyoweed.org/

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17. **Perennial plant reproductive capability:** Salt-dependent species (inland saltgrass, alkali sacaton) express high vigor relative to recent weather conditions. Adapted or tolerant species will exhibit moderate vigor. All perennial grasses will have vigorous rhizomes or tillers; vegetative and reproductive structures may be slightly stunted in response to high salt content in soils. All perennial species should be capable of reproducing annually.
