USDA Natural Resources Conservation Service

Ecological site DX034A02X162
Shallow Loamy Pinedale Plateau (SwLy PP)

Last updated: 2/19/2025
Accessed: 05/11/2025

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): 034A–Cool Central Desertic Basins and Plateaus

Major Land Resource Area (MLRA) 34A, Cool Central Desertic Basins and Plateaus, consists of approximately 21 million acres in Wyoming, Colorado and Utah, it consists of 10 Land Resource Units (LRU). These units are divisions of the MLRA based on geology, landscape, common soils, water resources and plant community potentials. The elevation ranges from approximately 5600 feet (1700 m) along the Green River in UT and CO to approximately 9500 feet (2900 m) near Jeffrey City, WY. Annual precipitation ranges from 7 to 16 inches (177 to 406 mm), with the driest areas in the Green River and Great Divide Basins and the wettest areas in northern Carbon County, Southeast Fremont County and Albany County. There is a seasonal weather pattern that trends west to east, with more winter precipitation in the west and more spring/summer in the east, illustrated by diminishing amounts of Big Sagebrush in the eastern part of the MLRA.

LRU notes

The Pinedale Plateau LRU is in the upper Green River Drainage from Pinedale, Wyoming at the north working southward to Farson, Wyoming and easterly to South Pass, Wyoming. It is situated between the Wyoming Range and Wind River Range largely in Sublette County with some areas in Lincoln County, northern Sweetwater County, and a small portion of Fremont County. The total area of this LRU is approximately 1,210,000 acres. It shares a boundary with MLRA 46-Northern Rocky Mountain Foothills (proposed for the foothills of western Wyoming).
This LRU is dominated by the New Fork Tongue of the Wasatch formation, a large artesian aquifer that is estimated to hold large amounts of water with relatively quick recharge (Martin, 1997). It is also home to the Lance Formation, a cretaceous strata that is part of the Mesaverde Group, which holds large amounts of hydrocarbons, giving way to one of the largest on shore natural gas fields (Jonah Field) (Bowker et al 2000). The soils in the Pinedale Plateau are dominated by older Alfisols with thick argillic and calcic horizons and younger deep alluvial soils along drainage ways and in river bottoms. Salts are not a major influence in the Pinedale Plateau compared to the adjacent Green River Basin LRU but do occur, including sodium, calcium carbonate, and other soluble salts. Soils are tied closely to their parent geology but are more developed and older so typically do not have bedrock contact within six feet.
This LRU has an aridic ustic soil moisture regime and frigid (bordering on cryic) soil temperature regime. The precipitation pattern is bimodal with a slight spikes in the spring and fall. Winter temperatures are cold allowing snow to accumulated and stay until spring. This lends perfectly to cool season grasses and forbs to flourish, also allowing Big Sagebrush to establish and dominate the landscape. The mean annual soil temperatures are between 36 to 40 degree Fahrenheit (2.2 to 4.4 degree Celsius) and average precipitation is between 9 and 12 inches (230-305 mm) annually. Elevations of this LRU range between 6500 and 7500 feet (1980-2280 m).

Classification relationships

Relationship to Other Established Classification Systems
National Vegetation Classification System (NVC):
3 Semi-Desert
3.B.1 Cool Semi-Desert Scrub & Grassland

3.B.1.Ne Western North American Cool Semi-Desert Scrub & Grassland Division
M169 Great Basin & Intermountain Tall Sagebrush Shrubland & Steppe Macrogroup
G303 Intermountain Dry Tall Sage Steppe and Shrubland Group
A3182 Wyoming big sagebrush Mesic Steppe and Shrubland Alliance
CEGL001009 *Artemisia tridentata* ssp. wyomingensis/Pseudoroegnaria spicata Shrubland Association

Ecoregions (EPA):
Level I: 10 North American Deserts
Level II: 10.1 Cold Deserts
Level III: 10.1.4 Wyoming Basin

Ecological site concept

• This site not does receive any additional water.
• These soils:
o are not saline or saline-sodic
o are shallow (10-20 inches deep)
o may be skeletal within 20 inches (50 cm) of the soil surface (greater than 35 percent rock fragments by volume)
o are not strongly or violently effervescent in the surface mineral layer (within top 10 inches; 25 cm)
o have surface textures that usually range from fine sandy loam to light clay loam in surface mineral layer (4 inches; 10 cm)
• have slopes that range from 15-45 percent
• clay content is not greater than 35 percent in mineral soil surface layer (6 inches; 15 cm)
Climate:
aridic ustic moisture regime (ustic bordering on aridic)
frigid (bordering on cryic) temperature regime

Associated sites

DX034A02X122	**Loamy Pinedale Plateau (Ly PP)** Soils are moderately deep to very deep (greater than 20 inches).

Similar sites

R034AY262WY	**Shallow Loamy Foothills and Basins West (SwLy)** Previous version of this site, but applied to a larger geographic area.

Table 1. Dominant plant species

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

Legacy ID

R034AC162WY

Physiographic features

The Shallow Loamy Pinedale Plateau (SwLy-PP) ecological site occurs in intermontane basin landscapes on hill and hillslope landforms (see following definitions). The slopes typically range from 15 to 45 percent, but can occur from 0 to greater than 50 percent. This site occurs on all aspects.

Landscape Definitions:
intermontane basin—-A generic term for wide structural depressions between mountain ranges that are partly filled with alluvium and called "valleys" in the vernacular.

Landform Definitions:
hills–-A landscape dominated by hills and associated valleys. The landform term is singular (hill).
hillslope -- A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of the hill.

Table 2. Representative physiographic features

Landforms	(1) Intermontane basin > Hill (2) Hillslope
Runoff class	Negligible to very high
Flooding frequency	None
Ponding frequency	None
Elevation	6,500–7,500 ft
Slope	15–45%
Aspect	Aspect is not a significant factor

Climatic features

Annual precipitation ranges from 9 to 12 inches per year. Wide fluctuations may occur in yearly precipitation and result in more below average years than those with above average precipitation. Temperatures show a wide range between summer and winter and between daily maximums and minimums. This is predominantly due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Much of the precipitation accumulation (45 percent) comes in the winter in the form of snow (October to April). The wettest month is May (1.69 inches). The dominant plants (sagebrush and cool season grasses) are well adapted to these conditions. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour. The growing season is short (less than 60 day) and cool (critical growth period): primary growth typically occurs between May and June.
Growth of native cool-season plants begins about mid-April and continues to approximately early July. Some green-up of cool-season plants usually occurs in September with adequate fall moisture.

All data is based on the 30-year average from 1981-2010.

Table 3. Representative climatic features

Frost-free period (characteristic range)	30-70 days
Freeze-free period (characteristic range)	50-80 days
Precipitation total (characteristic range)	9-12 in
Frost-free period (actual range)	15-70 days
Freeze-free period (actual range)	45-90 days
Precipitation total (actual range)	9-13 in
Frost-free period (average)	36 days
Freeze-free period (average)	64 days
Precipitation total (average)	11 in

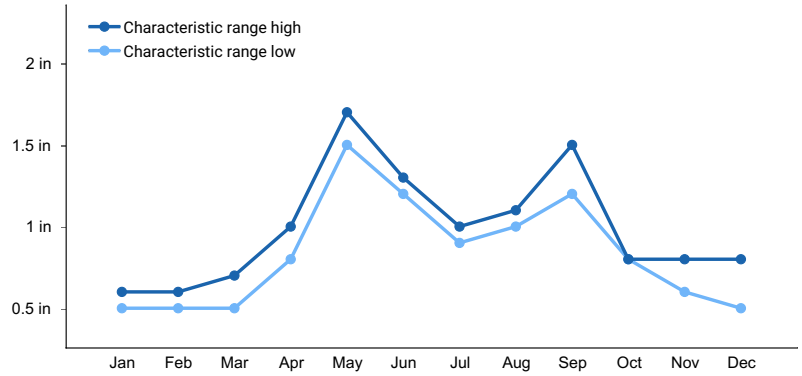


Figure 1. Monthly precipitation range

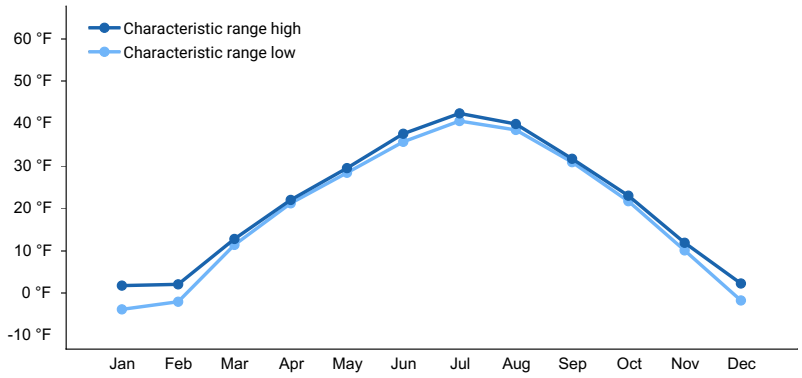


Figure 2. Monthly minimum temperature range

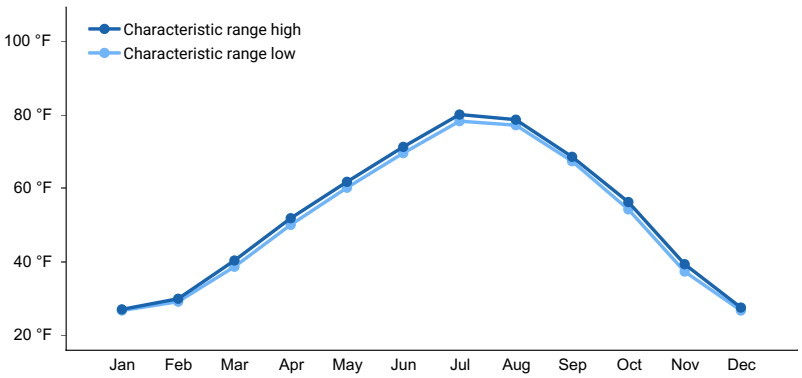


Figure 3. Monthly maximum temperature range

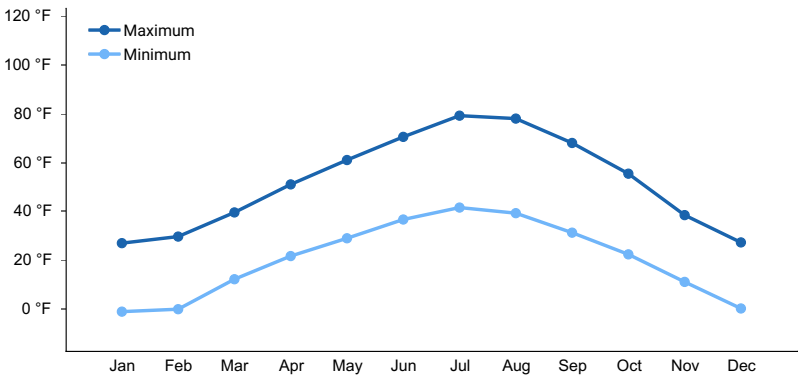


Figure 4. Monthly average minimum and maximum temperature

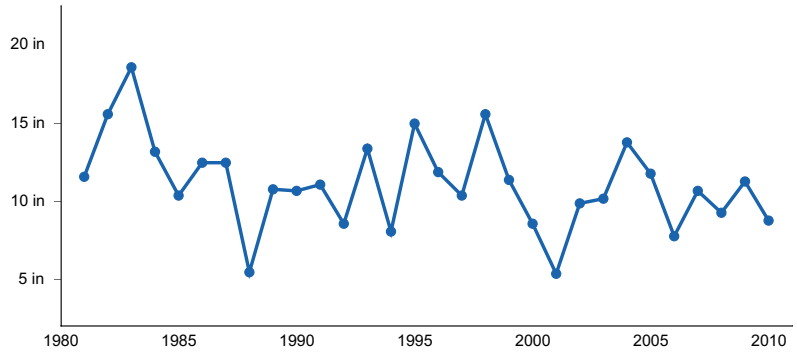


Figure 5. Annual precipitation pattern

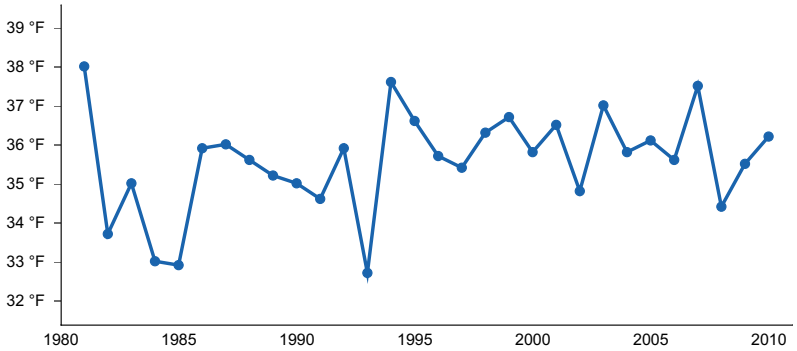


Figure 6. Annual average temperature pattern

Climate stations used

- (1) PINEDALE [USC00487260], Pinedale, WY
- (2) BOULDER REARING STN [USC00480951], Boulder, WY
- (3) CORA [USC00482054], Cora, WY

Influencing water features

There are no influencing water features in the Shallow Loamy Pinedale Plateau ecological site.

Wetland description

N/A

Soil features

The soils of this site are shallow and formed in slope alluvium and colluvium derived from interbedded sedimentary rock and conglomerate. Surface and subsurface textures are fine sandy loam to light clay loam. Rock fragments are typically channery or flaggy (angular) and may be present at the surface with outcropping bedrock, increasing in volume with depth to lithic or paralithic contact. These soils are well-drained and have moderate to moderately rapid permeability. The soil moisture regime is ardic ustic and the soil temperature regime is frigid.

Major Soil Series correlated to this site include: Broback, Craighigh, and Hoofer
Representative soil taxonomy:
Loamy-skeletal, mixed, superactive, calcareous, frigid, shallow Aridic Ustorthents
Loamy-skeletal, mixed, superactive, frigid Aridic Haplustalfs
Loamy, mixed, superactive, frigid, shallow Aridic Haplustalfs

Table 4. Representative soil features

Parent material	(1) Slope alluvium–sandstone and shale (2) Residuum–sandstone and shale

Surface texture	(1) Very parachannery loam (2) Sandy clay loam (3) Very gravelly sandy loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	10–20 in
Soil depth	10–20 in
Surface fragment cover <=3"	5–20%
Surface fragment cover >3"	5–15%
Available water capacity (0-20in)	1.9–3.9 in
Calcium carbonate equivalent (0-20in)	0–15%
Electrical conductivity (0-10in)	0–4 mmhos/cm
Sodium adsorption ratio (0-10in)	0–10
Soil reaction (1:1 water) (0-10in)	7.6–8.4
Subsurface fragment volume <=3" (15-40in)	0–50%
Subsurface fragment volume >3" (15-30in)	0–40%

Ecological dynamics

A State-and-Transition Model (STM)diagram is depicted below. Thorough descriptions of each state, transition, plant community phase, and pathway are found after the model in this document. This diagram is based on available experimental research, field observations, professional consensus, and interpretations. While based on the best available information, the STM will change over time as knowledge of ecological processes increases.

Plant community composition within the same ecological site has a natural range of variability across the LRU due to the naturally occurring variability in weather, soils, and aspect. Not all managers will choose the Reference Plant Community as the management goal. Other plant communities may be desired to meet land management objectives. This is valid as long as the rangeland health attributes assessment departures are none to slight or slight to moderate from the Reference State. The biological processes on this site are complex; therefore, representative values are presented in a land management context. The species lists are representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are not intended to cover every situation or the full range of conditions, species, and responses for the site.

Both percent species composition by weight and percent cover are used in this ESD. Most observers find it easier to visualize or estimate percent cover for woody species (trees and shrubs). Foliar cover is used to define plant community phases and states in the State-and-Transition Model. Cover drives the transitions between communities and states because of the influence of shade and interception of rainfall.

Species composition by dry weight remains an important descriptor of the herbaceous community and of site productivity as a whole and includes both herbaceous and woody species. Calculating similarity index requires data on species composition by dry weight.

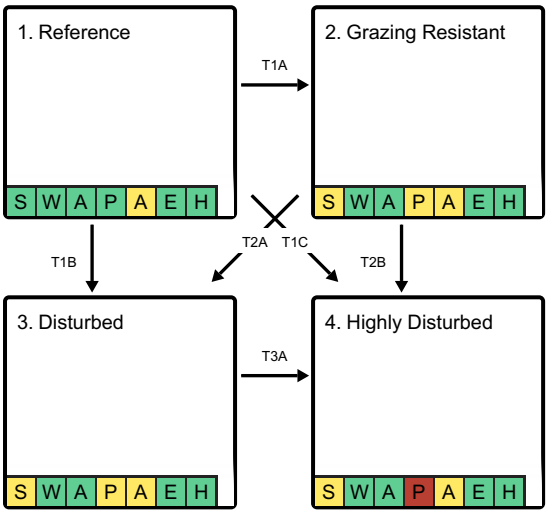
Although there is considerable qualitative experience supporting the pathways and transitions within the State-and-Transition Model, no quantitative information exists that specifically identifies threshold parameters between reference states and degraded states in this ecological site. For information on STMs, see the following citations:

Bestelmeyer et. al. 2003, Bestelmeyer et. al. 2004, Bestelmeyer and Brown 2005, and Stringham et. al. 2003.

A resource concern risk assessment and dominant resource concerns are provided for each Land Use, State, and/or Plant Community Phase based on NRCS resource concern and planning criteria used to determine resource treatment levels during the conservation planning process. A resource concern is the resource condition that does not meet the minimum accepted levels established by planning criteria as shown in Section III of the NRCS Field Office Technical Guide (https://efotg.sc.egov.usda.gov/#/).
• Low risk means a low probability for the category of resource concerns and additional assessment is typically not necessary.
• Medium risk means that the category of resource concerns could occur, and additional assessment is recommended if the identified resource is a client concern and/or objective.
• High risk means that a resource concern in that category is likely to occur.
The resource categories are: S (soil), W (water), A (air), P (plant), A (animal), E (energy), and H (human). The dominant resource concerns further refine the resource category to a specific resource concern within that category.

State and transition model

Ecosystem states



T1A - Herbivory (continuous or season-long, low to moderate stocking)

T1B - Soil-disturbance (e.g. hoof action, rodents, water erosion) and high intensity fire or chemical and mechanical treatment

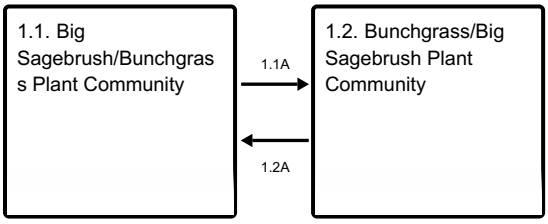
T1C - Extreme soil-disturbance (e.g. oil and gas development, road construction, heavy use areas)

T2A - Soil-disturbance (e.g. hoof action, rodents, water erosion) or catastrophic wildfire or chemical and mechanical treatment

T2B - Extreme soil-disturbance (e.g. oil and gas development, road construction, heavy use areas)

T3A - Extreme soil-disturbance (e.g. oil and gas development, road construction, heavy use areas)

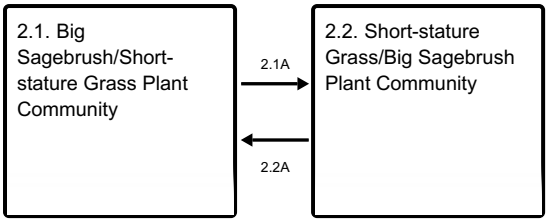
State 1 submodel, plant communities



1.1A - Sage-killing event (drought, herbivory, prolonged soil saturation, freeze-kill, snow mold, infrequent fire)

1.2A - Natural Succession

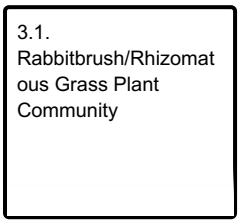
State 2 submodel, plant communities



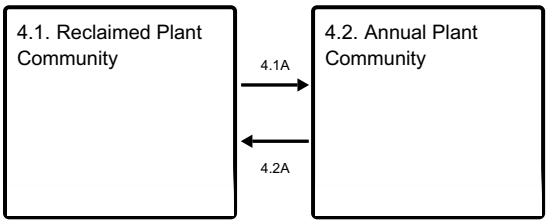
2.1A - Sage-killing event (herbivory, drought, prolonged soil saturation, freeze-kill, snow mold)

2.2A - Natural Succession

State 3 submodel, plant communities



State 4 submodel, plant communities



4.1A - Extreme soil disturbance (oil and gas development, road construction, gravel pit, heavy use areas)

4.2A - Reclamation (contouring, deep ripping, re-seeding, prescribed grazing)

State 1
Reference

The Reference State consists of two plant communities: the Big Sagebrush/Bunchgrass Plant Community and the Bunchgrass/Big Sagebrush Plant Community. Each plant community differs in percent composition and foliar cover of bunchgrasses and Wyoming big sagebrush (*Artemisia tridentata* ssp. wyomingensis) as the dominant shrub. Forbs are a minor component. Two important processes occur in the reference state and result in plant community changes: 1) sagebrush-killing disturbances such as herbivory, drought, prolonged soil saturation, freeze-kill, snow mold, and to a lesser extent, fire; and 2) time without those disturbances, generally referred to as "natural succession." Fire is thought to have been infrequent due to low fine fuel loads, but when it occurred it was small acreage and stand replacing (Innes 2019). Fire Return Intervals are difficult to estimate due to little direct evidence

of fire from pre-settlement times, but what information does exist suggests over 200 years for low fuel sites in the Wyoming Basin (Innes 2019).

Characteristics and indicators. The shift between plant community phases is dependent upon sagebrush-killing disturbances, and without them sagebrush will increase even with proper grazing management. Improper grazing management may accelerate the rate of increase for the shrub component. Management actions or treatments are not typically prescribed or used to mimic the natural disturbance regime due to fragile nature of the soils and lower productivity potential on this site. Treatments that do exist many times have goals for increased leader growth on shrubs for big game winter range. Prescribed fire is not used due to land uses, ownership patterns and lack of fine fuels (Clause and Randall, 2014).

Resilience management. This site has moderate to moderately high resilience due to its aridic ustic (ustic bordering on aridic) soil moisture regime and frigid bordering on cryic temperature regime (Chambers et.al. 2014). Precipitation is typically low, but more effective with cooler temperatures and present when needed during the critical growth period (May through June). The site can usually recover after disturbance but is susceptible to delays in recovery during extreme climatic events such as drought. The site has moderately high resistance to invasion by annual grasses because of climate limitations (dry and cold). The site may be susceptible to invasion after extreme disturbance during warmer climatic periods or on southeast aspects and concave microtopography. At the LRU scale, this site is less resilient than Sandy, Loamy, or Clayey sites, and it is less resistant to invasion by annual invasive grasses when on south-facing aspects. Lower resilience and resistance is caused by slope, aspect, rock fragments, and reduced infiltration, making this site more susceptible to dry and drought conditions and harder for new perennial plants to become established.

Dominant plant species

- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass
- needle and thread (*Hesperostipa comata*), grass

Dominant resource concerns

- Terrestrial habitat for wildlife and invertebrates
- Inadequate livestock water quantity, quality, and distribution

Community 1.1
Big Sagebrush/Bunchgrass Plant Community

This plant community is well adapted to Cool Central Desertic Basins and Plateaus climatic conditions. The diversity in plant species allows for drought tolerance, and natural plant mortality is very low. Perennial plants that dominate this site have strong, healthy root systems that allow production to increase significantly with favorable moisture conditions. Abundant plant litter is available for soil building and moisture retention. Plant litter is properly distributed with very little movement off-site. This plant community provides for soil stability and a properly functioning hydrologic cycle. The Big Sagebrush/Bunchgrass Community can occur across the entire ecological site or can occur in a mosaic with the Bunchgrass/Big Sagebrush Community. This community can occur over time without these disturbances and accelerated with added herbivory pressure. Wyoming big sagebrush is dominant with foliar

cover ranging from 15 to 25 percent. At this sagebrush canopy level in this precipitation zone, there is some competition between the shrub overstory and the herbaceous understory. (Winward, 2007) A Big Sagebrush/Bunchgrass Community with a degraded understory is an “at-risk” community. There are generally few canopy gaps that can be moderate in size (three to six feet). Rock cover on the soil surface is common and often armors the site against soil erosion. Many plant interspaces have canopy or litter cover. Production of grasses is lower than in the Bunchgrass/Big Sagebrush Community. Total annual production ranges from 300 to 700 pounds per acre with a Representative Value (RV) of 500 pounds per acre.

Community 1.2
Bunchgrass/Big Sagebrush Plant Community

The Bunchgrass/Big Sagebrush Community can occur across the entire ecological site on a given landscape but more likely occurs in a mosaic pattern associated with the disturbance cycle at any given location. Mid-stature bunchgrasses dominate and sagebrush is sub-dominant with foliar cover ranging from 5 to 15 percent. At this sagebrush canopy level in this precipitation zone, there is little, if any, competition between the shrub over-story and the herbaceous understory. In fact, there is evidence to suggest that the under-story receives more benefit from the sage over-story than negative effects. (Winward, 2007). There are generally few canopy gaps and most are generally small (one to two feet) with some moderate (two to three feet). Rock cover on the soil surface is common. Most shrub inter-spaces have canopy or litter cover that armors the site against soil erosion. Production of grasses is higher than in the Big Sagebrush/Bunchgrass Community.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	195	325	455
Shrub/Vine	75	125	175
Forb	30	50	70
Total	**300**	**500**	**700**

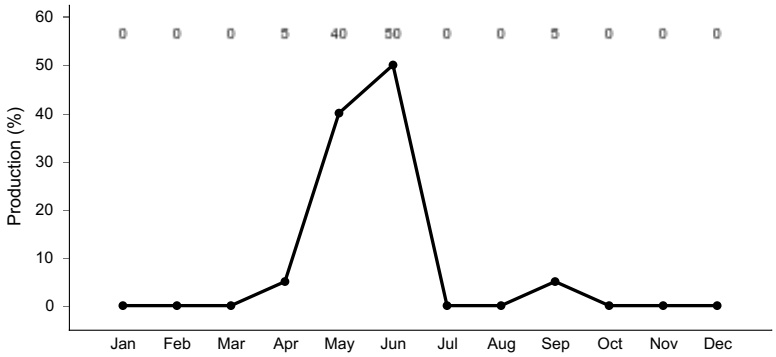
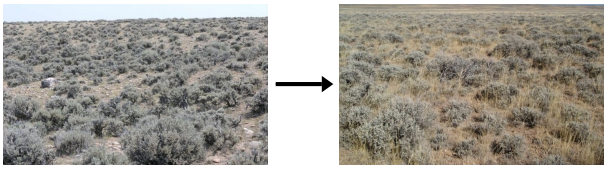


Figure 8. Plant community growth curve (percent production by month). WY0301, 34AC, Upland Sites. All Upland Sites.

Pathway 1.1A
Community 1.1 to 1.2



Big Sagebrush/Bunchgrass Plant Community

Bunchgrass/Big Sagebrush Plant Community

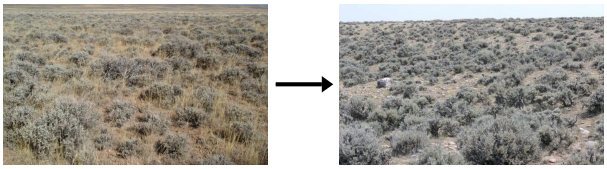
Sagebrush killing event via climatic events such as drought, prolonged soil saturation, freeze-kill, snow mold, and herbivory with infrequent fire.

Context dependence. A successful pathway is contingent upon a grazing regime that allows for periodic critical growth period rest (May through June). The historic herbivory regime was light and episodic, sometimes including spring/fall migration patterns by mid-size ungulates who "ride the green wave" from winter to summer ranges (Aikens et.al. 2017).

Conservation practices

Prescribed Grazing

Pathway 1.2A
Community 1.2 to 1.1



Bunchgrass/Big Sagebrush Plant Community

Big Sagebrush/Bunchgrass Plant Community

Natural succession (time without sagebrush killing event).

Context dependence. The time period for this pathway is dependent upon weather events such as drought and above normal precipitation years. Drought results in a slower pathway while favorable precipitation can result in a faster pathway. A grazing regime that mimics the historic regime (light intensity, episodic grazing events) will not alter the pathway, but a continuous grazing regime at low to moderate intensity can accelerate the pathway and puts the plant community at-risk of transitioning to the Grazing Resistant State if maintained over long periods of time.

State 2
Grazing Resistant

Figure 9. Interbedded sandstone and shale bedrock outcrop

The Grazing Resistant State consists of two plant communities: the Big Sagebrush/Short-stature Grass Plant Community and the Short-stature Grass/Big Sagebrush Plant Community. There has been a shift in under-story herbaceous species dominance from mid-stature cool-season bunchgrasses to short-stature, shallow rooted bunchgrasses and rhizomatous grasses and grass-likes. Gap interspace and bare ground increase, while herbaceous foliar cover decrease.

Characteristics and indicators. There are fewer mid-size bunchgrasses and they are typically found under the shrub canopy where they are protected from herbivory. The shrub canopy interspaces are occupied by grazing tolerant grasses as well as patches of bare ground that are sometimes connected. Canopy gaps and bare ground increase, while herbaceous foliar cover decreases. Drier site conditions result in lower productivity and less herbaceous production potential. Decreased infiltration is caused by increased bare ground patch size and lack of litter that acts as mulch in retaining soil moisture and retarding runoff. In many cases, the transition to the Grazing Resistant State may have occurred many decades ago during an era of higher stocking rates and continuous grazing during the growing season. However, continual grazing during the critical growth period (roughly May-June) at proper stocking rates will facilitate the transition to this state or maintain it as a stable state.

Resilience management. Site resilience is lower than the Reference State. Site hydrology has been modified due to moisture being utilized by shallower rooting species. Therefore, the site is drier earlier in the season, lower in diversity, and unable to recover as quickly after a disturbance such as drought. This state is more drought-prone, and therefore sees wider productivity swings during dry versus wet years. Site resistance to invasion by annual grasses is similar to the reference state, although there are more niches for undesirable annual forbs such as desert alyssum or annual invasive grasses such as cheatgrass to become established during favorable (hot/dry) conditions on southeastern aspects and concave micro-topography.

Dominant plant species

- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- Sandberg bluegrass (*Poa secunda*), grass
- thickspike wheatgrass (*Elymus lanceolatus ssp. lanceolatus*), grass
- needleleaf sedge (*Carex duriuscula*), grass

Dominant resource concerns

- Sheet and rill erosion
- Classic gully erosion
- Plant productivity and health
- Plant structure and composition
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance
- Inadequate livestock water quantity, quality, and distribution

Community 2.1
Big Sagebrush/Short-stature Grass Plant Community

This plant community is characterized as Wyoming big sagebrush dominated with a diminished under-story. The understory has lost many of the mid-stature cool-season bunchgrasses, and they have been replaced with short-stature bunchgrasses such as Sandberg bluegrass, rhizomatous wheatgrasses and grass-likes, and mat-forming forbs. Shrub foliar cover is often greater than 15 percent and typically comprising over have of total annual production. Areas that catch and retain snow are more likely to have higher shrub cover. Herbaceous production and foliar cover has decreased. A small amount of annual invasive grasses such as cheatgrass could occur on south aspects, mostly less than five percent foliar cover. There is often a slight increase in sprouting shrubs (less than 10 percent composition by weight). This plant community is at-risk of transitioning to the Disturbed State with additional disturbance such as heavy grazing, sagebrush treatment, or ground-disturbing activity. Productivity is highly variable and fluctuates drastically in response to drought and wet cycles. Total annual production is lower than in Reference State, leading to lower soil organic matter content and therefore lower soil stability than in the Reference State. Total annual production ranges from 200 to 600 pounds per acre with a Representative Value (RV) of 400 pounds per acre. Biotic integrity is affected by the change in functional/structural group dominance.

Community 2.2
Short-stature Grass/Big Sagebrush Plant Community

This plant community is characterized by a dominance of short-stature grasses such as Sandberg bluegrass, rhizomatous grasses and grass-likes, and mat-forming forbs. A sagebrush killing event has happened recently, and Wyoming big sagebrush foliar cover is typically less than 15 percent. A small amount of annual invasive grasses such as cheatgrass could occur on south aspects, mostly less than five percent foliar cover. There is often a slight increase in sprouting shrubs (less than 10 percent composition by weight).Total annual production ranges from 200 to 600 pounds per arcre with a Representative Value (RV) of 400 pounds per acre. Biotic integrity is affected by the change in functional/structural group dominance. This plant community is at-risk of transitioning to the Disturbed State with additional disturbance such as heavy grazing, sagebrush treatment, or ground-disturbing activity.

Pathway 2.1A
Community 2.1 to 2.2

Sagebrush killing event, mainly natural climatic events such as herbivory, drought, prolonged soil saturation, freeze-kill, or snow mold. Fire is not typically a driver in this state due to the lack of fine fuels in the understory.

Context dependence. This pathway relies upon close to normal precipitation and temperature as well as a grazing regime that is low to moderate intensity. If extreme conditions/disturbances such as hot temperatures, drought, or high intensity grazing occur, there is risk of a transition to the Disturbed State depending upon severity and cumulative disturbance.

Conservation practices

Brush Management

Pathway 2.2A

Community 2.2 to 2.1

Natural succession (time without sagebrush killing event).

Context dependence. The time period for pathway is dependent upon weather events such as drought and above normal precipitation years. Drought conditions result in a slower pathway while favorable precipitation can result in a faster pathway. A grazing regime that mimics the historic regime (light intensity, episodic grazing events) will not alter the pathway, but a continuous grazing regime at low to moderate to intensity can accelerate the pathway. Prolonged high intensity grazing without adequate recovery puts the plant community at risk of transitioning to the Disturbed State.

State 3
Disturbed

The Disturbed State is a result of soil-disturbing activities outside of the normal disturbance regime expected for this site. Examples are high intensity hoof action, anthropogenic activity, rodent activity, or prolonged soil saturation, which includes occasional irrigation. It may also occur after brush management (sagebrush treatment) preceded or followed by grazing that include high-intensity grazing use without appropriate recovery periods. Brush management treatment methods are typically chemical (including 2,4-D or tebuthiuron) due to soil limitations to mechanical treatment. However, mechanical treatments do occur when large rock fragments are not present on the soil surface. Herbivory (including browse and/or insects) can contribute to disturbances affecting this state. High intensity fire could be a factor in maintaining this plant community by stimulating sprouting shrubs (rabbitbrush) and killing sagebrush. The Disturbed State consists of one plant community, the Rabbitbrush/Rhizomatous Grass Plant Community. Soil erosion is accelerated because of increased bare ground. This state is maintained by recurrent disturbance and by soil erosion.

Characteristics and indicators. There is a shift toward sprouting shrub and rhizomatous grass dominance. Both green and rubber rabbitbrush may be present. Annual weeds such as desert alyssum, flixweed, and lambsquarter, are often present in small amounts (less than five percent composition by dry weight). Invasive annual grasses such as cheatgrass may occur in small amounts on southern aspects.

Resilience management. Site resilience is lower than the Reference State or Grazing Resistant State. Site hydrology has been modified due to moisture being utilized by shallower rooting species. Therefore, the site is drier earlier in the season and unable to recover as quickly after a disturbance. However, existing sprouting shrub canopy and remnant perennial vegetation provide some amount of resiliency. Site resistance to invasion by annual grasses is lower due to niches in the understory for establishment as well as the added factor of disturbance. Episodic and limited moisture is more suited to annual life forms during drought.

Dominant plant species

- yellow rabbitbrush (*Chrysothamnus viscidiflorus*), shrub
- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- thickspike wheatgrass (*Elymus lanceolatus ssp. lanceolatus*), grass

Dominant resource concerns

- Sheet and rill erosion
- Classic gully erosion
- Plant productivity and health
- Plant structure and composition
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance
- Inadequate livestock water quantity, quality, and distribution

Community 3.1
Rabbitbrush/Rhizomatous Grass Plant Community

This plant community is the result of a recent soil-disturbing activity. Rhizomatous wheatgrasses are the dominant perennial grass, and annual forbs are often present. Annual grasses such as cheatgrass could be present on south

aspects. With sagebrush removed, green or rubber rabbitbrush is the dominant shrub, often exceeding 30 percent of the annual production. Subdominant understory species include bottlebrush squirreltail, Sandberg bluegrass, and unpalatable annual and perennial forbs. In the absence of annuals, there can be a substantial amount of bare ground. Total annual production ranges from 200 to 600 pounds per acre with a Representative Value (RV) of 400 pounds per acre. The soil is not adequately protected, and erosion is expected without management to allow for adequate litter and residual. The biotic integrity is reduced due to low annual production, relative dominance and unexpected structural/functional groups, and potentially invasive species if present. The watershed is functioning-at-risk.

State 4
Highly Disturbed

The Disturbed State is a result of extreme soil-disturbing activities outside of the normal disturbance regime expected for this site. Primary examples include road construction, oil and gas exploration, as well as livestock and recreation heavy use areas.

Characteristics and indicators. Primary indicators of this state are extreme soil disturbance associate with anthropogenic activities. Depending on the time since disturbance, recent climatic events, and reclamation efforts, the plant community could be dominated by annual weeds or it could be reclaimed to a variety of introduced or native species.

Resilience management. Site resilience is lower than the Reference State, but potentially higher than the Grazing Resistant or Disturbed States. Site hydrology modifications exist, but may be temporary if proper reclamation occurs. Site resistance to invasion by annual forbs is lower due to an increase in soil disturbance allowing niches in the understory for establishment. Common annuals to invade this site include kochia, Russian thistle, and halogeton. Cheatgrass may be present if introduced with seeding efforts, but does not dominate the site or influence site dynamics.

Dominant resource concerns

- Sheet and rill erosion
- Classic gully erosion
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance
- Inadequate livestock water quantity, quality, and distribution

Community 4.1
Reclaimed Plant Community

This plant community is highly variable based on weather conditions during restoration activities, the management practices used, the seed mix, and how soil was stockpiled during the disturbance. Total annual production ranges from 300 to 700 pounds per acre with a Representative Value (RV) of 500 pounds per acre. The soil is is typically adequately protected, but erosion can occur during high runoff events. The biotic integrity is dependent on the seed mix used to reclaim the site. There is high variability in watershed function depending on reclamation success.

Community 4.2
Annual Plant Community

As part of succession, all sites that are severely disturbed will go through this plant community as part of their restoration. Weather is the largest determining factor in how long a site will be in this plant community phase, but is approximately two to five years on sites that use Best Management Practices for site restoration (http://www.uwyo.edu/wrrc/). The site has low potential for recovery. Seeding is needed to restore functional structural groups. Productivity in this plant community phase is highly variable based on current year's weather. Total annual production ranges from 100 to 300 pounds per acre with a Representative Value (RV) of 200 pounds per acre.

Pathway 4.1A
Community 4.1 to 4.2

Extreme soil-disturbance from anthropogenic activity such as oil and gas development, road construction, and heavy use areas for livestock production or recreation.

Context dependence. Subsurface rock fragments are often brought to the surface during disturbance, complicating reclamation efforts. This pathway could also occur from one severe disturbance or multiple consecutive disturbances (e.g. livestock or recreational heavy use areas) and extreme conditions such as hot temperatures, extreme drought, or high intensity grazing.

Pathway 4.2A
Community 4.2 to 4.1

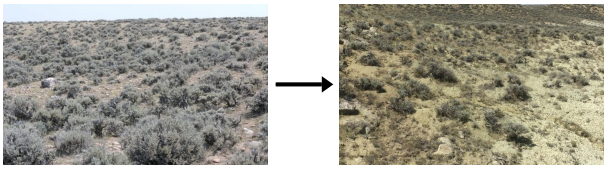
Reclamation efforts include re-seeding. In cases where heavy equipment caused the disturbance, contouring, or deep ripping may be necessary to provide a suitable site for re-seeding. Care must be taken to not bring subsurface rock to the surface and to stockpile and replace surface layers separately from subsurface. Prescribed grazing and restricting vehicle traffic on the site is necessary to facilitate successful seeding of perennial species.

Context dependence. Drought conditions and herbivory pressure may hinder restoration efforts, and multiple seeding efforts may be necessary if failure is caused by drought. Mulch can be effective for soil moisture retention and erosion control on slopes greater than eight percent.

Conservation practices

Critical Area Planting
Mulching
Prescribed Grazing

Transition T1A
State 1 to 2



Reference **Grazing Resistant**

Herbivory pressure in excess of normal Reference State conditions. A typical scenario is continuous spring or season-long grazing with low stocking intensity.

Constraints to recovery. Recovery is inhibited by continued herbivory pressure, reduced seedbank, and drought conditions. Annual grasses may occur in small amounts when on southeast aspects and concave microtopography.

Context dependence. This transition typically occur over a long period of time with no sudden event to trigger the transition.

Transition T1B
State 1 to 3

Soil-disturbance outside of the normal disturbance regime expected for this site. Examples include high intensity fire, high intensity hoof action, anthropogenic activity (e.g. mechanical and/or chemical treatments), recreational activities, rodent activity, or prolonged soil saturation, which includes occasional irrigation.

Constraints to recovery. Recovery is inhibited by consecutive disturbances over a relatively short time period and prolonged drought conditions. There is a risk of annual invasion on southeastern aspects and concave micro-topography.

Context dependence. This transition typically occurs after multiple consecutive disturbances.

Transition T1C
State 1 to 4

Extreme soil-disturbance from anthropogenic activity such as oil and gas development, road construction, and heavy use areas for livestock production or recreation.

Constraints to recovery. Recovery is inhibited by soil depth, herbivory pressure, and prolonged drought conditions.

Context dependence. Soils are fragile, and this pathway could occur from one severe disturbance or multiple consecutive disturbances (e.g. livestock or recreation heavy use areas) and/or extreme conditions such as hot temperatures, extreme drought, or high intensity grazing without adequate recovery periods.

Transition T2A
State 2 to 3

Soil-disturbance outside of the normal disturbance regime expected for this site. Examples include catastrophic wildfire, high intensity hoof action, anthropogenic activity (e.g. mechanical and chemical treatments), recreational activity, rodent activity, or prolonged soil saturation, which includes occasional irrigation.

Constraints to recovery. Recovery is inhibited by consecutive disturbances over a relatively short time period, herbivory pressure, and drought conditions. There is a risk of annual grass invasion on southeastern aspects and concave micro-topography.

Context dependence. This transition typically occurs after multiple consecutive disturbances.

Transition T2B
State 2 to 4

Extreme soil-disturbance from anthropogenic activity such as oil and gas development, road construction, and heavy use areas for livestock production or recreation.

Constraints to recovery. Recovery is inhibited by soil depth, herbivory pressure, and prolonged drought conditions.

Context dependence. This transition is typically sudden after a mechanical disturbance, but can also occur with multiple consecutive disturbances (e.g. livestock or recreation heavy use areas) and can be exacerbated by hot temperatures and/or extreme drought.

Transition T3A
State 3 to 4

Extreme soil-disturbance from anthropogenic activity such as oil and gas development, road construction, and heavy use areas for livestock production or recreation.

Constraints to recovery. Recovery is inhibited by soil depth, herbivory pressure, and prolonged drought conditions.

Context dependence. This transition is typically sudden after a mechanical disturbance, but can also occur with multiple consecutive disturbances (e.g. livestock or recreation heavy use areas) and can be exacerbated by hot temperatures and extreme drought.

Additional community tables

Table 6. Community 1.2 plant community composition

				Annual Production	Foliar Cover

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Perennial Mid-Size Cool Season Bunchgrasses**			120–200	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	50–200	10–40
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	25–100	5–20
	needle and thread	HECO26	*Hesperostipa comata*	25–100	5–20
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–50	0–10
	Sandberg bluegrass	POSE	*Poa secunda*	5–50	1–10
	muttongrass	POFE	*Poa fendleriana*	5–50	1–10
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	5–50	1–10
	squirreltail	ELEL5	*Elymus elymoides*	5–50	1–10
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–50	0–10
2	**Rhizomatous Grasses**			20–50	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	25–50	5–10
	western wheatgrass	PASM	*Pascopyrum smithii*	25–50	5–10
3	**Misc Grasses/Grasslikes**			20–50	
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–25	0–5
	needleleaf sedge	CADU6	*Carex duriuscula*	0–25	0–5
	threadleaf sedge	CAFI	*Carex filifolia*	0–25	0–5
	Sandberg bluegrass	POSE	*Poa secunda*	5–25	1–5
	Grass, perennial	2GP	*Grass, perennial*	0–25	0–5
Forb					
4	**Perennial Forbs**			20–45	
	buckwheat	ERIOG	*Eriogonum*	5–25	1–5
	lupine	LUPIN	*Lupinus*	0–25	0–5
	aster	SYMPH4	*Symphyotrichum*	0–25	0–5
	spiny phlox	PHHO	*Phlox hoodii*	5–25	1–5
	longleaf phlox	PHLO2	*Phlox longifolia*	0–15	0–3
	flaxleaf plainsmustard	SCLI	*Schoenocrambe linifolia*	0–15	0–3
	ragwort	SENEC	*Senecio*	0–15	0–3
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–15	0–3
	stemless mock goldenweed	STAC	*Stenotus acaulis*	0–15	0–3
	fleabane	ERIGE2	*Erigeron*	0–15	0–3
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–15	0–3
	rayless tansyaster	MAGR2	*Machaeranthera grindelioides*	0–15	0–3
	bluebells	MERTE	*Mertensia*	0–15	0–3
	beardtongue	PENST	*Penstemon*	0–15	0–3
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–15	0–3
	milkvetch	ASTRA	*Astragalus*	0–15	0–3
	Wyoming besseya	BEWY	*Besseya wyomingensis*	0–15	0–3
	pussytoes	ANTEN	*Antennaria*	5–15	1–3
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0–15	0–3
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–15	0–3

	agoseris	AGOSE	*Agoseris*	0–15	0–3
	onion	ALLIU	*Allium*	0–5	0–1
	cryptantha	CRYPT	*Cryptantha*	0–5	0–1
	larkspur	DELPH	*Delphinium*	0–5	0–1
	rockcress	ARABI2	*Arabis*	0–5	0–1
	sandwort	ARENA	*Arenaria*	0–5	0–1
	Indian paintbrush	CASTI2	*Castilleja*	0–5	0–1
	pale bastard toadflax	COUMP	*Comandra umbellata ssp. pallida*	0–5	0–1
	ipomopsis	IPOMO2	*Ipomopsis*	0–5	0–1
	desertparsley	LOMAT	*Lomatium*	0–5	0–1
	western wallflower	ERAS2	*Erysimum asperum*	0–5	0–1
	stonecrop	SEDUM	*Sedum*	0–5	0–1
	sagebrush buttercup	RAGL	*Ranunculus glaberrimus*	0–5	0–1
	hollyleaf clover	TRGY	*Trifolium gymnocarpon*	0–5	0–1
	clover	TRIFO	*Trifolium*	0–5	0–1
	violet	VIOLA	*Viola*	0–5	0–1
	deathcamas	ZIGAD	*Zigadenus*	0–5	0–1
	Forb, perennial	2FP	*Forb, perennial*	0–5	0–1
5	**Annual Forbs**			0–5	
	rockjasmine	ANDRO3	*Androsace*	0–5	0–1
	bushy bird's beak	CORA5	*Cordylanthus ramosus*	0–5	0–1
	cryptantha	CRYPT	*Cryptantha*	0–5	0–1
	smallflower gymnosteris	GYPA2	*Gymnosteris parvula*	0–5	0–1
	flatspine stickseed	LAOC3	*Lappula occidentalis*	0–5	0–1
	bushy blazingstar	MEDI	*Mentzelia dispersa*	0–5	0–1
	broomrape	OROBA	*Orobanche*	0–5	0–1
	wirelettuce	STEPH	*Stephanomeria*	0–5	0–1
	Forb, annual	2FA	*Forb, annual*	0–5	0–1
Shrub/Vine					
6	**Sagebrush**			40–100	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	0–100	0–15
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	25–100	5–15
	little sagebrush	ARARL	*Artemisia arbuscula ssp. longiloba*	0–25	0–5
	prairie sagewort	ARFR4	*Artemisia frigida*	0–25	0–5
	black sagebrush	ARNO4	*Artemisia nova*	0–25	0–5
7	**Misc Shrubs**			10–25	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–25	0–5
	Gardner's saltbush	ATGA	*Atriplex gardneri*	0–25	0–5
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	5–25	1–5
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–25	0–5
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–25	0–5
	granite prickly phlox	LIPU11	*Linanthus pungens*	0–25	0–5
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–25	0–5

	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–25	0–5
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–25	0–5
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	0–25	0–5
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–25	0–5
	spineless horsebrush	TECA2	*Tetradymia canescens*	0–25	0–5

Animal community

Livestock:
The following table lists suggested stocking rates for cattle under continuous season-long grazing under normal growing conditions with a harvest efficiency (HE) of 25 percent. 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). A field visit is required to document actual plant composition and production. More precise carrying capacity estimates, considering forage preference and accessibility (slope, distance to water, etc.), should be calculated using field data, particularly when grazers other than cattle are involved. Under more intensive grazing management, improved harvest efficiencies (up to 35 percent) can result in an increased carrying capacity, but recovery time for upland sites is much longer. If distribution problems occur, stocking rates should be reduced or facilitating conservation practices (i.e., cross-fencing, water development) implemented to maintain plant health and vigor.

Initial Suggested Stocking Rate:
Plant Community Production (lbs./ac.) (AUMs/ac.)* Ac./AUM
1.1 Big Sagebrush/Bunchgrass 300-500-700 0.05 20
1.2 Bunchgrass/Big Sagebrush 300-500-700 0.08 13
2.1 Big Sagebrush/Short-stature Grass 200-400-600 0.04 25
2.2 Short-stature Grass/Big Sagebrush 200-400-600 0.05 20
3.1 Rabbitbrush/Rhizomatous Grass 200-400-600 0.05 20
4.1 Reclaimed 300-500-700 0.10 10
4.2 Annual 100-200-300 0.03 33
* Continuous, season-long grazing by cattle under average growing conditions.

Calculation for stocking rates are as follows: Using RV values for production, take forage palatable to grazing cattle and multiply by 0.25 HE and divide by 912.5 pounds per AUM air-dry weight (ADW) to arrive at the initial suggested stocking rate in AUMs per acre.

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

Distance to water, shrub density, and slope can affect grazing capacity within a management unit. Accessibility adjustments should be made for the planning area as necessary. For example, 30 percent of a management unit may have 25 percent slopes and distances of greater than one mile from water, resulting in a 50 percent reduction in grazing access; therefore, the adjustment is 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 grazing access within a management unit. Adjustments should be made that incorporate these factors when calculating the carrying capacity of a management unit.

Wildlife:
Reference State:
1.1 Big Sagebrush/Bunchgrass: This community phase provides optimal transitional and summer habitat for sage-grouse, mule deer, pronghorn, and elk. A diverse suite of herbaceous species also provide important micronutrient requirements for big game species throughout the year. These areas also provide high quality bird nesting habitat where sagebrush canopy and residual bunchgrasses hide nests and young from predators. This very common community is used widely as migration and stopover habitat by big game. Spring green-up of grass is a critical

nutritional component of this community for migrating big game.
1.2 Bunchgrass/Big Sagebrush: This community phase tends to have higher herbaceous plant diversity that may attract more diverse wildlife use. The plant community provides suitable forage and cover for sagebrush obligate species. The more open canopy promotes higher diversity and quantity of forbs that are important for early sage-grouse brood-rearing habitat. It also provides high quality habitat for mule deer, elk and pronghorn as they transition between winter and summer ranges. This very common community is used widely as migration and stopover habitat by big game. Spring green-up of grass and forb diversity is a critical nutritional component of this community for migrating big game.

Grazing Resistant State:
2.1 Big Sagebrush/Short-stature Grass: This community phase is variable in its value to wildlife. The value of the sagebrush community is similar to the reference state but the value of the grass community decreases. In periods of high plant vigor, the herbaceous understory provides cover for nesting birds and small mammals. In periods of drought and low plant vigor, the herbaceous understory is short and not dense enough to provide adequate cover and habitat value declines. Diversity is low, and mat-forming forbs often occupy the space and nutrients needed for more desirable forbs.
2.2 Short-stature Grass/Big sagebrush: This community phase is variable in its value to wildlife. Value is low for species dependent on sagebrush unless in close proximity to areas with sagebrush cover. In periods of high plant vigor, herbaceous species provide cover for some birds and small mammals. In periods of drought and low plant vigor, the herbaceous community is often too short and not dense enough to provide adequate cover and habitat. Plant and animal diversity is low.

Disturbed State:
3.1 Rabbitbrush/Rhizomatous Grass: This community phase is highly variable in its value to wildlife. It typically is less diverse, has lower forage value and has limited structure that wildlife need for cover. This state is vulnerable to repeated disturbance which can result in a complete loss of value for wildlife. In addition, sites in this state are more susceptible to invasion of non-native species, further degrading the value for wildlife.

Highly Disturbed State
4.1 Reclaimed: This community phase is highly variable in its value to wildlife. Reclamation success, size and configuration of the reclaimed area, the species planted, and the time it takes for plants to establish will determine the value of the site for wildlife. A fully reclaimed site containing a diversity of herbaceous and woody native plants can eventually provide the same wildlife habitat benefits as the reference state. In most cases, grasses and forbs establish early in the reclamation process, whereas shrubs take significantly longer to establish. Wildlife species dependent on herbaceous plant communities for forage (such as elk) will benefit from reclamation sooner than those species dependent on a mixed shrub/grass community. Suitable habitat for wildlife species that require tall, dense sagebrush (sage-grouse, pronghorn, mule deer, and sagebrush obligate songbirds) is likely possible within a decade, providing appropriate shrub species were planted. It is possible to achieve successful, diverse reclamation on linear disturbances (i.e. pipelines) without seeding shrubs, but it will take longer than a decade for seed from shrubs adjacent to the area to established on-site.
4.2 Annual Plant Community: This plant community exhibits a low level of plant species diversity, and thus, is less apt to meet the seasonal needs of most wildlife who frequent this community. Small mammals and songbirds will still utilize this phase, although not to the capacity as the above states.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group D. Infiltration is low when soils are wet due to shallow depth to bedrock or impervious subsurface layer. Runoff potential for this site varies from high to moderate depending on soil depth, bedrock type (impervious vs. permeable) and ground cover (refer to Part 630, NRCS National Engineering Handbook for detailed hydrology information).

Rills and gullies are 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. Biological 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 variety of plants which bloom in the spring have an aesthetic value that appeals to recreationists.

Wood products

No appreciable wood products are present on the site.

Other products

None

Inventory data references

Information has been derived from NRCS clipping data and other inventory data. Field observations from range trained personnel were also used. Those involved in developing this site include: Bryan Christensen, Range Management Specialist, NRCS and Karen Clause, Range Management Specialist, NRCS. Other sources used as references include: USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, and USDA NRCS Soil Surveys from various counties.

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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)	
Contact for lead author	
Date	02/18/2025
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

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

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

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

5. **Number of gullies and erosion associated with gullies:**

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

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

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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

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:

    Sub-dominant:

    Other:

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

14. **Average percent litter cover (%) and depth (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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:**

17. **Perennial plant reproductive capability:**