USDA Natural Resources
Conservation Service

Ecological site DX032X02B162
Shallow Loamy (SwLy) Wind River Basin Rim

Last updated: 9/27/2023
Accessed: 05/03/2024

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

Major land resource area (MLRA):

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

Land Resource Unit (LRU):
32X02B (WY): This LRU is the Wind River Basin within MLRA 32X. This LRU is tends to be just a fraction higher in elevation, slightly cooler (by 1-degree Celsius), and spring snowpack tends to persist longer into the spring than the Big Horn Basin (LRU 01). This LRU was originally divided into two LRU's - LRU C which was the core and LRU D which was the rim. With the most current standards, this LRU is divided into two Subsets. This Subset is the rim of the Wind River Basin and is comprised of eroded fan remnants and stream terraces. This subset is driven by the relation to the mountains creating minor shifts in soil chemistry influencing the variety of ecological sites and plant interactions. The extent of soils currently correlated to this ecological site does not fit within the current subset or LRU boundary. Many of the map units are correlated to ecological sites outside of this MLRA, but will be reviewed and corrected during mapping update projects.

Moisture Regime: 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: 10-14 inches (254 – 355 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 & Intermountain Tall Sagebrush Shrubland & Steppe Macrogroup
G302 Artemisia Tridentata - Artemisia tripartita - Purshia tridentata Big Sagebrush Steppe Group
CEGL001535 - Artemisia tridentata ssp. wyomingensis/Pseudoroegneria spicata Herbaceous Vegetation or
CEGL001009 - Artemisia tridentata ssp. wyomingensis/Pseudoroegneria spicata Shrubland

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

Ecological site concept

• Site receives no additional water.
• Slope is < 45%
• Soils Characteristics:
o Textures range from very fine sandy loam to clay loam in top 4” (10 cm) of mineral soil surface
o All subsurface horizons have a weighted average of >18% clay but < 35% clay.
o Shallow (10-20 in. (25-50 cm))
o < 10% stone and boulder cover and < 10% cobble and gravel cover
o Not skeletal (<35% rock fragments) within 20” (50 cm) of mineral soil surface
o Non-saline, sodic, or saline-sodic

Associated sites

R032XY366WY	**Shallow Sandy (SwSy) 10-14" East Precipitation Zone** Shallow Sandy sites will occur in association with Shallow Loamy sites along the outcropping of inter-bedded sedimentary parent material and sandstone. They will also occur on the dipslopes and ridges of escarpments formed by these same parent materials.
R032XY312WY	**Gravelly (Gr) 10-14" East Precipitation Zone** Gravelly sites will occur along the exposed shoulder and Shallow Loamy occurs down slope or inward on the landform.
DX032X02B122	**Loamy (Ly) Wind River Basin Rim** Loamy sites will be found down slope or in lower landscape positions along the same inter-bedded sedimentary parent material as Shallow Loamy.

Similar sites

DX032X02A162	**Shallow Loamy (SwLy) Wind River Basin Core** Shallow Loamy (SwLy) Wind River Basin Core has the same ecological site concept as DX032X02B162 but falls within a lower precipitation zone (5-9
DX032X01B162	**Shallow Loamy (SwLy) Big Horn Basin Rim** Shallow Loamy (SwLy) Big Horn Basin Rim Ecological Sites are the equivalent ecological site concept for DX032X02B162 found in LRU 01 within the Major Land Resource Area 032X. These sites have slightly lower annual production

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata ssp. wyomingensis*
Herbaceous	(1) *Pseudoroegneria spicata*

Legacy ID

R032XD162WY

Physiographic features

Shallow Loamy Ecological Sites occur on steep slopes ranging up to 45 percent. Ridge tops, escarpments and hillsides are the major landforms where this site is found. This site generally comprises a small soils component mapped on these landforms. Soil deposition is minimal on steep slopes and the soils are less developed and shallow to bedrock. The geology and inherent soil chemistry is complex in the Northern Intermountain Desertic Basins. The Shallow Loamy Ecological Site lacks influence from saline/sodic soils and is a key factor to categorize it separately from other shallow sites.

Table 2. Representative physiographic features

Landforms	(1) Intermontane basin > Hill (2) Intermontane basin > Ridge (3) Intermontane basin > Escarpment
Flooding frequency	None
Ponding frequency	None
Elevation	1,646–2,286 m
Slope	0–45%
Aspect	Aspect is not a significant factor

Climatic features

Annual precipitation and modeled relative effective annual precipitation ranges from 10 to 14 inches (254 to 356 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 is about 20 inches annually. Wide fluctuations may occur in yearly precipitation and result in more dry years than those with more than normal precipitation.

Average temperatures show a wide range between summer and winter and between daily maximums and minimums, due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring. High winds are generally blocked from the basin by high mountains, but can occur in conjunction with an occasional thunderstorm. Growth of native cool-season plants begins about April 1 and continues until about July 1. Cool weather and moisture in September may produce some green-up of cool season plants that will continue through late October.

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

For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/. Burris and Diversion Dam are the representative weather stations within LRU 02B. 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)	86 days
Freeze-free period (characteristic range)	121 days
Precipitation total (characteristic range)	229 mm
Frost-free period (actual range)	86 days
Freeze-free period (actual range)	121 days
Precipitation total (actual range)	229 mm
Frost-free period (average)	86 days
Freeze-free period (average)	121 days
Precipitation total (average)	229 mm

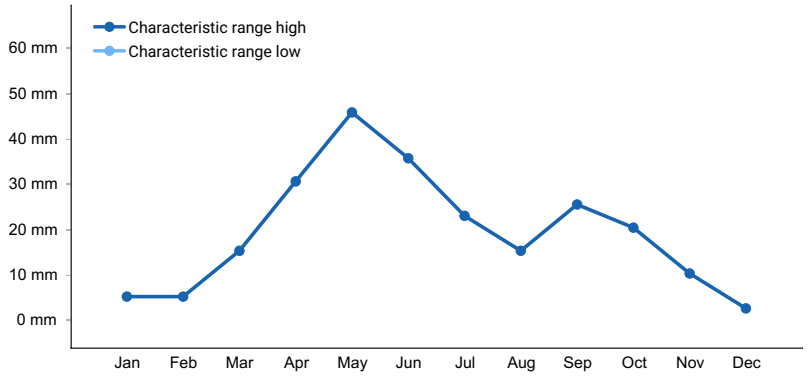


Figure 1. Monthly precipitation range

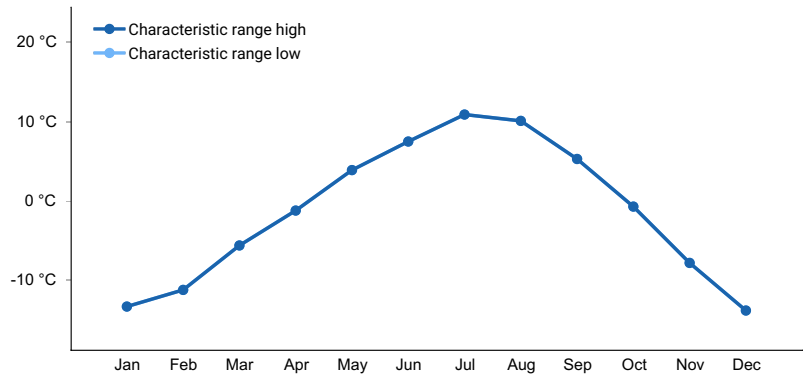


Figure 2. Monthly minimum temperature range

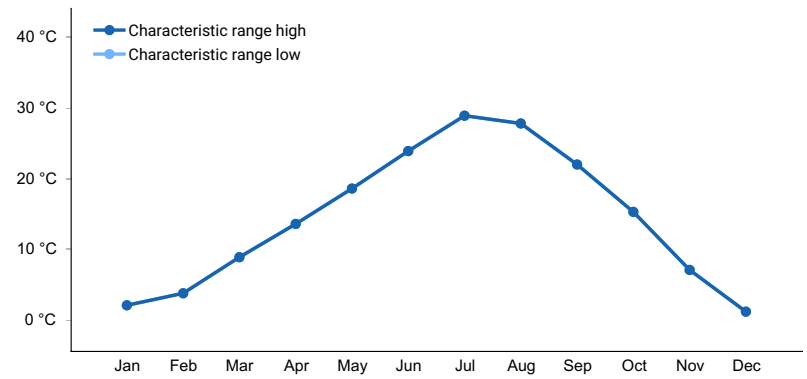


Figure 3. Monthly maximum temperature range

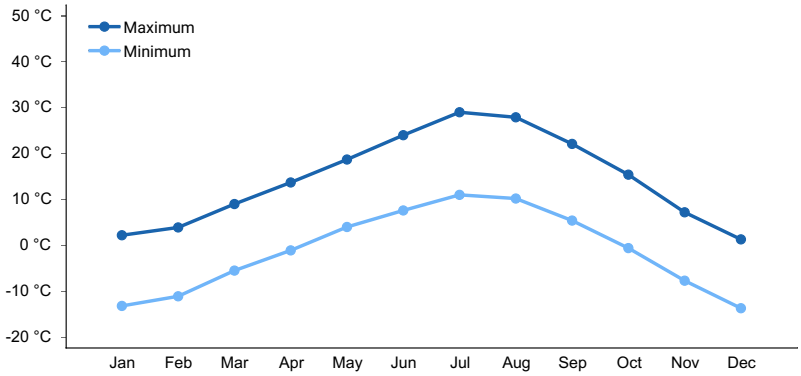


Figure 4. Monthly average minimum and maximum temperature

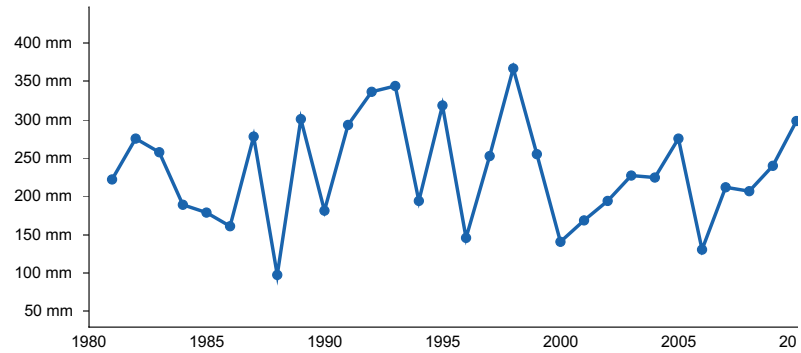


Figure 5. Annual precipitation pattern

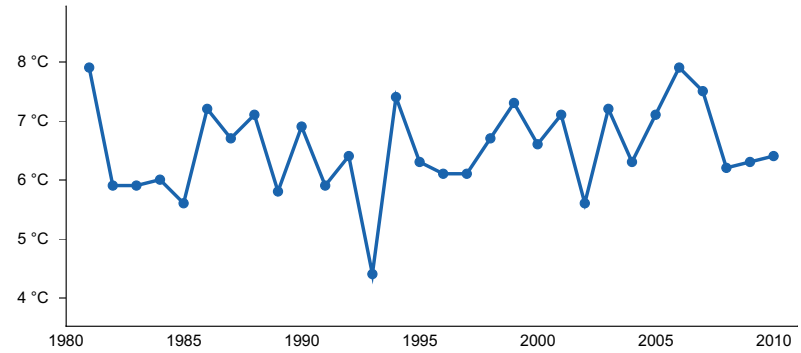


Figure 6. Annual average temperature pattern

Climate stations used

- (1) DIVERSION DAM [USC00482595], Kinnear, WY

Influencing water features

The characteristics of these upland soils have minimal influence from surface water/overland flow and no influence from groundwater (water table below 60 inches (150 cm)). There may be isolated features that are affected by snow pack that persists longer than surrounding areas due to position on the landform (shaded or protected pockets). No streams are classified within this ecological site.

Wetland description

No wetlands associated with this ecological site.

Soil features

The soils of this site are shallow (10 to 20 inches to bedrock), well-drained soils formed in alluvium over residuum or in residuum. These soils have moderately slow to moderate permeability and may occur on all slopes. The bedrock

may be any kind which is virtually impenetrable to plant roots, except igneous. The surface soil will have one or more of the following textures: very fine sandy loam, loam, silt loam, sandy clay loam, silty clay loam, and clay loam. Thin ineffectual layers of other textures are disregarded. The soil characteristics having the most influence on the plant community are the shallow depth, and potential for elevated quantities of soluble salts.

Major Soil Series correlated to this site include: Blazon, Stutzman, Dalhquist, Brownsto, Thermopolis, Blazon, Shingle, Pensore, Cragosen, Rootel, Pilotpeak, Asholler

Table 4. Representative soil features

Parent material	(1) Residuum–sandstone and shale (2) Alluvium–sandstone and shale
Surface texture	(1) Loam (2) Silt loam (3) Clay loam (4) Silty clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	25–51 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–10%
Available water capacity (0-101.6cm)	1.42–16 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–13
Soil reaction (1:1 water) (0-101.6cm)	7.4–9
Subsurface fragment volume <=3" (Depth not specified)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

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

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

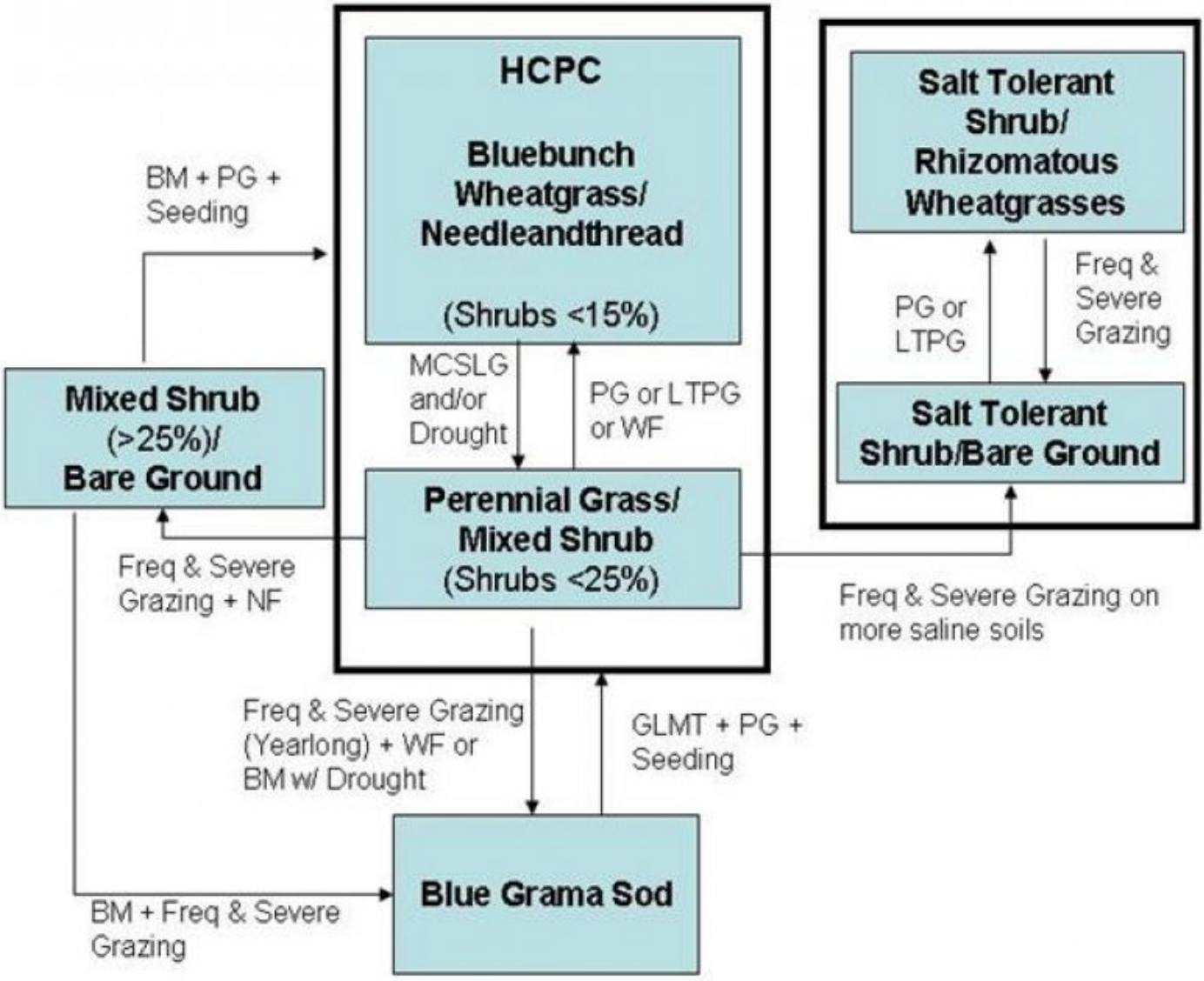
The Reference State (State 1) (description follows the plant community diagram) has been determined by study of rangeland relic areas, or areas protected from excessive disturbance. Trends in plant communities going from heavily grazed areas to lightly grazed areas, seasonal use pastures, and historical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

The following is a State and Transition Model Diagram that illustrates the common plant communities (states) that can occur on the site and the transitions between these communities. The ecological processes will be discussed in

more detail in the plant community narratives following the diagram.

Plant Community Narratives
Following are the narratives for each of the described plant communities. These plant communities may not represent every possibility, but they probably are the most prevalent and repeatable plant communities. The plant composition tables shown above have been developed from the best available knowledge at the time of this revision. As more data is collected, some of these plant communities may be revised or removed, and new ones may be added. None of these plant communities should necessarily be thought of as “Desired Plant Communities”. According to the USDA NRCS National Range and Pasture Handbook, Desired Plant Communities (DPC’s) will be determined by the decision-makers and will meet minimum quality criteria established by the NRCS. The main purpose for including any description of a plant community here is to capture the current knowledge and experience at the time of this revision.

State and transition model



BM - Brush Management (fire, chemical, mechanical)
Freq. & Severe Grazing - Frequent and Severe Utilization of the Cool-season Mid-grasses during the Growing Season
GLMT - Grazing Land Mechanical Treatment
LTPG - Long-term Prescribed Grazing
MCSLG - Moderate, Continuous Season-long Grazing
NU, NF - No Use and No Fire
PG - Prescribed Grazing (proper stocking rates with adequate recovery periods during the growing season)
VLTPG - Very Long-term Prescribed Grazing (could possibly take generations)
WF - Wildfire (Natural or Human Caused)

State 1
Reference State

The Reference State (State 1) for the Shallow Loamy Ecological Site is dominated by mid-stature, cool-season bunchgrasses and rhizomatous wheatgrasses. This state persisted under grazing by large ungulates and was a resource for forage and habitat for a variety of wildlife.

Characteristics and indicators. The Reference State (State 1) is characterized by the prominent cover of bluebunch and Montana wheatgrasses (25 to 50 percent composition) and needle and thread (5 to 15 percent composition). Shrubs such as Wyoming big sagebrush and yellow rabbitbrush are primarily a minor component (5 to 20 percent composition) but will increase as the plant community moves away from the Reference State conditions.

Resilience management. The state is stable and well adapted to the Northern Intermountain Desertic Basins climate. The diversity in plant species provides resistance to influence from drought, non-native species, etc. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity).

Dominant plant species

- Montana wheatgrass (*Elymus albicans*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass
- needle and thread (*Hesperostipa comata*), grass

Community 1.1
Reference Plant Community: Bluebunch Wheatgrass/Needle and thread

The Reference Plant Community is the interpretive plant community for this site. This state evolved with grazing by large herbivores, soils less than 20 inches (50 cm), and periodic fires. The cyclical nature of the fire regime in this community and the shallow soils prevented Wyoming big sagebrush from being dominant on the landscape. This plant community can be found on areas that are properly managed with grazing or prescribed burning, and on areas receiving occasional short periods of rest. Potential vegetation is about 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent woody plants. Cool season midgrasses dominate the state. The major grasses include western wheatgrass, bluebunch wheatgrass, Indian ricegrass, and needle and thread. Other grasses occurring in the state include Sandberg bluegrass, blue grama, and prairie Junegrass. Wyoming big sagebrush and yellow rabbitbrush are key elements of this state, which can make up 15 percent of the annual production. A variety of forbs also occur in this state and plant diversity is high (see Plant Composition Table). The total annual production (air-dry weight) of this state is about 300 pounds per acre, but it can range from about 150 pounds per acre in unfavorable years to about 375 pounds per acre in above average years.

Resilience management. The state is extremely stable and well adapted to the Northern Intermountain Desertic Basins climate. The diversity in plant species allows for high drought resistance. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity).

Dominant plant species

- western wheatgrass (*Pascopyrum smithii*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass
- Indian ricegrass (*Achnatherum hymenoides*), grass
- needle and thread (*Hesperostipa comata*), grass

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	135	269	336
Forb	17	34	45
Shrub/Vine	17	34	45
Total	**169**	**337**	**426**

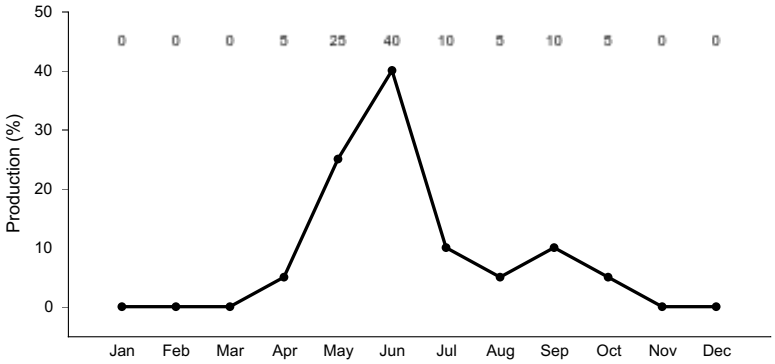


Figure 8. Plant community growth curve (percent production by month). WY0701, 10-14E upland sites.

Community 1.2
Perennial Grass Mixed Shrub Plant Community

Historically, this plant community evolved under grazing and a low fire frequency. Currently, it is found under moderate, season-long grazing by livestock and will be exacerbated by prolonged drought conditions. In addition, the fire regime for this site has been modified and extended periods without fire is now common. This plant community is still dominated by cool-season grasses, while short warm-season grasses and miscellaneous forbs account for the balance of the understory. A variety of shrubs is now a conspicuous part of the overall production. Dominant grasses include western wheatgrass, and needle and thread. Grasses and grass-like species of secondary importance include blue grama, Sandberg bluegrass and threadleaf sedge. Forbs commonly found in this plant community include scarlet globemallow, prairie sagewort, fleabanes, leafy wildparsley, and phlox. Wyoming big sagebrush and yellow rabbitbrush dominate the overstory. Big sagebrush can make up to 20% of the annual production. The overstory of shrubs and understory of grass and forbs provide a diverse plant community When compared to the Reference Plant Community (1.1), shrubs and blue grama have increased. Plains prickly pear cactus will also have increased, but occurs only in small patches. Indian ricegrass and bluebunch wheatgrass have decreased and may occur in only trace amounts under the sagebrush canopy or within the patches of plains prickly pear cactus. The total annual production (air-dry weight) of this state is about 200 pounds per acre, but it can range from about 100 pounds per acre in unfavorable years to about 300 pounds per acre in above average years.

Resilience management. This plant community is resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. 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

- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- yellow rabbitbrush (*Chrysothamnus viscidiflorus*), shrub
- bluebunch wheatgrass (*Pseudoroegneria spicata*), shrub
- western wheatgrass (*Pascopyrum smithii*), shrub
- needle and thread (*Hesperostipa comata*), shrub

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	78	157	235
Shrub/Vine	22	45	67
Forb	11	22	34
Total	**111**	**224**	**336**

Pathway CP 1.1-1.2

Community 1.1 to 1.2

Moderate, continuous season-long grazing will convert the plant community to the Perennial Grass/Mixed Shrub Plant Community (1.2). Prolonged drought will exacerbate this transition.

Pathway CP 1.2-1.1
Community 1.2 to 1.1

Prescribed grazing or possibly long-term prescribed grazing, will convert this plant community to the Reference Plant Community (1.1). The probability of this occurring is high especially if rotational grazing along with short deferred grazing is implemented as part the prescribed method of use. In addition, the removal of fire suppression will allow a somewhat natural fire regime to reoccur to more easily transition between this plant community and the Reference Plant Community (1.1). A prescribed fire treatment can be useful to hasten this transition if desired.

State 2
Mixed Shrub/Bare Ground

The Mixed Shrub/*Bare Ground* State of the Shallow Loamy Ecological Site is dominated by shrubs as a result of extensive grazing and lack of fire. Preferred cool season grasses have been highly reduced. Remnant grasses missed by grazers such as prairie Junegrass, Sandberg bluegrass, and blue grama dominate the grass and grasslike composition. Bare ground is prominent in the interspaces between plants in this state.

Characteristics and indicators. The Mixed Shrub/*Bare Ground* State is characterized by the prominent cover of Wyoming big sagebrush (greater than 20 percent composition). Bare ground is prevalent in the interspaces between plants. Prairie Junegrass, Sandberg Bluegrass, and blue grama continue to occur (10 to 40 percent composition).

Resilience management. The state is resistant to change and may become more fire resistant as fine fuels are reduced by continued frequent and severe grazing. Plant diversity is is moderate to poor making it more susceptible to the effects of drought or disease. Soil erosion is accelerated with the increase in bare ground and frequently result in water flow patterns on the surface.

Dominant plant species

- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- yellow rabbitbrush (*Chrysothamnus viscidiflorus*), shrub
- prairie Junegrass (*Koeleria macrantha*), grass
- Sandberg bluegrass (*Poa secunda*), grass
- threadleaf sedge (*Carex filifolia*), grass
- blue grama (*Bouteloua gracilis*), grass

Dominant resource concerns

- Sheet and rill erosion
- Ephemeral gully erosion
- Classic gully erosion
- Ground water depletion
- Plant productivity and health
- Plant structure and composition
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance

Community 2.1
Mixed Shrub/Bare Ground Plant Community

This plant community is the result of frequent and severe grazing and protection from fire. Shrubs and especially sagebrush dominates this plant community, as the annual production of sagebrush exceeds 20 percent. Shrubs are a significant component of the plant community and the preferred cool season grasses have been eliminated or greatly reduced. The dominant grasses are Sandberg bluegrass, threadleaf sedge, and blue grama. Weedy annual species such as cheatgrass may occupy the site if a seed source is available. Plains prickly pear cactus and

sageworts often increase. Noxious weeds such as Russian knapweed, leafy spurge, or Canada thistle may invade the site if a seed source is available. The interspaces between plants have expanded leaving the amount of bare ground more prevalent. As compared with the Reference Plant Community (1.1) or the Perennial Grass/ Mixed Shrub Plant Community (1.2), the annual production is similar, as the shrub production compensates for the decline in the herbaceous production. The total annual production (air-dry weight) of this state is about 125 pounds per acre, but it can range from about 75 pounds per acre in unfavorable years to about 225 pounds per acre in above average years.

Resilience management. This plant community is resistant to change as the stand becomes more decadent. These areas may actually be more resistant to fire as less fine fuels are available and the bare ground between the sagebrush plants is increased. Continued frequent and severe grazing or the removal of grazing does not seem to affect the composition or structure of the plant community. Plant diversity is moderate to poor. Soil erosion is accelerated because of increased bare ground. Water flow patterns and pedestalling are obvious. Infiltration is reduced and runoff is increased. Rill channels may be noticeable in the interspaces and gullies may be establishing where rills have concentrated down slope.

Dominant plant species

- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- yellow rabbitbrush (*Chrysothamnus viscidiflorus*), shrub
- Sandberg bluegrass (*Poa secunda*), grass
- threadleaf sedge (*Carex filifolia*), grass
- blue grama (*Bouteloua gracilis*), grass

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	50	84	151
Shrub/Vine	22	45	78
Forb	11	17	28
Total	**83**	**146**	**257**

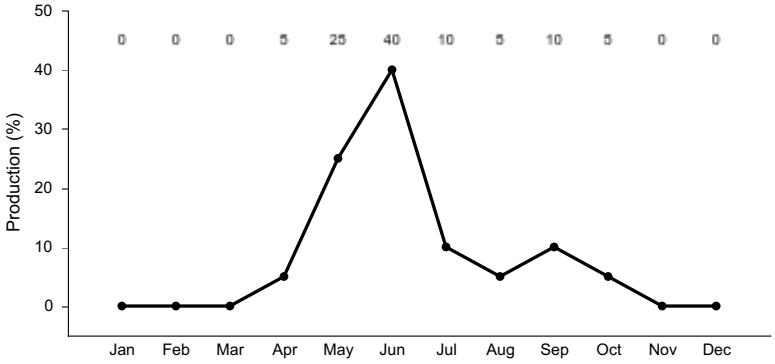


Figure 11. Plant community growth curve (percent production by month). WY0701, 10-14E upland sites.

State 3
Sod-Former

The Sod-Former State of the Shallow Loamy Ecological Site is dominated by sod-forming grasses and grasslikes. This state occurs as a result of frequent and severe grazing and removal of brush either naturally (drought, fire) or human brush control methods. preferred cool-season grasses and shrubs are greatly reduced or lacking completely.

Characteristics and indicators. The Sod-Former State of the Shallow Loamy Ecological Site is characterized by the prominent cover of blue grama and threadleaf sedge in large patches (25 to 70 percent cover). Overall production is greatly reduced compared the Reference State and Mixed Shrub/*Bare Ground* State.

Resilience management. The Sod-Former state is extremely resistant to change and the plant diversity is

extremely low. Water infiltration is greatly reduced which protects that site itself but can result in increased runoff around the edges of the mat.

Dominant plant species

- blue grama (*Bouteloua gracilis*), grass
- threadleaf sedge (*Carex filifolia*), grass

Dominant resource concerns

- Sheet and rill erosion
- Ephemeral gully erosion
- Classic gully erosion
- Ground water depletion
- Plant productivity and health
- Plant structure and composition
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance

Community 3.1
Threadleaf Sedge Sod Plant Community

This plant community is the result of frequent and severe grazing, which has adversely affected the perennial grasses as well as the addition of other impacts that can affect the shrub component. These factors include drought, heavy browsing, wildfires, and human brush control measures. A dense sod of blue grama with patches of threadleaf sedge dominates this state. Plains prickly pear cactus can become dense enough in patches so that livestock cannot graze forage growing within the cactus clumps. Wyoming big sagebrush has been reduced and in some cases removed. When compared to the Reference Plant Community (1.1), blue grama and threadleaf sedge have increased. All cool-season mid-grasses and forbs have been greatly reduced and the shrub component is lacking. Total production has been significantly decreased. The total annual production (air-dry weight) of this state is about 75 pounds per acre, but it can range from about 25 pounds per acre in unfavorable years to about 125 pounds per acre in above average years.

Resilience management. This sod is extremely resistant to change and continued frequent and severe grazing or the removal of grazing does not seem to affect the plant composition or structure of the plant community. The biotic integrity of this state is not functional and plant diversity is extremely low. This sod bound plant community is very resistant to water infiltration. While this sod protects the site itself, off-site areas are affected by excessive runoff that can cause rills and gully erosion. Water flow patterns are obvious in the bare ground areas and pedestalling is apparent along the sod edges. Rill channels are noticeable in the interspaces and down slope. The watershed may or may not be functioning, as runoff may affect adjoining sites.

Dominant plant species

- threadleaf sedge (*Carex filifolia*), grass
- blue grama (*Bouteloua gracilis*), grass

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	22	67	112
Forb	6	11	17
Shrub/Vine	6	11	17
Total	**34**	**89**	**146**

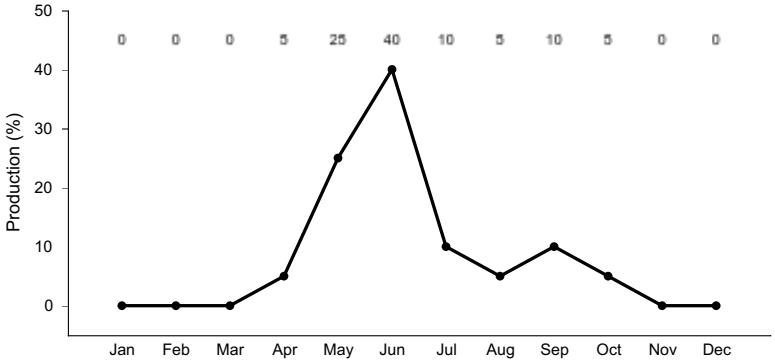


Figure 13. Plant community growth curve (percent production by month). WY0701, 10-14E upland sites.

State 4
Invaded

Wyoming rangelands, much like the neighboring states, has quickly fallen victim to the aggressive invasion of cheatgrass, also called downy brome (*Bromus tectorum*). The rapid development of an extensive seedbank and duff layer forms with the potential for multiple growth cycles throughout a year. The advantageous ability of cheatgrass to persist through the winter under a blanket of snow and sprout early makes it difficult for natives to outcompete it for limited resources. Shifts in climatic patterns, changes in management, and exposure to human activity are a few of the explanations for the current flush and rapid expansion across the western United States. Although cheatgrass is the most prevalent large-scale threat for rangeland managers, a variety of knapweeds (spotted, Russian, etc.), in combination with other aggressive invaders such as whitetop (hoary cress), black henbane, field bindweed, and leafy spurge are increasing in density and frequency, producing their own set of challenging management issues. As more species are found or as other species become more prevalent on a large scale, the community dynamics in this state will shift in response to the concerns of the identified species.

Characteristics and indicators. The Invaded State (State 4) is characterized by the presence and eventual dominance of invasive and non-native species. The open canopy of the arid native community combined with extended periods of drought alone or in combination with overutilization, insect damage, or wildfire, has weakened the native composition, thus allowing invasion.

Resilience management. The competitive nature of annuals and other invasive species creates a complex environment that inhibits control and makes it implausible to attain complete eradication once an invasive species has established on the landscape.

Dominant plant species

- cheatgrass (*Bromus tectorum*), grass
- knapweed (*Centaurea*), other herbaceous
- whitetop (*Cardaria draba*), other herbaceous

Dominant resource concerns

- Organic matter depletion
- Surface water depletion
- Naturally available moisture use
- Plant productivity and health
- Plant structure and composition
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance

Community 4.1
Invasive Plant Community

Downy brome, better known as cheatgrass (*Bromus tectorum*), can green-up and grow late into the fall and green-up early spring before snowmelt; this growth pattern allows cheatgrass to utilize fall and spring resources that are

otherwise stored for the cool-season native vegetation before they can begin to break dormancy. The morphology of the seed allows for easy dispersal and longevity, creating a widespread and long-term seed bank. Seeds can persist for long periods of time until growing conditions are optimal, allowing growth before most native species. The ability of the plant to grow quickly, utilizing available resources and producing large quantities of seed rapidly, and to reproduce in poor conditions are what drive cheatgrass above the natives and many improved varieties of grass; as well as creates a management challenge that has not been successfully met at this time. Once this species has a niche on a landscape it is resistant and resilient to change. The absence of sagebrush in this community restricts the potential for native herbaceous species, but some will persist in small scattered populations or sparsely under the canopy of cheatgrass. When climatic conditions are optimal, these resilient native species will respond to the available resources (typically mid-spring moisture). They are not able to out-compete invasive species long-term, so are restricted to a minor composition in the community. The ability for cheatgrass to emerge, bolt, produce seed, and mature two to three times within a year utilizes all available soil nutrients and moisture resources. Chemical control is difficult to attain and maintain success without lasting effects on the native grasses in the area. Chlorosis of wheatgrasses, stunted plants, and loss of certain forbs are a few of the residual chemical effects: plateauing is what has been observed in this region. This generally comes from the chemical composition and its ability to bind to the chemistry or nutrients in the soil, inhibiting the uptake by roots. The risk, frequency and intensity of wildfires increase with the increasing fine fuels (biomass load) created by cheatgrass. The fire frequency interval has been noted to shift to a possible five-year cycle, preventing sagebrush and other woody species from establishing on the site. Negative impacts on many of the native herbaceous species in the understory are intensified by increased evaporation and mineralization or vaporization of many of the nutrients, rendering the soils nearly sterile. The grazing potential is limited due to the unpalatable and harsh environment that the mature seeds create with their long awns and chaff. If grazed in early spring or late fall some of this can be avoided, but general use through the middle of the growing season is difficult and defeats the purpose of intensively grazing the location. In smaller invaded sites or under certain conditions, grazing can be used as a tool within the integrated pest management toolbox, but it is not effective alone.

Resilience management. Rangeland Health Implications/Indicators: This plant community is resistant to change. Plant diversity is poor. The plant vigor is diminished, and replacement capabilities are non-existent due to the loss of cool-season grasses. Plant litter is noticeably more when compared to Reference State plant communities in response to the dense duff layer created by cheatgrass. Soil erosion generally is reduced in response to the litter accumulation. Infiltration and runoff are variable due to the loss of perennial vegetation, but with the potential increase in root density. Overall biotic integrity is lost in this community.

Dominant plant species

- cheatgrass (*Bromus tectorum*), grass
- knapweed (*Centaurea*), other herbaceous
- whitetop (*Cardaria draba*), other herbaceous

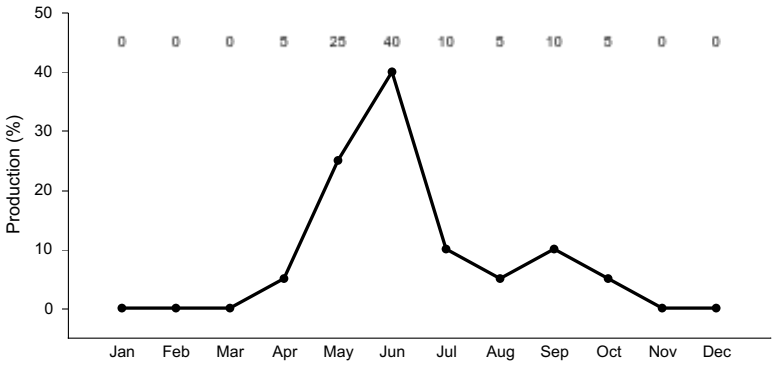


Figure 14. Plant community growth curve (percent production by month). WY0701, 10-14E upland sites.

Transition T 1-2
State 1 to 2

Frequent and severe grazing plus no fire will convert the plant community to the Mixed Shrub/*Bare Ground* Plant Community. The probability of this occurring is high, especially evident on areas with historically higher precipitation and where drought or heavy browsing does not adversely impact the sagebrush stand.

Transition T 1-3
State 1 to 3

Frequent and severe grazing (yearlong grazing) plus wildfire or brush control, will convert the plant community to the Sod-Former State. The probability of this occurring is high, especially if the sagebrush stand has been severely affected by drought or heavy use or has been removed altogether.

Restoration pathway R 2-1
State 2 to 1

Brush management, followed by prescribed grazing, will return this plant community at or near the Reference State (State 1). Reseeding after brush management with native species may be necessary to ensure a more rapid transition. If prescribed fire is used as a means to reduce or remove the shrubs, sufficient fine fuels will need to be present. This may require deferment from grazing prior to treatment. Post management is critical to ensure success. This can range from two or more years of rest to partial growing season deferment, depending on the condition of the understory at the time of treatment and the growing conditions following treatment. In the case of an intense wildfire that occurs when desirable plants are not completely dormant, the length of time required to reach the Reference State (State 1) may be increased and seeding of natives is recommended.

Transition T 2-3
State 2 to 3

Brush management, or an intense wildfire followed by frequent and severe grazing, will convert the plant community to the Sod-Former State.

Transition T 2-4
State 2 to 4

Fire (wild), Frequent or Severe Grazing, Drought with Insect Damage/Brush Management – Throughout most of this LRU there is a seed source present for cheatgrass, knapweed, and other invasive species. Stress to the native community from fire, drought, disease/insect damage to sagebrush, or ground/soil disturbance including impacts by grazing large herbivores or recreational uses; opens the canopy and exposes the soil, creating a niche for undesirable and invasive species to establish. Early detection and rapid response provides a chance to prevent a full-scale invasion, but if left untreated, infestations can establish rapidly and spread with one growing season. The population soon grows exponentially as further stress or disturbance occurs. In some cases, once the invasive species are established, they can create their own habitat; this reduces the competitive ability of native species. The open canopy of the Mixed Shrub/*Bare Ground* State is vulnerable to invasive species without further influence. With continued over-use, drought, or insect damage/disease, the invasive species will establish and quickly dominate a location. The threshold species in this system is Wyoming big sagebrush, which protects the remnants of the perennial native grasses, allowing them to persist on the landscape.

Constraints to recovery. The lack of sufficient key native species and the inability to eradicate or sufficiently control invasive species are the main constraints to recovery for this state.

Context dependence. Extent of the transition for the Mixed Shrub/*Bare Ground* State to the Invaded State will determine the severity of the recovery constraints. The loss of shrubs from this state will further limit/remove any ability of this state to recover back to any previous state.

Restoration pathway R 3-1
State 3 to 1

Grazing land mechanical treatment (chiseling, etc.) and plains prickly pear cactus control (if needed), followed by prescribed grazing, will return this plant community to near Reference State (State 1) condition. Reseeding with natives is often needed to hasten this transition.

Transition T 3-4

State 3 to 4

Frequent and severe grazing, drought, or disturbance with a seed source present—Increased interspatial gaps in these communities leaves exposed soil that is vulnerable to invasion by undesirable species. Increased pressure from overuse and drought work to weaken the sod or mat-like community, exposing soil further to annuals and other invaders, such as cheatgrass and knapweeds. The aggressive nature and altered hydrology of these sites do restrict weed invasion. But if a seed source is available, ground disturbance by herbivores or man-induced, allows invasive species to find a way into the community. Once established in the community, it may not be feasible to completely remove eradicate the invasive species. Once the invasive species have become prevalent on the landscape (less than five percent composition), the community crosses the threshold into the Invaded State.

Constraints to recovery. The lack of ability to eradicate or remove invasive species from the community at this time is the constraint to any recover from the invader driven state.

Context dependence. Substantial evidence that a blue grama dominated community has shifted to a invaded community has not been gathered. It has been documented where a significant population of invasive species (ex: cheatgrass) has established within the interspaces of the blue grama sod.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**bluebunch wheatgrass**			140–280	
	Montana wheatgrass	ELAL7	*Elymus albicans*	140–280	–
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	140–280	–
1	**Montana wheatgrass**			140–280	
	winterfat	KRASC	*Krascheninnikovia*	0–15	–
2	**needle and thread**			28–84	
	needle and thread	HECO26	*Hesperostipa comata*	28–84	–
3	**Indian ricegrass**			28–56	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	28–71	–
4	**prairie Junegrass**			28–56	
	western wheatgrass	PASM	*Pascopyrum smithii*	28–56	–
5	**western wheatgrass**			28–56	
	prairie Junegrass	KOMA	*Koeleria macrantha*	28–56	–
6				28–84	
	Grass, perennial	2GP	*Grass, perennial*	0–28	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–28	–
	sedge	CAREX	*Carex*	0–28	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	0–28	–
	spike fescue	LEKI2	*Leucopoa kingii*	0–28	–
	green needlegrass	NAVI4	*Nassella viridula*	0–28	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–28	–
Forb					
7				0–56	
	Forb, perennial	2FP	*Forb, perennial*	0–28	–
	textile onion	ALTE	*Allium textile*	0–28	–
	rosy pussytoes	ANRO2	*Antennaria rosea*	0–28	–

	prairie sagewort	ARFR4	*Artemisia frigida*	0–28	–
	Missouri milkvetch	ASMI10	*Astragalus missouriensis*	0–28	–
	Indian paintbrush	CASTI2	*Castilleja*	0–28	–
	little larkspur	DEBI	*Delphinium bicolor*	0–28	–
	fleabane	ERIGE2	*Erigeron*	0–28	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–28	–
	beardtongue	PENST	*Penstemon*	0–28	–
	spiny phlox	PHHO	*Phlox hoodii*	0–28	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–28	–
	thrift mock goldenweed	STAR10	*Stenotus armerioides*	0–28	–
Shrub/Vine					
8				28–112	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–28	–
	black sagebrush	ARNO4	*Artemisia nova*	0–28	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–28	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–28	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–28	–

Animal community

Animal Community – Wildlife Interpretations

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

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

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

3.1 - Blue Grama Sod Plant Community: These communities provide limited foraging for antelope and other grazers. They may be used as a foraging site by sage grouse if proximal to woody cover and if the Reference Plant Community (1.1) or the Perennial Grass/Mixed Shrub Plant Community (1.2) is limiting. Generally, these are not target plant communities for wildlife habitat management.

4.1 - Invasive Plant Community: Early spring and fall green-up of cheatgrass provides foraging opportunities for many of our grazers and mixed feeders. However, as the invasive species increase, decreasing the desirable species, the wildlife species benefits are decreased as well.

Animal Community – Grazing Interpretations

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

Plant Community Production Carrying Capacity*
(lb./ac) (AUM/ac)
Reference 350-700 .14
Perennial Grass/Mixed Shrub 250-650 .12
Mixed Shrub/*Bare Ground* 150-350 .07
Blue Grama Sod 100-250 .04
Invasive

* - 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.

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

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group B and C, with localized areas in hydrologic group D. Infiltration ranges from moderate 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 such as bluebunch wheatgrass. 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 one to two percent of the soil surface.

Recreational uses

This site provides hunting opportunities for upland game species. The wide varieties of plants which bloom from spring until fall have an aesthetic value that appeals to visitors. Outside of plants, the extent offers a variety of cultural resources to view on the landscape based on the location of many of these sites on higher ground on the benches and fans which also provides a rich source of geology for exploration.

Wood products

No appreciable wood products are present on the site.

Other products

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

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

Inventory data references

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

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

Those involved in the development of the new concept for sandy ecological site include: Jim Haverkamp, Area Range Management Specialist, NRCS; Mandi Hirsche, Range Management Specialist/Sage Grouse Coordinator, Popo Agie Conservation District; John Likins, Range Management Specialist (Retired), USDI-BLM; 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; James Bauchert, 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.)

Other references

Baker, William L. 2006. Fire and Restoration of Sagebrush Ecosystems. Wildlife Society Bulletin 34(1): 177-185.

Bestelmeyer, B., and J. R. Brown. 2005. State-and-transition models 101: a fresh look at vegetation change. The Quivira Coalition Newsletter, Vol. 7, No. 3.

Bestelmeyer, B., J. R. Brown, K. M. Havstad, B. Alexander, G. Chavez, J. E. Herrick. 2003. Development and use of state and transition models for rangelands. Journal of Range Management 56(2):114-126.

Bestelmeyer, B., J. E. Herrick, J. R. Brown, D. A. Trujillo, and K. M. Havstad. 2004. Land management in the American Southwest: a state-and-transition approach to ecosystem complexity. Environmental Management 34(1):38-51.

Herrick, J. E., J. W. Van Zee, K. M. Havstad, L. M. Burkett, and W. G. Whitford. 2005. Monitoring manual for grassland, shrubland and savanna Ecosystems. Volume I Quick Start. USDA - ARS Jornada Experimental Range, Las Cruces, New Mexico.

Herrick, J. E., J. W. Van Zee, K. M. Havstad, L. M. Burkett, and W. G. Whitford. 2005. Monitoring manual for grassland, shrubland and savanna Ecosystems. Volume II: Design, supplementary methods and interpretation. USDA - ARS Jornada Experimental Range, Las Cruces, New Mexico.

NRCS. 2014. (electronic) National Water and Climate Center. Available online at http://www.wcc.nrcs.usda.gov/

NRCS. 2014. (electronic) Field Office Technical Guide. Available online at http://efotg.nrcs.usda.gov/efotg_locator.aspx?map=WY NRCS. 2009. Plant Guide: Cheatgrass. Prepared by Skinner et al., National Plant Data Center.

Pellant, M., P. Shaver, D. A. Pyke, and J. E. Herrick. 2005. Interpreting indicators of rangeland health. Version 4. Technical Reference 1734-6. USDI-BLM. Ricketts, M. J., R. S. Noggles, and B. Landgraf-Gibbons. 2004. Pryor Mountain Wild Horse Range Survey and Assessment. USDA-Natural Resources Conservation Service.

Schoeneberger, P. J., D. A. Wysocki, E. C. Benham, and Soil Survey Staff. 2012. Field book for describing and sampling soils, Version 3.0. Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE. (http://soils.usda.gov/technical/fieldbook/)

Stringham, T. K. and W. C. Krueger. 2001. States, transitions, and thresholds: Further refinement for rangeland applications. Agricultural Experiment Station, Oregon State University. Special Report 1024.

Stringham, T. K., W. C. Kreuger, and P. L Shaver. 2003. State and transition modeling: an ecological process approach. Journal of Range Management 56(2):106-113.

United States Department of Agriculture. Soil Survey Division Staff. 1993. Soil Survey Manual, United States Department of Agriculture Handbook No. 18, Chapter 3: Examination and Description of Soils. Pg.192-196.

USDA, NRCS. 1997. National Range and Pasture Handbook. (http://www.glti.nrcs.usda.gov/technical/publications/nrph.html)

Trlica, M. J. 1999. Grass growth and response to grazing. Colorado State University. Cooperative Extension. Range. Natural Resource Series. No. 6.108.

U.S. Department of Agriculture, Natural Resources Conservation Service (USDA/NRCS). 2007. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

U.S. Department of Agriculture, Natural Resources Conservation Service (USDA/NRCS), Soil Survey Staff. 2010. Keys to Soil Taxonomy, Eleventh Edition, 2010.

USDA/NRCS Soil survey manuals for appropriate counties within MLRA 32X.
Western Regional Climate Center. (2014) (electronic) Station Metadata. Available online at: http://www.wrcc.dri.edu/summary/climsmwy.html.

Contributors

Marji Patz
Daniel Holter

Approval

Kirt Walstad, 9/27/2023

Acknowledgments

The original Generation 1 ESD, and foundation for this site description was first published by Everet Bainter.

This version of the ESD has been reviewed and edited by Dan Mattke, Resource Soil Scientist; James Bauchert, State Soil Scientist; Daniel Wood, MLRA Soil Survey Leader; Ray Gullion, Multi-county Rangeland Management Specialist; John Likins, Retired BLM; and Leah Yandow, Wildlife Biologist - BLM. A sincere thank you is sent to each of these folks for their efforts to improve the quality and depth of this description.

Further Quality Assurance review was provided by Scott Woodall. His insight has helped to ensure a technically sound tool.

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)	Ray Gullion, E. Bainter
Contact for lead author	ray.gullion@wy.usda.gov or 307-347-2456
Date	05/02/2008
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

---

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

---

3. **Number and height of erosional pedestals or terracettes:** Rare to nonexistent.

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground can range from 15-45%.

---

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

---

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

---

7. **Amount of litter movement (describe size and distance expected to travel):** Herbaceous litter expected to move

only in small amounts (to leeward side of shrubs) due to wind. Large woody debris from sagebrush will show no movement.

---

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil Stability Index ratings range from 1 (interspaces) to 5 (under plant canopy), but 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):** Soil data is limited for this site. Described A-horizons vary from 1-15 inches (3-38 cm) with OM of .5 to 1.5%.

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Plant community consists of 70-85% grasses, 10% forbs, and 5-20% shrubs. Evenly distributed plant canopy (30-60%) and litter plus slow to moderate infiltration rates result in minimal runoff. Basal cover is typically less than 5% for this site and does very little to effect runoff on this site. Surface rock fragments of 10-20% provide stability to the site, but reduce infiltration.

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None.

---

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

    Dominant: Mid-size, cool season bunchgrasses>> cool season rhizomatous grasses>perennial shrubs>>perennial forbs>short, cool season bunchgrasses

    Sub-dominant:

    Other:

    Additional:

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Minimal decadence, typically associated with shrub component.

---

14. **Average percent litter cover (%) and depth (in):** Litter ranges from 10-25% of total canopy measurement with total litter (including beneath the plant canopy) from 25-65% expected. Herbaceous litter depth typically ranges from 3-10mm. Woody litter can be up to a couple inches (4-6 cm).

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** English: 350-700 lb/ac (525 lb/ac average); Metric 392-784 kg/ha (588 kg/ha average).

---

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Bare ground greater than 75% is the most common indicator of a threshold being crossed. Yellow rabbitbrush, Wyoming big sagebrush, blue grama, Sandberg bluegrass, buckwheat, and phlox are common increasers. Annual weeds such as kochia, mustards, lambsquarter, and Russian thistle are common invasive species in disturbed sites.

---

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