USDA Natural Resources Conservation Service

Ecological site DX034A02X130
Overflow Pinedale Plateau (Ov PP)

Last updated: 2/24/2025
Accessed: 05/10/2025

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 (2900m) 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 1996). 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 6 feet.
This LRU has an aridic ustic soil moisture regime and frigid (bordering on cryic) soil temperature regime. The precipitation pattern is bi-modal with a slight spikes in the spring and fall. Winter temperatures are cold allowing snow to accumulate 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 degrees Fahrenheit (2.2 to 4.4 degrees Celsius) and average precipitation is between 9 and 12 inches (230 to 305 mm) annually. Elevations of this LRU range between 6500 and 7500 feet (1980 to 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
G302 Intermountain Mesic Tall Sage Steppe and Shrubland Group
A3183 Basin Big Sagebrush Mesic Steppe and Shrubland Alliance
CEGL001016 Artemisia tridentata ssp. tridentata/Leymus cinereus 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 receives additional water from overland flow and is located in drainageways
Soils:
o are not saline or saline-sodic
o are typically deep to very deep (greater than 40 inches deep)
o are not skeletal within 20 inches (50 cm) of the soil surface; they have less than 35 percent rock fragments by volume in the top 20 inches (50 cm)
o are not violently effervescent in the surface mineral layer (within top 10 inches; 25 cm)
o have surface textures that usually range from sandy loam to clay loam in surface mineral layer (4 inches; 10 cm)
o have slopes less than 5 percent
Climate:
aridic ustic (ustic bordering on aridic) OR oxyaquic ustic (ustic bordering on oxyaquic) moisture regime
frigid (bordering on cryic) temperature regime

Associated sites

DX034A02X122	**Loamy Pinedale Plateau (Ly PP)** Site does not receive additional water from overland flow, is not located in drainageways, and has different species composition and lower plant production potential.
R034AY274WY	**Subirrigated Foothills and Basins West (Sb)** Site has a seasonal water table with different species composition and higher plant production potential.
DX034A02X150	**Sandy Pinedale Plateau (Sy PP)** Site does not receive additional water from overland flow, is not located in drainageways, and has different species composition and lower plant production potential.
DX034A02X146	**Sands Pinedale Plateau (Sa PP)** Site does not receive additional water from overland flow, is not typically located in drainageways, although it could be located on the next terrace level above, and soil textures are coarser (loamy sand).

Similar sites

DX034A02X104	**Clayey Pinedale Plateau (Cy PP)** Site does not receive additional water from overland flow, is typically located on fans not drainageways, has lower production and different species composition potential.
R034AY230WY	**Overflow Foothills and Basins West (Ov)** 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. tridentata*
Herbaceous	(1) *Leymus cinereus*

Legacy ID

R034AC130WY

Physiographic features

This site occurs on drainageway landforms at elevations between 6,500 and 7,500 feet. This site occurs on all aspects. The slopes range from level to five percent. Flooding and ponding may occur on this site.

Landform Definition:
drainageway -- (a) A general term for a course or channel along which water moves in draining an area. (b) [soil survey] a term restricted to relatively small, roughly linear or arcuate depressions that move concentrated water at some time, and either lack a defined channel (e.g. head slope, swale) or have a small, defined channel (e.g. low order streams).

Table 2. Representative physiographic features

Landforms	(1) Intermontane basin > Drainageway
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	Rare to occasional
Ponding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Ponding frequency	None to rare
Elevation	6,500–7,500 ft
Slope	0–5%
Water table depth	40–200 in
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 in April and continues to approximately early August. 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

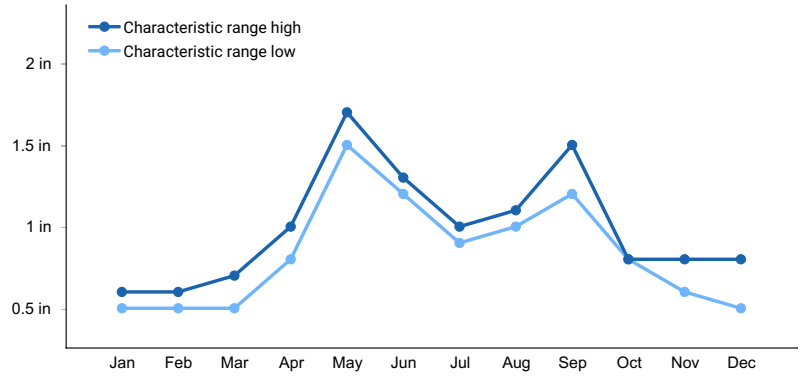


Figure 1. Monthly precipitation range

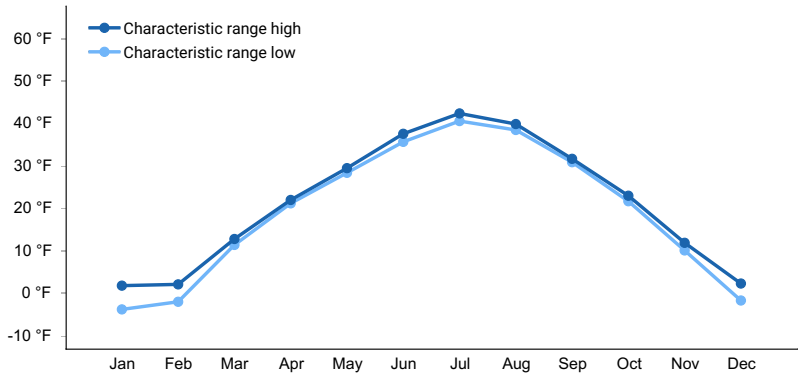


Figure 2. Monthly minimum temperature range

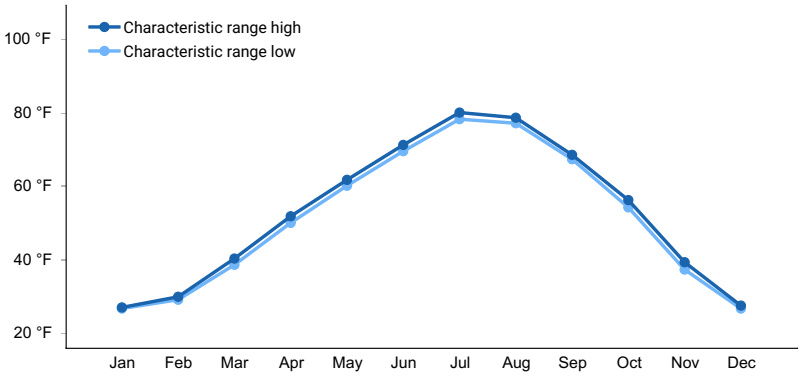


Figure 3. Monthly maximum temperature range

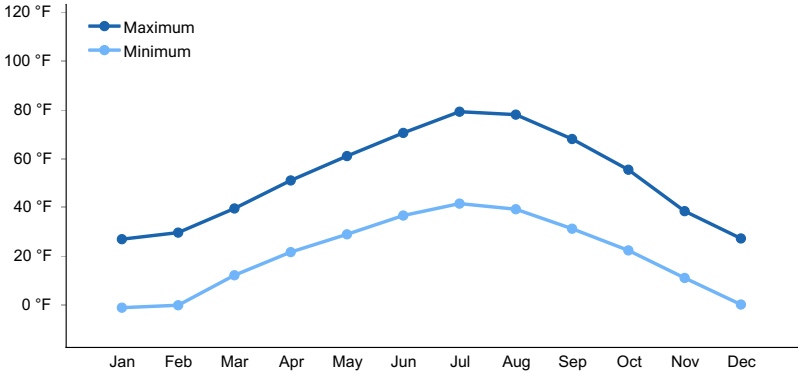


Figure 4. Monthly average minimum and maximum temperature

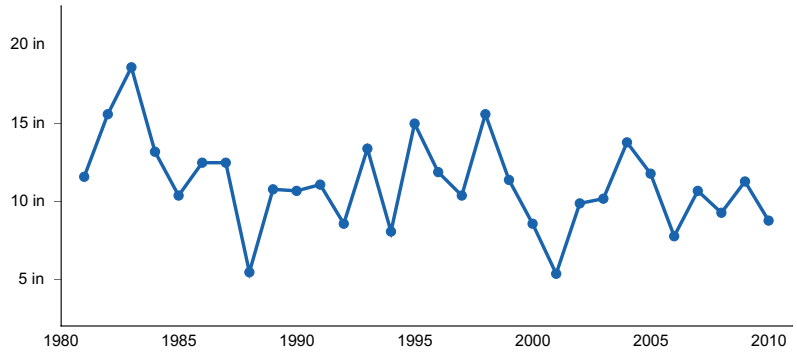


Figure 5. Annual precipitation pattern

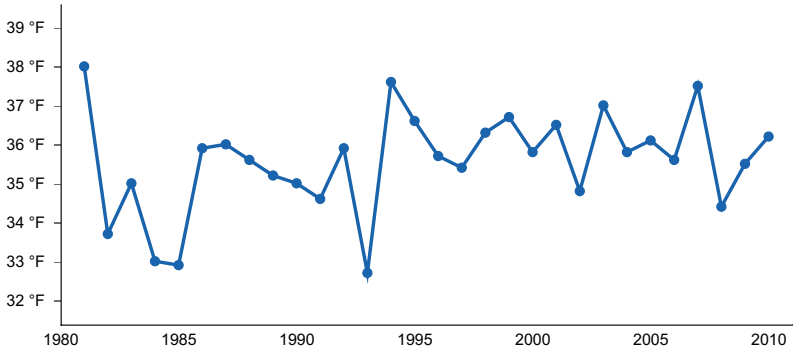


Figure 6. Annual average temperature pattern

Climate stations used

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

Influencing water features

This site receives additional moisture from snow melt and runoff events from surrounding uplands. Flooding and ponding may occur, but is very brief (4 to 48 hours) to brief (2 to 7 days).

Wetland description

N/A

Soil features

The soils of this site are deep to very deep (40 to 200 inches) and formed in alluvium derived from inter-bedded sedimentary rock. Surface and subsurface textures are sandy loam to clay loam. Rock fragments may be found on the soil surface or in the profile, but make up less than 15 percent of the soil volume. These soils are well-drained and have moderately slow to moderately rapid permeability.
Landscape position is very important to this site, and it occurs in and adjacent to drainageways that receive periodic overland flow from adjacent uplands.
The soil moisture regime is aridic ustic (ustic bordering on aridic) and the soil temperature regime is frigid bordering on cryic.
Major Soil Series correlated to this site include: Yamacall, Weed, Cowestglen, Overwhich, Harshinger, Spang,
Representative Taxonomy:
Fine-loamy, mixed, superactive, frigid Aridic Haplustepts;
Fine-loamy, mixed, superactive, frigid Pachic Argiustolls;
Coarse-loamy, mixed, superactive, calcareous, frigid Ustic Torrifluvents;
Coarse-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Oxyaquic Haplustolls;
Coarse-loamy over sandy or sandy-skeletal, mixed, superactive, calcareous, frigid oxyaquic torrifluvents;

Coarse-loamy, mixed, superactive, frigid Aridic Haplustepts

Table 4. Representative soil features

Parent material	(1) Alluvium–metamorphic and sedimentary rock
Surface texture	(1) Sandy loam (2) Loam (3) Sandy clay loam (4) Clay loam
Family particle size	(1) Coarse-loamy (2) Fine-loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Soil depth	40–80 in
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0–5%
Available water capacity (0-40in)	5–6.6 in
Calcium carbonate equivalent (0-20in)	0–10%
Electrical conductivity (0-20in)	0–5 mmhos/cm
Sodium adsorption ratio (0-20in)	0–3
Soil reaction (1:1 water) (0-20in)	7–7.9
Subsurface fragment volume <=3" (0-20in)	0–15%
Subsurface fragment volume >3" (0-20in)	0–5%

Ecological dynamics

A State-and-Transition Model (STM) diagram is depicted in this section. Narrative 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, logical extrapolations, and interpretations. While based on the best available information, the STM will change over time as knowledge of ecological processes increases. 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 et.al. 2010, Bestelmeyer and Brown 2005, Briske et.al. 2008, and Stringham et,al. 2003.

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. 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

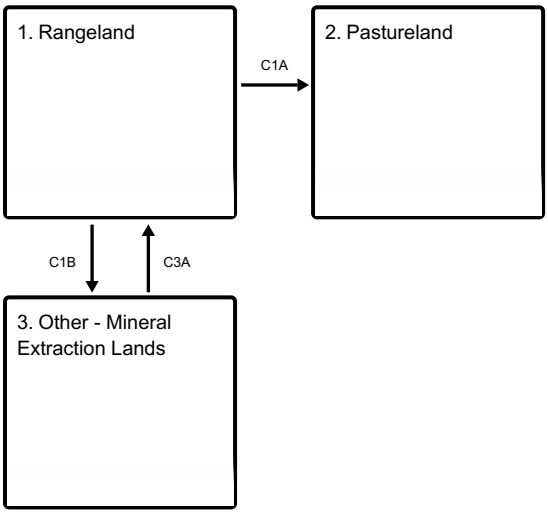
herbaceous and woody species. Calculating Similarity Index requires data on species composition by dry weight.

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 as described in the Range Health Reference sheet.

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 a 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

Land uses

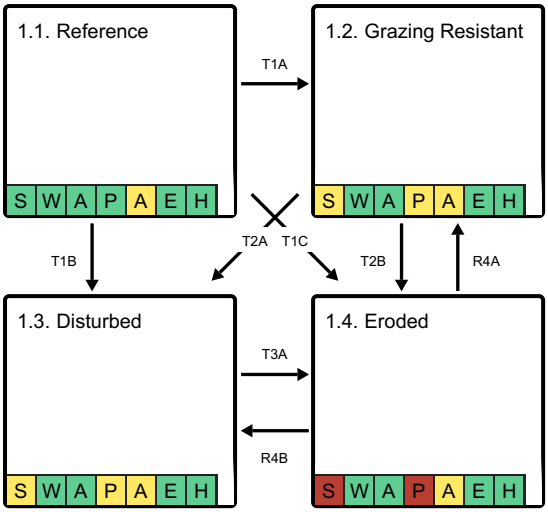


C1A - Flood irrigation, tillage, and seeding

C1B - vegetation and extreme soil disturbance (heavy equipment)

C3A - re-shaping/re-contouring; deep ripping; topsoil replacement; seedbed preparation; seeding; weed and grazing management

Land use 1 submodel, ecosystem states



T1A - Herbivory pressure (moderate to high intensity continuous spring grazing or low intensity season-long grazing)

T1B - Multiple soil disturbances or extreme herbivory combined with catastrophic drought

T1C - Classic gully erosion and herbivory pressure

T2A - Multiple soil disturbances or extreme herbivory combined with catastrophic drought

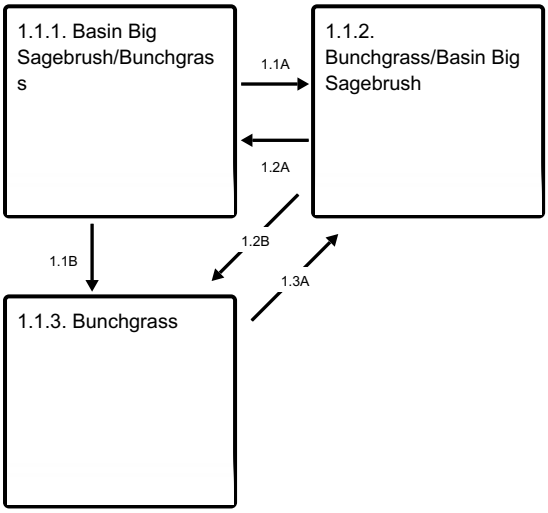
T2B - Classic gully erosion and herbivory pressure

T3A - Classic gully erosion and herbivory pressure

R4A - Low-tech mesic habitat restoration (Zeedyk structures)

R4B - Low-tech mesic habitat restoration (Zeedyk structures)

State 1 submodel, plant communities



1.1A - Sagebrush thinning event (low intensity fire, anthropogenic treatments, prolonged soil saturation, drought, freeze-kill, snow mold, herbivory, insects, disease)

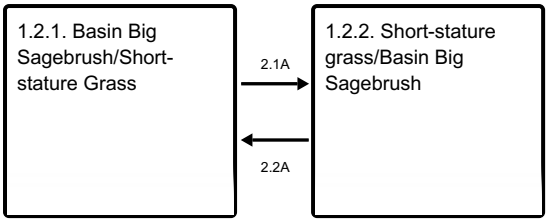
1.1B - Sagebrush killing event (moderate intensity fire, anthropogenic treatments, prolonged soil saturation, drought, freeze-kill, snow mold, herbivory, insects, disease)

1.2A - Natural succession (time without sagebrush killing event)

1.2B - Sagebrush killing event (moderate intensity fire, anthropogenic treatments, prolonged soil saturation, drought, freeze-kill, snow mold, herbivory, insects, disease)

1.3A - Natural succession (time without sagebrush killing event)

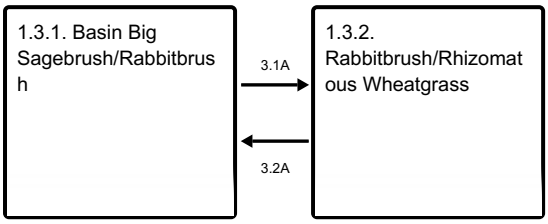
State 2 submodel, plant communities



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

2.2A - Natural succession (time without sagebrush killing event)

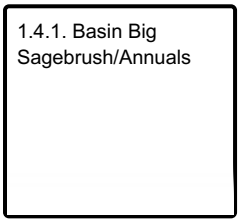
State 3 submodel, plant communities



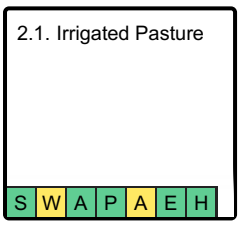
3.1A - Sagebrush killing event (fire, flood, drought, mechanical or chemical treatment)

3.2A - Natural succession (time without sagebrush killing event).

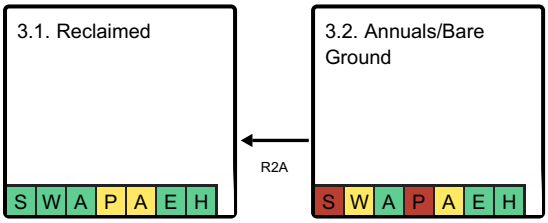
State 4 submodel, plant communities



Land use 2 submodel, ecosystem states



Land use 3 submodel, ecosystem states



R2A - reclamation (re-contouring, deep ripping, seeding, mulching, prescribed grazing)

Land use 1
Rangeland

Rangeland is the dominant land use for this site and provides the most diverse ecosystem services. Range is land on which the historic and/or introduced vegetation is predominantly grasses, grass-like plants, forbs or shrubs managed as a natural ecosystem. Range may include natural grasslands, savannas, shrublands, tundra, alpine

communities, marshes and meadows.

Characteristics and indicators. This landuse consists of diverse native plant communities dominated by basin big sagebrush and perennial cool season grasses that provide for site stability, hydrologic function, and biotic integrity of the site.

State 1.1
Reference

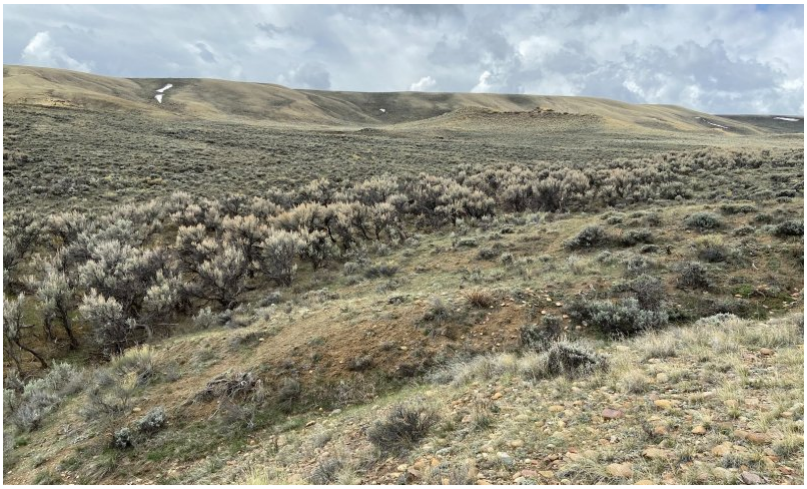


Figure 7. Overview of drainageway landform

The Reference State consists of three plant communities, the Basin Big Sagebrush/Bunchgrass community, the Bunchgrass/Basin Big Sagebrush community, and the Bunchgrass community. Each plant community differs in percent composition and foliar cover of bunchgrasses and shrubs. The dominant shrub is basin big sagebrush. Dominant bunchgrasses include basin wildrye and slender wheatgrass, 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 fire, herbivory, drought, and flood; and 2) time without those disturbances, generally referred to as "natural succession."

Characteristics and indicators. The shift between plant community phases is dependent upon sagebrush-killing disturbances, and without them it will increase even with proper grazing management that includes light to moderate utilization, adequate recovery, and periodic critical growth period rest. Improper grazing management that includes high utilization, inadequate recovery, and continuous season-long grazing may accelerate the rate of increase for the shrub component. Management actions can and are often used to mimic the natural disturbance regime through mechanical and chemical treatments. Prescribed fire is not often used due to land use and ownership patterns, lack of fine fuels, and adequate burn windows (Clause and Randall, 2014).

Resilience management. This site has moderate resilience due to its ustic bordering on aridic soil moisture regime and frigid bordering on cryic temperature regime (Chambers et.al. 2014). Precipitation is typically adequate with good timing and more effective with cooler temperatures. This site typically recovers after minor disturbances, but is susceptible to delays in recovery during extreme climatic events such as drought. This site has moderately high resistance to invasion by annual grasses because of cold climatic conditions.

Dominant plant species

- basin big sagebrush (*Artemisia tridentata ssp. tridentata*), shrub
- basin wildrye (*Leymus cinereus*), grass
- slender wheatgrass (*Elymus trachycaulus*), grass

Dominant resource concerns

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

Community 1.1.1

Basin Big Sagebrush/Bunchgrass

This 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 moderate to low. These plants 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 soils associated with this site are fertile and hold moderately large amounts of soil moisture, providing a very favorable soil-water-plant relationship. The Basin Big Sagebrush/Bunchgrass Community can occur across the entire ecological site or can occur in a mosaic with the Bunchgrass/Basin Big Sagebrush Community. This plant community occurs in the absence of sagebrush killing disturbances and with grazing that mimics the historic herbivory regime (light, episodic, and associate with mid-size ungulate migration). Basin big sagebrush is dominant. Sagebrush canopy cover ranges from 20 to 30 percent. At this sagebrush canopy level in this precipitation zone, there is some competition between the shrub over-story and the herbaceous understory (Winward, 2007). A Basin Big Sagebrush/Bunchgrass Community with a degraded under-story is an “at-risk” community that could transition to the Grazing Resistant State. Chemical or mechanical treatments are occasionally used to replace natural sagebrush killing events. However, chemical treatments impact non-target species, particularly broad-leafed species (forbs and shrubs) differently than natural events such as drought or fire. Where fire tends to result in a short-term increase in forbs, some chemical treatments result in a short-term (or long-term) reduction in forb density and diversity. Mechanical treatments do not cause a change in plant diversity, however soil disturbance combined with improper grazing techniques has the potential to transition this plant community to either the Disturbed or Eroded States, depending on the severity of disturbance. There are generally few canopy gaps and most basal gaps are small (one to two feet). Rock cover on the soil surface is essentially nonexistent. Many plant interspaces have canopy or litter cover. Production of grasses is much lower than in the Bunchgrass Community and lower than in the Bunchgrass/Basin Big Sagebrush Community.

Dominant plant species

- basin big sagebrush (*Artemisia tridentata ssp. tridentata*), shrub
- slender wheatgrass (*Elymus trachycaulus*), grass
- basin wildrye (*Leymus cinereus*), grass

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	400	600	800
Grass/Grasslike	320	480	640
Forb	80	120	160
Total	**800**	**1200**	**1600**

Table 6. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	0-1%
Grass/grasslike basal cover	0-1%
Forb basal cover	0-1%
Non-vascular plants	0%
Biological crusts	1-2%
Litter	60-90%
Surface fragments >0.25" and <=3"	0-5%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%

Bare ground	5-20%

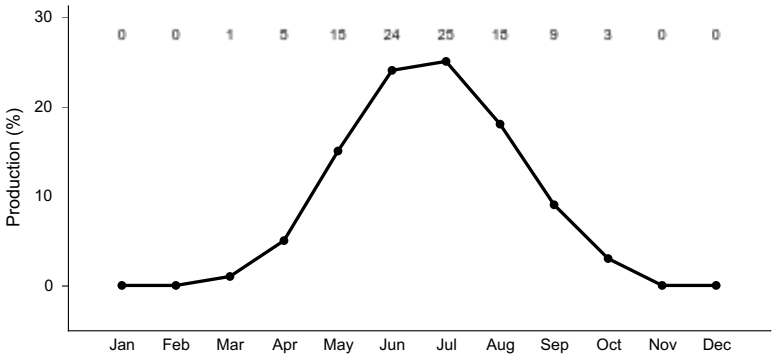


Figure 9. Plant community growth curve (percent production by month). WY34A02Xa, MLRA34A-Pinedale Plateau-all. Forage Production (herbaceous only) Developed by using the Rangeland Analysis Platform (RAP).

Community 1.1.2
Bunchgrass/Basin Big Sagebrush

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 Bunchgrass/Big Sagebrush Community can occur across the entire ecological site or can occur in a mosaic associated with the disturbance cycle at any given time and location with the Big Sagebrush/Bunchgrass Community. This plant community occurs after a recent sagebrush killing disturbances and with grazing that mimics the historic herbivory regime (light, episodic, and associate with mid-size ungulate migration). Tall and mid-stature bunchgrasses dominate and basin big sagebrush is sub-dominant with foliar cover ranging from 10 to 20 percent. At this sagebrush canopy level in this precipitation zone, there is little if any competition between the shrub overstory and the herbaceous understory. In fact, there is evidence to suggest that the understory receives more benefit from the sage overstory than negative effects (Winward, 2007). There are few canopy gaps and basal gaps are generally small (one to two feet). Surface rock fragments in general do not occur and are not a significant source of site stability. Many plant interspaces have canopy or litter cover, which provides site stability. Production of grasses is higher than in the Basin Big Sagebrush/Bunchgrass community, but lower than in the Bunchgrass community.

Dominant plant species

- basin big sagebrush (*Artemisia tridentata ssp. tridentata*), shrub
- slender wheatgrass (*Elymus trachycaulus*), grass
- basin wildrye (*Leymus cinereus*), grass

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	480	720	960
Shrub/Vine	240	360	480
Forb	80	120	160
Total	**800**	**1200**	**1600**

Table 8. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	0-1%

Grass/grasslike basal cover	0-1%
Forb basal cover	0-1%
Non-vascular plants	0%
Biological crusts	1-2%
Litter	60-90%
Surface fragments >0.25" and <=3"	0-5%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	5-20%

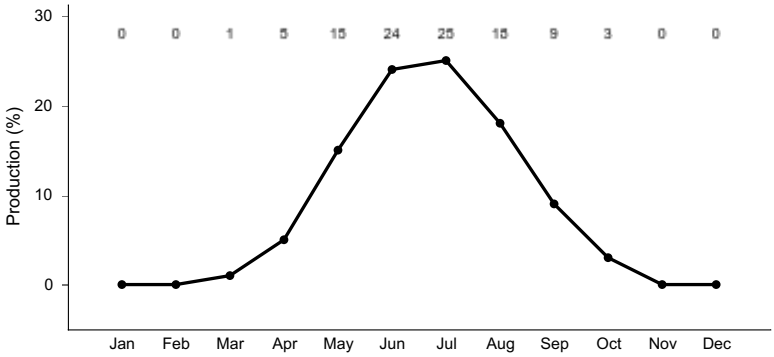


Figure 11. Plant community growth curve (percent production by month). WY34A02Xa, MLRA34A-Pinedale Plateau-all. Forage Production (herbaceous only) Developed by using the Rangeland Analysis Platform (RAP).

Community 1.1.3
Bunchgrass

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 Bunchgrass/Big Sagebrush Community can occur across the entire ecological site or can occur in a mosaic associated with the disturbance cycle at any given time and location with the Big Sagebrush/Bunchgrass Community. This plant community occurs after a recent sagebrush killing disturbances and with grazing that mimics the historic herbivory regime (light, episodic, and associate with mid-size ungulate migration). Tall and mid-stature bunchgrasses dominate with a minor component of forbs and shrubs. Basin big sagebrush is resent as a part of the community, but is minor with 0 to 10 percent foliar cover. There are more canopy gaps in this plant community compared to the other plant communities in the Reference State, and most basal gaps are generally small (one to two feet). Surface rock fragments in general do not occur and are not a significant source of site stability. Many plant interspaces have canopy or litter cover, which provides site stability. Production of grasses is higher than the other plant communities in the Reference State.

Dominant plant species

- slender wheatgrass (*Elymus trachycaulus*), grass
- basin wildrye (*Leymus cinereus*), grass

Table 9. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	640	960	1280
Forb	80	120	160
Shrub/Vine	80	120	160
Total	**800**	**1200**	**1600**

Table 10. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	0-1%
Grass/grasslike basal cover	0-3%
Forb basal cover	0-1%
Non-vascular plants	0%
Biological crusts	0-1%
Litter	60-90%
Surface fragments >0.25" and <=3"	0-5%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	5-20%

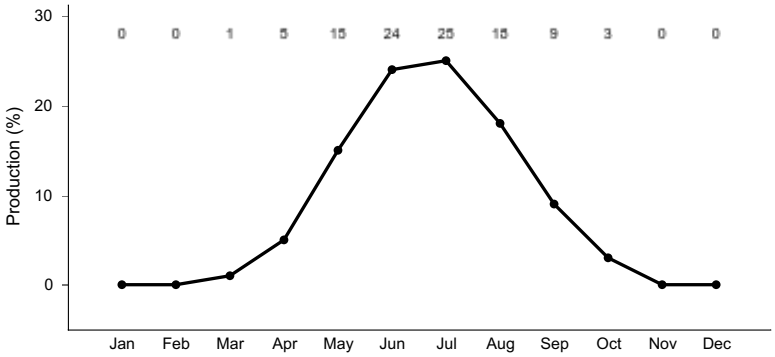


Figure 13. Plant community growth curve (percent production by month). WY34A02Xa, MLRA34A-Pinedale Plateau-all. Forage Production (herbaceous only) Developed by using the Rangeland Analysis Platform (RAP).

Pathway 1.1A
Community 1.1.1 to 1.1.2

This pathway occurs after a sagebrush thinning event, such as low intensity fire, prolonged soil saturation, drought, freeze-kill, snow mold, or herbivory from insects or disease. Moderate fire intensity is typically a stand replacing event and results in the Bunchgrass plant community. Brush Management is a conservation practice used to achieve this plant community. Chemical treatment of shrubs has replaced natural sagebrush killing events on many sites in the area. However, chemical treatments impact non-target species, particularly broad-leafed species (forbs and shrubs) differently than natural events such as drought or fire. Where fire tends to result in a short-term increase in forbs, some chemical treatments result in a short-term (or long-term) reduction in forb density and diversity. Chemical treatment of sagebrush with tebuthiuron can have impacts to the under-story, depending on application rate (WWC, 2009). There is a danger of transition to the Disturbed State if multiple consecutive treatments occur.

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, catastrophic fire, or high intensity grazing occur, there is risk of a transition to either the Grazing Resistant or Disturbed State depending upon severity and cumulative disturbance. 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

Brush Management
Prescribed Grazing

Pathway 1.1B
Community 1.1.1 to 1.1.3

Sagebrush killing event such as moderate intensity fire or climatic events such as severe drought, prolonged soil saturation, freeze-kill, snow mold, or herbivory by wildlife, insects, or disease. Anthropogenic sagebrush block treatments such as prescribed fire, chemical (tebuthiuron), or mechanical (mowing, aerator, etc.) can result in a similar pathway. Brush Management is a conservation practice used to achieve this plant community. Chemical treatment of shrubs has replaced natural sagebrush killing events on many sites in the area. However, chemical treatments impact non-target species, particularly broad-leafed species (forbs and shrubs) differently than natural events such as drought or fire. Where fire tends to result in a short-term increase in forbs, some chemical treatments result in a short-term (or long-term) reduction in forb density and diversity. Chemical treatment of sagebrush with tebuthiuron can have impacts to the understory, depending on application rate (WWC, 2009). There is a danger of transition to the Disturbed State if multiple consecutive treatments occur.

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, catastrophic fire, or high intensity grazing occur, there is risk of a transition to either the Grazing Resistant or Disturbed State depending upon severity and cumulative disturbance. 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

Brush Management
Prescribed Grazing

Pathway 1.2A
Community 1.1.2 to 1.1.1

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 faster pathway while favorable precipitation can result in a slower 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 moderate to heavy intensity can accelerate the pathway and puts the plant community "at-risk" for transition to the Grazing Resistant State.

Pathway 1.2B
Community 1.1.2 to 1.1.3

Sagebrush killing event such as moderate intensity fire or climatic events such as severe drought, prolonged soil saturation, freeze-kill, snow mold, or herbivory by wildlife, insects, or disease. Anthropogenic sagebrush block treatments such as prescribed fire, chemical (tebuthiuron), or mechanical (mowing, aerator, etc.) can result in a similar pathway. Brush Management is a conservation practice used to achieve this plant community. Chemical

treatment of shrubs has replaced natural sagebrush killing events on many sites in the area. However, chemical treatments impact non-target species, particularly broad-leafed species (forbs and shrubs) differently than natural events such as drought or fire. Where fire tends to result in a short-term increase in forbs, some chemical treatments result in a short-term (or long-term) reduction in forb density and diversity. Chemical treatment of sagebrush with tebuthiuron can have impacts to the understory, depending on application rate (WWC, 2009). There is a danger of transition to the Disturbed State if multiple consecutive treatments occur.

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, catastrophic fire, or high intensity grazing occur, there is risk of a transition to either the Grazing Resistant or Disturbed State depending upon severity and cumulative disturbance. 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

Brush Management
Prescribed Grazing

Pathway 1.3A
Community 1.1.3 to 1.1.2

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 faster pathway while favorable precipitation can result in a slower 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 moderate to heavy intensity can accelerate the pathway and puts the plant community "at-risk" for transition to the Grazing Resistant State.

State 1.2
Grazing Resistant

Figure 14. Grazing Resistant State

The Grazing Resistant State consists of two plant communities: the Basin Big Sagebrush/Short-stature Grass community and the Short-stature Grass/Basin Big Sagebrush community. There has been a shift in under-story functional/structural group dominance. Due to herbivory pressure, there is a shift from mid-stature cool-season bunchgrasses to short-stature cool-season bunchgrasses such as Sandberg bluegrass and rhizomatous wheatgrasses such as thickspike and western wheatgrass. Canopy gap interspace and bare ground has increased from the Reference State, while herbaceous foliar cover has decreased.

Characteristics and indicators. There are fewer tall and mid-size bunchgrasses and they are typically found under

the shrub canopy where they are protected from herbivory. The shrub canopy inter-spaces are occupied by grazing tolerant grasses as well as patches of bare ground that are sometimes connected. 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 and 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 and unable to recover as quickly after a disturbance. This state is more drought-prone, and therefore therefore sees wider productivity swings during dry vs. wet years. However, existing sagebrush canopy and remnant perennial vegetation provide some amount of resiliency. Rhizomatous grasses provide soil protection by protecting the soil from raindrop impact, decreasing the risk of soil erosion. However, overall soil stability is lower than the reference state, primarily due to a reduction in foliar cover and soil organic matter due to a reduction in litter. Site resistance to invasion by annual grasses is lower due to niches in the under-story for establishment as well as site water availability during the time suited for winter annuals such as cheatgrass (*Bromus tectorum*). Episodic and limited moisture is more suited to annual life forms. There are a wider range of soil surface textures on this site, and coarser surface textures area more vulnerable to invasion by annual invasive species.

Dominant plant species

- basin big sagebrush (*Artemisia tridentata ssp. tridentata*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- Sandberg bluegrass (*Poa secunda*), 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 1.2.1
Basin Big Sagebrush/Short-stature Grass

Figure 15. Grazing Resistant (Plant Community 1.2.1)

This plant community is characterized by a dense stand of basin big sagebrush with a diminished under-story. The understory has lost many of the tall and mid-stature cool-season bunchgrasses, and they have been replaced with low-stature bunchgrasses such as Sandberg bluegrass, rhizomatous wheatgrasses, upland sedges, and mat-forming forbs. Shrub foliar cover is often greater than 30 percent, higher than in the Reference State, and typically

making up greater than 40 percent of total annual production (species composition by dry weight). Areas that catch and retain snow are more likely to have higher shrub cover. Herbaceous production and foliar cover have decreased. There are often small amounts of annual invasive grasses and weedy forbs, mostly less than 5 percent foliar cover. There is often a slight increase in sprouting shrubs (less than 10 percent composition by dry weight). The site is susceptible to classic gully erosion, has lower soil organic matter, and overall lower Site Stability. Hydrologic Function has been altered through higher than normal sagebrush canopy and more bare ground. Biotic Integrity is reduced due to low vegetative production, relative dominance of structural/functional groups , and potentially invasive species if present. Total annual production ranges from 600 to 1,400 pounds per acre with a Representative Value (RV) of 1,000 pounds per acre. Productivity is highly variable and fluctuates drastically in response to drought and wet cycles. This plant community is at-risk of transitioning to the Eroded State with additional disturbance such as heavy grazing, sagebrush treatment, or ground-disturbing activity.

Dominant plant species

- basin big sagebrush (*Artemisia tridentata ssp. tridentata*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- Sandberg bluegrass (*Poa secunda*), grass

Community 1.2.2
Short-stature grass/Basin Big Sagebrush

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 basin big sagebrush foliar cover is less than 15 percent.There can be an initial flush of invasive annuals and weedy forbs within the first few years of a sagebrush treatment, but they are expected reduce to less than five percent foliar cover within five years. There is often a slight increase in sprouting shrubs (less than 10 percent composition by dry weight). The site is susceptible to classic gully erosion, has lower soil organic matter, and overall lower Site Stability. Hydrologic Function has been altered through a shift in functional/structural groups and higher than normal bare ground. Biotic Integrity is reduced due to low vegetative production, relative dominance of structural/functional groups , and potentially invasive species if present. Total annual production ranges from 600 to 1,400 pounds per acre with a Representative Value (RV) of 1,000 pounds per acre. Productivity is highly variable and fluctuates drastically in response to drought and wet cycles. This plant community is at-risk of transitioning to the Eroded State with additional disturbance such as heavy grazing, sagebrush treatment, or ground-disturbing activity.

Pathway 2.1A
Community 1.2.1 to 1.2.2

Sagebrush killing event, typically anthropogenic sagebrush treatments such as chemical (tebuthiuron) or mechanical (mowing, aerator, etc.) and herbivory. Natural climatic events such as prolonged soil saturation, drought, freeze-kill, or snow mold can also occur. 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 or disturbances such as hot temperatures, drought, catastrophic fire, or high intensity grazing occur, there is risk of a transition to either the Disturbed State or Eroded State depending upon severity and cumulative disturbance.

Conservation practices

Brush Management

Pathway 2.2A
Community 1.2.2 to 1.2.1

Natural succession (time without a 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 faster pathway while favorable precipitation can result in a

slower 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 moderate to heavy intensity can accelerate the pathway.

State 1.3
Disturbed

Figure 16. Disturbed State

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 soil-disturbing activities, rodent activity, or frequent flooding, which includes occasional irrigation. It may also occur after brush management preceded followed by improper grazing techniques that include high-intensity grazing use without appropriate recovery periods. A common scenario resulting in this State is multiple consecutive disturbances over a relatively short period of time. Consequences of this are decreased soil organic matter and increased soil erosion, soil crusting, and a decrease in soil surface aggregate stability.

Characteristics and indicators. There is a shift toward sprouting shrub dominance or co-dominance with big sagebrush depending on how long it has been since the disturbance(s). Both green (*Chrysothamnus viscidiflorus*) and rubber rabbitbrush (Ericameria nauseosus) may be present, but rubber rabbitbrush is typically more dominant. Along with a shift in shrub species, the herbaceous under-story also shifts toward more disturbance tolerant species such as western wheatgrass (*Pascopyrum smithii*) and needleleaf sedge (*Carex duriuscula*). Annual weeds such as bur buttercup (*Ceratocephala testiculata*), flixweed (*Descurainia sophia*), and lambsquarter (*Chenopodium album*), and invasive annual grasses such as cheatgrass (*Bromus tectorum*) are are often present in small amounts (less than five percent composition by dry weight).

Resilience management. Site resilience is lower than the Reference State or Grazing Resistant State, but higher than the Eroded 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 sagebrush canopy and remnant perennial vegetation provide some amount of resiliency. Site resistance to invasion by annual grasses is lower due to niches in the under-story for establishment as well as site water availability during the time suited for winter annuals such as cheatgrass (*Bromus tectorum*). Episodic moisture is more suited to annual life forms during drought.

Dominant plant species

- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- basin big sagebrush (*Artemisia tridentata ssp. tridentata*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- Sandberg bluegrass (*Poa secunda*), grass

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 1.3.1
Basin Big Sagebrush/Rabbitbrush

Basin big sagebrush and rabbitbrush dominate with foliar cover often exceeding 30 percent, typically making up over 50 percent of total annual production (species composition by dry weight). The understory has decreased and bare ground often exceeds 30 percent. Dominant perennial grasses include rhizomatous species that are resistant to soil disturbance. Bunchgrasses are limited to the protected areas under shrubs. Annuals grasses and forbs may be present, but are not dominant. Common annuals include desert alyssum, flixweed, and occasionally cheatgrass if a seed source has been introduced to the site. The site is typically adequately protected, but erosion can occur during high runoff events. The watershed is functioning-at-risk. Biotic Integrity is reduced due to low vegetative production, relative dominance and unexpected structural/functional groups, and potentially invasive species if present. Total annual production ranges from 600 to 1,000 pounds per acre with a Representative Value (RV) of 1,400 pounds per acre.

Dominant plant species

- basin big sagebrush (*Artemisia tridentata ssp. tridentata*), shrub
- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- thickspike wheatgrass (*Elymus lanceolatus ssp. lanceolatus*), grass

Community 1.3.2
Rabbitbrush/Rhizomatous Wheatgrass

Rabbitbrush dominates with foliar cover often exceeding 20 percent, typically making up over 30 percent of total annual production (species composition by dry weight). Rhizomatous wheatgrasses are the dominant perennial grass, and annual grasses and forbs are often present. Common annuals include desert alyssum, flixweed, and occasionally cheatgrass if a seed source has been introduced to the site. The understory has decreased and bare ground exceeds 30 percent. Bunchgrasses are limited to the protected areas under shrubs. The site is typically adequately protected, but erosion can occur during high runoff events. The watershed is functioning-at-risk. Biotic Integrity is reduced due to low vegetative production, relative dominance and unexpected structural/functional groups, and potentially invasive species if present. Total annual production ranges from 600 to 1,000 pounds per acre with a Representative Value (RV) of 1,400 pounds per acre.

Dominant plant species

- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- thickspike wheatgrass (*Elymus lanceolatus ssp. lanceolatus*), grass

Pathway 3.1A
Community 1.3.1 to 1.3.2

Sagebrush killing event, typically high intensity fire or consecutive climatic events (flooding, drought, etc.), and anthropogenic sagebrush treatments such as chemical (tebuthiuron) or mechanical (mowing, aerator, etc.).

Context dependence. Continued disturbances can maintain this plant community for long periods of time. Prolonged drought and improper grazing (high intensity, season-long) can accelerate the pathway back to a sagebrush dominated plant community.

Conservation practices

Brush Management

Pathway 3.2A
Community 1.3.2 to 1.3.1

Natural succession (time without sagebrush killing event). Sagebrush and rabbitbrush will eventually become co-dominant.

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 faster pathway while favorable precipitation can result in a slower 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 moderate to heavy intensity can accelerate the pathway.

State 1.4
Eroded

The Eroded State has seen a shift in functional/structural group dominance to a monotypic old-aged, decadent basin big sagebrush stand with very little perennial herbaceous understory. Due to classic gully erosion, the ecological dynamics have been altered to prevent prolonged soil saturation, which is a major driver in sited dynamics in the reference state.

Characteristics and indicators. Site productivity is lower and is dominated by even-aged stands of old, decadent basin big sagebrush. The understory is sparse and can resemble many other states described for this site, but the defining indicator is gully erosion that effectively drains this site, changing site hydrology.

Resilience management. Site resilience is much lower than the all other states. Site hydrology has been modified due to classic gully erosion. Therefore, the site is drier earlier in the season and unable to turn over sagebrush communities. This state is more drought-prone, and therefore more vulnerable to invasion by annual invasive species. Overall soil stability is much lower than the reference state due to a reduction in litter resulting in lower soil organic matter. Site resistance to invasion by annual grasses is lower due to niches in the under-story for establishment as well as site water availability during the time suited for winter annuals such as cheatgrass (*Bromus tectorum*). Episodic and limited moisture is more suited to annual life forms.

Dominant plant species

- basin big sagebrush (*Artemisia tridentata ssp. tridentata*), shrub

Dominant resource concerns

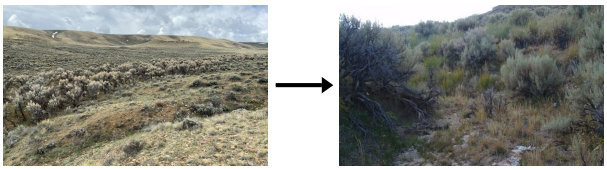
- Sheet and rill erosion
- Classic gully erosion
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance
- Inadequate livestock water quantity, quality, and distribution

Community 1.4.1
Basin Big Sagebrush/Annuals

This plant community is characterized by a dense stand of basin big sagebrush with a sparse understory. The site has lost its hydrology. Shrub foliar cover often exceeds 30 percent, higher than in the reference state, typically making up over 50 percent of total annual production (species composition by dry weight). The under-story has decreased and bare ground exceeds 30 percent. Perennial grass and forbs are sparse and bunchgrasses are limited to the protected areas under shrubs. Annuals grass and forb dominates herbaceous understory cover. Common annuals include desert alyssum, flixweed, and occasionally cheatgrass if a seed source has been introduced to the site. The site is experiencing classic gully erosion and Site Stability is Moderate or greater departure from the Reference State. Hydrologic Function is impaired due to altered hydrology from classic gully erosion. Biotic integrity is affected by the change in functional/structural group dominance. More recently, there have been efforts to promote economical restoration activities due to high production potential for this site and high

rates of degradation from a myriad of competing uses. Recommended restoration activities include Low-Tech Mesic Restoration techniques such as Zeedyk structures. For more information, see: https://www.sagegrouseinitiative.com/mesic/ Total annual production ranges from 400 to 1,200 pounds per acre with a Representative Value (RV) of 800 pounds per acre.

Transition T1A
State 1.1 to 1.2



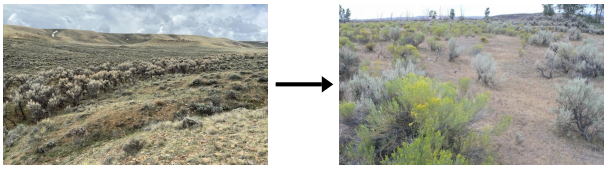
Reference | Grazing Resistant

Herbivory pressure in excess of normal Reference State conditions. Typical scenarios include moderate to high intensity continuous spring grazing or low intensity season-long grazing.

Constraints to recovery. Recovery is inhibited by continued herbivory pressure, reduced seedbank, and drought conditions. Annual grasses and forbs may occur in the shrub understory.

Context dependence. Because this site receives additional moisture through overland flow, chances of restoration are higher. However, warmer and drier climate trends contribute to uncertainty of restoration efforts. Animals concentrate on these sites, further reducing the likelihood of restoration.

Transition T1B
State 1.1 to 1.3



Reference | Disturbed

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 chemical treatments), rodent activity, or prolonged soil saturation, typically occasional irrigation. Extreme herbivory in combination with catastrophic drought may be a trigger for this transition as well.

Constraints to recovery. Persistent drought conditions, and herbivory pressure are constraints to recovery to the Reference State. Recovery is further inhibited by consecutive disturbances repeated over a relatively short time period and prolonged drought conditions. There is a risk of annual grass and forb invasion.

Context dependence. This transition typically occurs after multiple consecutive disturbances. Warmer and drier climate trends contribute to uncertainty of restoration efforts.

Transition T1C
State 1.1 to 1.4

Classic gully erosion is primary driver of this transition which is caused by large precipitation events outside of normal reference conditions in combination with herbivory pressure.

Constraints to recovery. Hydrology is altered, and the site lacks the ability to hold additional moisture on the site. This effectively interrupts site dynamics, lowers productivity potential, and prevents the normal ecological dynamics of sagebrush-killing events due to prolonged soil moisture.

Context dependence. Large precipitation events that would have resulted in prolonged soil saturation and caused sagebrush mortality instead result in additional soil erosion and head-cutting in drainageways with little to no sagebrush mortality and conditions that do not promote understory recruitment. The resulting plant community is

dominated by sagebrush with a reduced herbaceous understory. Herbivory pressure further exacerbates sparse understory conditions.

Transition T2A
State 1.2 to 1.3

Grazing Resistant | Disturbed

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 chemical treatments), rodent activity, or prolonged soil saturation, typically occasional irrigation. Extreme herbivory in combination with catastrophic drought may be a trigger for this transition as well.

Constraints to recovery. Persistent drought conditions, and herbivory pressure are constraints to recovery to the Reference State. Recovery is further inhibited by consecutive disturbances repeated over a relatively short time period and prolonged drought conditions. There is a risk of annual grass and forb invasion.

Context dependence. This transition typically occurs after multiple consecutive disturbances. Warmer and drier climate trends contribute to uncertainty of restoration efforts.

Transition T2B
State 1.2 to 1.4

Classic gully erosion is primary driver of this transition which is caused by large precipitation events outside of normal reference conditions in combination with herbivory pressure.

Constraints to recovery. Hydrology is altered, and the site lacks the ability to hold additional moisture on the site. This effectively interrupts site dynamics, lowers productivity potential, and prevents the normal ecological dynamics of sagebrush-killing events due to prolonged soil moisture.

Context dependence. Large precipitation events that would have resulted in prolonged soil saturation and caused sagebrush mortality instead result in additional soil erosion and head-cutting in drainageways with little to no sagebrush mortality and conditions that do not promote understory recruitment. The resulting plant community is dominated by sagebrush with a reduced herbaceous understory. Herbivory pressure further exacerbates sparse understory conditions.

Transition T3A
State 1.3 to 1.4

Classic gully erosion is primary driver of this transition which is caused by large precipitation events outside of normal reference conditions in combination with herbivory pressure.

Constraints to recovery. Hydrology is altered, and the site lacks the ability to hold additional moisture on the site. This effectively interrupts site dynamics, lowers productivity potential, and prevents the normal ecological dynamics of sagebrush-killing events due to prolonged soil moisture. Because the site previously experienced soil disturbing activities, the dominant shrub may be rabbitbrush or after a long period of time sagebrush may be co-dominant with rabbitbrush.

Context dependence. Large precipitation events that would have resulted in prolonged soil saturation and caused sagebrush mortality instead result in additional soil erosion and head-cutting in drainageways with little to no sagebrush mortality and conditions that do not promote understory recruitment. The resulting plant community is dominated by sagebrush and/or rabbitbrush with a reduced herbaceous understory. Herbivory pressure further exacerbates sparse understory conditions.

Restoration pathway R4A
State 1.4 to 1.2

More recently, there have been efforts to promote economical restoration activities due to high production potential for this site and high rates of degradation from a myriad of competing uses. Recommended restoration activities include Low-Tech Mesic Restoration techniques such as Zeedyk structures. The NRCS Conservation Practice is (643) Restoration of Rare or Declining Habitats. See the Conservation Practice Standard (CPS) at: https://efotg.sc.egov.usda.gov/api/CPSFile/3533/643_WY_CPS_Restoration_of_Rare_or_Declining_Natural_Communities_2018

Context dependence. Restoration to the Grazing Resistant State is likely possible without drastic changes in grazing management, but recovery will be slow and episodic with climatic conditions. Favorable weather (above normal precipitation) can result in more accelerated restoration while drought conditions can delay recovery.

Conservation practices

Restoration and Management of Rare and Declining Habitats

Restoration pathway R4B
State 1.4 to 1.3

More recently, there have been efforts to promote economical restoration activities due to high production potential for this site and high rates of degradation from a myriad of competing uses. Recommended restoration activities include Low-Tech Mesic Restoration techniques such as Zeedyk structures. The NRCS Conservation Practice is (643) Restoration of Rare or Declining Habitats. See the Conservation Practice Standard (CPS) at: https://efotg.sc.egov.usda.gov/api/CPSFile/3533/643_WY_CPS_Restoration_of_Rare_or_Declining_Natural_Communities_2018

Context dependence. Restoration to the Disturbed State is likely if the site was previously degraded from the Disturbed State to the Eroded State. It can likely occur without drastic changes in grazing management, but recovery will be slow and episodic with climatic conditions. Favorable weather (above normal precipitation) can result in more accelerated restoration while drought conditions can delay recovery.

Conservation practices

Restoration and Management of Rare and Declining Habitats

Land use 2
Pastureland

This is a deep to very deep site with very few limitations for agriculture production, and therefore is often converted to irrigated pasture due to high water holding capacity, low slopes, and landscape position that lends itself to tillage and irrigation practices. Pasture is land composed of introduced or domesticated native forage species that is used primarily for the production of livestock. Pastures receive periodic renovation and cultural treatments, such as tillage, fertilization, mowing/haying, weed control, and may be irrigated. Pastures are not in rotation with annual crops.

Characteristics and indicators. Plant communities can be very diverse with a mixture of native and non-native forage species or as a monoculture of a highly competitive forage grass such as creeping meadow foxtail. Hay production with aftermath grazing is the most common management scenario, but pastures on this site can also managed for grazing throughout the growing season with some dormant season grazing as well.

State 2.1
Irrigated Pasture

Figure 17. Pasture Land Use

This site belongs to the Deep Sub-irrigated, Loamy Forage Suitability Group (FSG) which covers deep to very deep soils with medium soil textures and greater than 6" available water-holding capacity (AWC) in the top 60" of the soil profile. A water table is often present at 48 to 72 inches in the soil profile. Production expected to range from 3,000 to 6,000 lbs./ac. with representative value (RV) of 4,500 lbs./ac. Adapted species for use as irrigated pasture include native species such as prairie junegrass, Canby's bluegrass, basin wildrye, slender wheatgrass, and western wheatgrass; introduced species including meadow brome, timothy, beardless wildrye, Altai wildrye, red fescue, sheep fescue, tall fescue, creeping meadow foxtail, Canada bluegrass, and Kentucky bluegrass; legume and forb species such as cicer milkvetch, birdsfoot trefoil, small burnett, white clover, alsike clover, red clover, and strawberry clover. Since this site is well-drained it is capable of supporting certain varieties of alfalfa when under an improved irrigation system such as sprinkler. Selection of species should be based on production goals and intended use (goals and objectives). More information regarding preferred varieties for irrigated pasture can be found at http://animalrange.montana.edu/documents/extension/mteb99.pdf AND https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/mtpmctn10704.pdf See the description for Deep Sub-irrigated, Loamy FSG for MLRA 34A LRU E (10-14" ppt, <70 day growing season) for more information at Wyoming's electronic Field Office Technical Guide, Section II, Forage Suitability Groups https://efotg.sc.egov.usda.gov/references/public/WY/mlra34A_fsg_deep_sub_irrigated_loamy_lru_E_.pdf

Characteristics and indicators. Irrigated pasture on this site is varies from a very diverse mix of native wetland plants to a monoculture of creeping meadow foxtail. Flood irrigation water management often results in hydric soil and hydrophytic vegetation. Improved irrigation systems allow for legume production.

Resilience management. Resilience on this site when in irrigated pasture is much higher than Reference State due to the additional moisture available for site recovery after disturbance. Resistance to weed invasion is typically much higher than the reference state. However, improper grazing or irrigation water management techniques could result in noxious weed invasion by perennials such as whitetop, perennial pepperweed, musk thistle, and Canada thistle.

Dominant resource concerns

- Inefficient irrigation water use
- Terrestrial habitat for wildlife and invertebrates

Land use 3
Other - Mineral Extraction Lands

Land that is barren, sandy, rocky, or that is impacted by the extraction of natural resources, such as minerals, gravel or sand, coal, shale, rock, oil, or natural gas.

Characteristics and indicators. This land use can be many things, but in this LRU is most often associated with oil and gas development. Barren land. A land cover/use category used to classify lands with limited capacity to support life and having less than 5 percent vegetative cover. Vegetation, if present, is widely spaced. [NRI-87] Typically, the surface of barren land is sand, rock, exposed subsoil, or salt-affected soils. Subcategories include salt flats; sand dunes; mud flats; beaches; bare exposed rock; quarries, strip mines, gravel pits, and borrow pits; river wash; oil

wasteland; mixed barren lands; and other barren land. [NRI-92]

State 3.1
Reclaimed

The Reclaimed State is highly variable based on weather conditions during reclamation activities, the management practices used to implement the reclamation, the seed mix, and timing/method of stockpiling topsoil during the disturbance.

Characteristics and indicators. The most common scenario is a reclaimed oil and gas well pad planted to crested wheatgrass (*Agropyron cristatum*) without appropriate topsoil stockpiling. If topsoil is stockpiled, it may have been stored for too long and/or stored too deep resulting in fewer soil microorganisms. Over time, basin big sagebrush will spread into the reclaimed area, but the understory will be dominated by introduced species. Biological soil crusts are minimal, further exposing the soil surface to erosional forces as well as impairing carbon, nutrient, and water cycles.

Resilience management. Resilience is lower than the Reference State, but with best management practices, a certain amount of resilience can be restored. Successful reclamation will result in reduced soil erosion and improved hydrologic function. Biotic integrity is highly variable. Because soil disturbance previously occurred on the site, resistance to invasive species is lower unless reclamation is highly successful with all available niches occupied by desirable perennial species.

Dominant resource concerns

- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Inadequate livestock water quantity, quality, and distribution

State 3.2
Annuals/Bare Ground

The Annuals/*Bare Ground* community occurs after severe disturbance, most often physical soil disturbance that removes topsoil, but it can also occur as a transition from the Eroded State after severe drought, flooding, pests, or disease, leaving the site with no perennial vegetation.

Characteristics and indicators. Populations of annual weedy forbs can reach critical levels and impact the ecological processes on the site until restoration or reclamation of the site occurs. As part of succession, all sites that are severely disturbed go through this plant community as part of the restoration process, but the time in this plant community phase is largely dependent on the use of restoration Best Management Practices (BPMs) and climate cycles. Biological soil crusts are non-existent, further exposing the soil surface to erosional forces as well as impairing carbon, nutrient, and water cycles.

Resilience management. Site resilience is at its lowest, and recovery is largely dependent on management practices and weather patterns. Resistance to invasion is at its lowest, and the site is vulnerable to all of the common annual weedy forbs such as Russian thistle (*Salsola tragus*)), flixweed (*Descurainia sophia*), lambsquarter (*Chenopodium album*), and halogeton (Halogeton glomeraturs) as well as existing or newly emerging noxious weed threats. When soil surface textures are coarse (sandy loam), this site is particularly susceptible to cheatgrass (*Bromus tectorum*).

Dominant resource concerns

- Sheet and rill erosion
- Classic gully erosion
- Sediment transported to surface water
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates

- Inadequate livestock water quantity, quality, and distribution

Restoration pathway R2A
State 3.2 to 3.1

Reclamation efforts include re-seeding. In cases where heavy equipment caused the disturbance, contouring and/or deep ripping may be necessary to provide a suitable site for re-seeding. Care must be taken to stockpile and replace surface layers separately from the subsurface. Prescribed grazing and restricting vehicle traffic on the site is necessary to facilitate successful seeding of perennial species.

Context dependence. Drought conditions and/or 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.

Conservation practices

Critical Area Planting
Mulching
Prescribed Grazing

Conversion C1A
Land use 1 to 2

Most range conversion to pasture occurred at the beginning of the 20th century through the use of horse-drawn implements and hand tools. Flood irrigation infrastructure was installed and introduced species, such as Kentucky bluegrass and clover, were planted. Wild flooding, or "Mountain Meadow Flooding," is the most common irrigation system which has little directional control and low efficiency. Land smoothing and land leveling are not common practices due to the potential of a thin topsoil or the economic cost for an area with such a short growing season. Because of the undulating natural surface, resulting microtopography ranges from 2.5cm to 20cm and sometimes greater. The field is over-irrigated to increase the water table, a practice called "sub-irrigating," or locally referred to as "getting the sub up," that results in hydrophytic vegetation and hydric soil development in the lower landscape positions. The goal with this irrigation system is to saturate the soil with enough water to supplement the higher areas. Over the years, willows have colonized the ditch systems and provide additional wildlife habitat. Late season return flow to streams are often cited as another added benefit to this type of system.

Conversion C1B
Land use 1 to 3

The conversion from Range to Other - Mineral Extraction Lands occurs when vegetation and soil is manipulated for the purpose of mineral extraction. Common practices are oil and natural gas pad and pipeline infrastructure, gravel pits, and road construction. Vegetation and topsoil is removed and topsoil is often stockpiled for on or off-site reclamation.

Conversion C3A
Land use 3 to 1

Conversion from Other - Mineral Extraction Lands to Range occurs, sometimes over a long period of time, as part of the reclamation and/or restoration process after mineral extraction. There is low potential for recovery without significant inputs of energy and resources, especially if topsoil has been removed. Seed mixes that mimic an adjacent “reference area” rather than the site potential as described in the Reference State (1.1) will often result in a plant community resembling the Grazing Resistant State (1.2) due to inappropriate seed mixes and pre- and post-seeding grazing management that does not provide adequate recovery and periodic critical growth period rest.

Additional community tables

Table 11. Community 3.1 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**			120–240	
	basin wildrye	LECI4	*Leymus cinereus*	36–240	3–20
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	60–240	5–20
	needle and thread	HECO26	*Hesperostipa comata*	0–120	0–10
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–120	0–10
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	12–120	1–10
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	0–120	0–10
	Montana wheatgrass	ELAL7	*Elymus albicans*	0–120	0–10
	squirreltail	ELEL5	*Elymus elymoides*	0–120	0–10
	Sandberg bluegrass	POSE	*Poa secunda*	12–120	1–10
	muttongrass	POFE	*Poa fendleriana*	0–120	0–10
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	0–120	0–10
2	**Rhizomatous Grasses**			60–120	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–120	0–10
	western wheatgrass	PASM	*Pascopyrum smithii*	96–120	8–10
3	**Miscellaneous Grasses/Grass-likes**			60–120	
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–60	0–5
	needleleaf sedge	CADU6	*Carex duriuscula*	0–60	0–5
	Sandberg bluegrass	POSE	*Poa secunda*	12–60	1–5
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	0–60	0–5
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–60	0–5
	Grass, perennial	2GP	*Grass, perennial*	0–60	0–5
Forb					
4	**Perennial Forbs**			60–108	
	meadow thistle	CISC2	*Cirsium scariosum*	0–60	0–5
	lupine	LUPIN	*Lupinus*	12–60	1–5
	aster	SYMPH4	*Symphyotrichum*	0–60	0–5
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–36	0–3
	bluebells	MERTE	*Mertensia*	0–36	0–3
	locoweed	OXYTR	*Oxytropis*	0–36	0–3
	beardtongue	PENST	*Penstemon*	0–36	0–3
	spiny phlox	PHHO	*Phlox hoodii*	0–36	0–3
	longleaf phlox	PHLO2	*Phlox longifolia*	0–36	0–3
	cinquefoil	POTEN	*Potentilla*	0–36	0–3
	flaxleaf plainsmustard	SCLI	*Schoenocrambe linifolia*	0–36	0–3
	ragwort	SENEC	*Senecio*	0–36	0–3
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–36	0–3
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0–36	0–3
	fleabane	ERIGE2	*Erigeron*	0–36	0–3
	buckwheat	ERIOG	*Eriogonum*	0–36	0–3
	milkvetch	ASTRA	*Astragalus*	12–36	1–3

	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	12–36	1–3
	agoseris	AGOSE	*Agoseris*	0–36	0–3
	onion	ALLIU	*Allium*	0–12	0–1
	pussytoes	ANTEN	*Antennaria*	0–12	0–1
	rockcress	ARABI2	*Arabis*	0–12	0–1
	Indian paintbrush	CASTI2	*Castilleja*	0–12	0–1
	ipomopsis	IPOMO2	*Ipomopsis*	0–12	0–1
	Rocky Mountain iris	IRMI	*Iris missouriensis*	0–12	0–1
	povertyweed	IVAX	*Iva axillaris*	0–12	0–1
	Lewis flax	LILE3	*Linum lewisii*	0–12	0–1
	desertparsley	LOMAT	*Lomatium*	0–12	0–1
	cryptantha	CRYPT	*Cryptantha*	0–12	0–1
	larkspur	DELPH	*Delphinium*	0–12	0–1
	pale bastard toadflax	COUMP	*Comandra umbellata ssp. pallida*	0–12	0–1
	sagebrush buttercup	RAGL	*Ranunculus glaberrimus*	0–12	0–1
	hollyleaf clover	TRGY	*Trifolium gymnocarpon*	0–12	0–1
	clover	TRIFO	*Trifolium*	0–12	0–1
	violet	VIOLA	*Viola*	0–12	0–1
	deathcamas	ZIGAD	*Zigadenus*	0–12	0–1
	Forb, perennial	2FP	*Forb, perennial*	0–12	0–1
5	**Annual Forbs**			0–12	
	rockjasmine	ANDRO3	*Androsace*	0–12	0–1
	bushy bird's beak	CORA5	*Cordylanthus ramosus*	0–12	0–1
	yellow owl's-clover	ORLU2	*Orthocarpus luteus*	0–12	0–1
	Forb, annual	2FA	*Forb, annual*	0–12	0–1
Shrub/Vine					
6	**Sagebrush**			240–480	
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	240–480	20–30
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–240	0–15
	silver sagebrush	ARCAV2	*Artemisia cana ssp. viscidula*	0–120	0–5
7	**Miscellaneous Shrubs**			60–120	
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	0–60	0–5
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	12–60	1–5
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	12–60	1–5
	currant	RIBES	*Ribes*	0–60	0–5
	Woods' rose	ROWOW	*Rosa woodsii var. woodsii*	0–60	0–5
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	0–60	0–5
	granite prickly phlox	LIPU11	*Linanthus pungens*	0–36	0–3
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–12	0–1

Table 12. Community 3.2 plant community composition

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

1	**Perennial Mid-Size Cool Season Bunchgrasses**			204–420	
	basin wildrye	LECI4	*Leymus cinereus*	120–360	10–30
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	60–240	5–20
	needle and thread	HECO26	*Hesperostipa comata*	0–120	0–10
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–120	0–10
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	12–120	1–10
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	0–120	0–10
	Montana wheatgrass	ELAL7	*Elymus albicans*	0–120	0–10
	squirreltail	ELEL5	*Elymus elymoides*	0–120	0–10
	Sandberg bluegrass	POSE	*Poa secunda*	60–120	5–10
	muttongrass	POFE	*Poa fendleriana*	0–120	0–10
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	0–120	0–10
2	**Rhizomatous Wheatgrasses**			96–180	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–180	0–15
	western wheatgrass	PASM	*Pascopyrum smithii*	96–180	8–15
3	**Miscellaneous Grasses/Grasslikes**			60–120	
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–60	0–5
	needleleaf sedge	CADU6	*Carex duriuscula*	0–60	0–5
	Sandberg bluegrass	POSE	*Poa secunda*	12–60	1–5
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	0–60	0–5
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–60	0–5
	Grass, perennial	2GP	*Grass, perennial*	0–60	0–5
Forb					
4	**Perennial Forbs**			60–108	
	meadow thistle	CISC2	*Cirsium scariosum*	0–60	0–5
	lupine	LUPIN	*Lupinus*	12–60	1–5
	aster	SYMPH4	*Symphyotrichum*	0–60	0–5
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–36	0–3
	bluebells	MERTE	*Mertensia*	0–36	0–3
	locoweed	OXYTR	*Oxytropis*	0–36	0–3
	beardtongue	PENST	*Penstemon*	0–36	0–3
	spiny phlox	PHHO	*Phlox hoodii*	0–36	0–3
	longleaf phlox	PHLO2	*Phlox longifolia*	0–36	0–3
	cinquefoil	POTEN	*Potentilla*	0–36	0–3
	flaxleaf plainsmustard	SCLI	*Schoenocrambe linifolia*	0–36	0–3
	ragwort	SENEC	*Senecio*	0–36	0–3
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–36	0–3
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0–36	0–3
	fleabane	ERIGE2	*Erigeron*	0–36	0–3
	buckwheat	ERIOG	*Eriogonum*	0–36	0–3
	milkvetch	ASTRA	*Astragalus*	12–36	1–3
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	12–36	1–3
	agoseris	AGOSE	*Agoseris*	0–36	0–3

	onion	ALLIU	*Allium*	0–12	0–1
	pussytoes	ANTEN	*Antennaria*	0–12	0–1
	rockcress	ARABI2	*Arabis*	0–12	0–1
	Indian paintbrush	CASTI2	*Castilleja*	0–12	0–1
	ipomopsis	IPOMO2	*Ipomopsis*	0–12	0–1
	Rocky Mountain iris	IRMI	*Iris missouriensis*	0–12	0–1
	povertyweed	IVAX	*Iva axillaris*	0–12	0–1
	Lewis flax	LILE3	*Linum lewisii*	0–12	0–1
	desertparsley	LOMAT	*Lomatium*	0–12	0–1
	cryptantha	CRYPT	*Cryptantha*	0–12	0–1
	larkspur	DELPH	*Delphinium*	0–12	0–1
	pale bastard toadflax	COUMP	*Comandra umbellata ssp. pallida*	0–12	0–1
	sagebrush buttercup	RAGL	*Ranunculus glaberrimus*	0–12	0–1
	hollyleaf clover	TRGY	*Trifolium gymnocarpon*	0–12	0–1
	clover	TRIFO	*Trifolium*	0–12	0–1
	violet	VIOLA	*Viola*	0–12	0–1
	deathcamas	ZIGAD	*Zigadenus*	0–12	0–1
	Forb, perennial	2FP	*Forb, perennial*	0–12	0–1
5	**Annual Forbs**			0–12	
	rockjasmine	ANDRO3	*Androsace*	0–12	0–1
	bushy bird's beak	CORA5	*Cordylanthus ramosus*	0–12	0–1
	yellow owl's-clover	ORLU2	*Orthocarpus luteus*	0–12	0–1
	Forb, annual	2FA	*Forb, annual*	0–12	0–1
Shrub/Vine					
6	**Sagebrush**			120–240	
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	120–240	10–20
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–120	0–10
	silver sagebrush	ARCAV2	*Artemisia cana ssp. viscidula*	0–60	0–5
7	**Miscellaneous Shrubs**			60–120	
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	0–60	0–5
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	12–60	1–5
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	12–60	1–5
	currant	RIBES	*Ribes*	0–60	0–5
	Woods' rose	ROWOW	*Rosa woodsii var. woodsii*	0–60	0–5
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	0–60	0–5
	granite prickly phlox	LIPU11	*Linanthus pungens*	0–36	0–3
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–12	0–1

Animal community

Livestock:
The following table lists initial 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 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 this information, 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.
Stocking rates are expressed in Animal Unit Months (AUMs) which is defined as the amount of forage consumed by a 1,000 pound cow with a less than 4 month old calf at her side.

Plant Community - Production (lb./ac Low-RV-High) - AUMs/ac - ac/AUM
1.1.1 Basin Big Sagebrush/Bunchgrass 800-1,200-1,600 0.13 8
1.1.2 Bunchgrass/Basin Big Sagebrush 800-1,200-1,600 0.2 5
1.1.3 Bunchgrass 800-1,200-1,600 0.26 4
1.2.1 Basin Big Sagebrush/Short-stature Grass 600-1,000-1,400 0.08 13
1.2.2 Short-stature Grass/Basin Big Sagebrush 600-1,000-1,400 0.12 8
1.3.1 Basin Big Sagebrush/Rabbitbrush 600-1,000-1,400 0.06 17
1.3.2 Rabbitbrush/Rhizomatous Wheatgrass 600-1,000-1,400 0.1 10
1.4.1 Basin Big Sagebrush/Annuals 400-800-1,200 0.04 25
2.1.1 Irrigated Pasture 3,000-4,500-6,000 1.2 0.8
3.1.1 Other - Reclaimed 800-1,200-1,600 0.26 4
3.1.2 Other - Annual 200-600-1,000 0.02 50.0
* Continuous, season-long grazing by cattle under average growing conditions.

Calculation for stocking rates are as follows: Using Representative (RV) values for production, take forage palatable to grazing cattle and multiply by 0.25 Harvest Efficiency (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:
Land Use 1 - Range
Reference State:
1.1.1 Basin Big Sagebrush/Bunchgrass: This community phase provides winter habitat for mule deer, pronghorn, and Sage Grouse, as well as transitional habitat for migrating ungulates. Although this community makes up a small portion on the overall landscape, the site occurs within areas highly used by big game species, primarily during winter months and provides suitable thermal and escape cover. These areas also provide nesting habitat for sagebrush obligates, such as Sage Thrashers and Brewer’s Sparrow, and foraging and protective cover for small mammals such as pygmy rabbits.
1.1.2 Bunchgrass/Basin Big Sagebrush: This community phase provides foraging opportunities for ungulates during winter, transitional and summer seasonal ranges, however, suitable cover due to lower canopy of sagebrush is lacking. Year-round habitat is provided for many other sagebrush obligate species including both generalists and specialists. This community can be used as migration and stopover habitat by big game, but is generally a small component of the landscape.
1.1.3 Bunchgrass: This community phase provides foraging habitat for Sage Grouse and other sagebrush obligates when in proximity to areas with denser sagebrush cover. Due to the higher production of mid-stature bunchgrasses,

this vegetation type provides high forage value for wintering elk. Spring green-up of grass is an important nutritional component of this community for migrating big game, such as mule deer. It also provides suitable habitat for burrowing animals.
Grazing Resistance State:
1.2.1 Basin Big Sagebrush/Short-stature Grass: This community phase is variable in its value to wildlife. The site provides suitable protective and thermal cover as a result of the density of big sagebrush. The diminished understory limits value of the site for birds and small mammals due to the lack of cover in the interspaces of the sagebrush plants.
1.2.2 Short-stature Grass/Basin Big Sagebrush: This community phase is variable in its value to wildlife. A dominance of short-stature grasses, such as Sandberg bluegrass, provides foraging opportunities during spring green-up and is an important nutritional component of this community for migrating ungulates seasonally. A lack of big sagebrush limits foraging opportunities and protective cover for a suite of wildlife species including birds, small mammals, and big game.
Disturbed State:
1.3.1 Basin Big Sagebrush/Rabbitbrush: These communities provide limited forage for ungulates such as pronghorn and mule deer, but still provide some protective and thermal cover. The areas are used by Sage Grouse and sagebrush generalists when near undisturbed sites, or seasonally used by cottontail or jack rabbits.
1.3.2 Rabbitbrush/Rhizomatous Wheatgrass: These communities provide limited forage for pronghorn and mule deer due to low production and lack of sagebrush. They may be used as a foraging site by Sage Grouse and sagebrush generalists if proximal to woody cover, or seasonally used by small mammals. The overall dominance of rabbitbrush is generally not ideal to support a wide variety of wildlife.
Eroded State:
1.4.1 Basin Big Sagebrush/Annuals: This site is highly variable in its value to wildlife. The overall lack of an understory and increased bare ground is not ideal to support a wide range of wildlife. Sites with a dominance of basin big sagebrush can provide suitable cover for thermal protection and escape cover for a variety of species.
Land Use 2 – Pasture
2.1 Irrigated Pasture: This community phase when properly managed can provide brood rearing habitat for Sage Grouse when in proximity to areas with denser sagebrush cover. In areas with a higher diversity of forage species (and where accepted), this type provides forage value for wintering elk, and mule deer and pronghorn during transition between winter and summer. It can provide habitat for a variety of small mammals and birds when adjacent to plant communities with higher densities of sagebrush.
Land Use 3 – Mineral Extraction
3.1 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 (elk, prairie dogs, and fox) will benefit from reclamation sooner than those species dependent on a mixed shrub/grass community. Small mammals, such as mice (Peromyscus spp.) and birds can be found foraging in these areas shortly after reclamation practices.
3.2 Annuals/Bareground: This state is highly variable in its value to wildlife. Lack of perennial forbs, grasses, and shrub cover severely reduce the quality of forage for wildlife including ungulates such as mule deer and pronghorn. The area does provide limited foraging opportunities for small mammals and birds, but lacks any structure for escape cover.

Hydrological functions

Water is the principal factor limiting forage production on this site, although this is considered an extra water site. This site is dominated by soils in hydrologic group B and C. Infiltration ranges from moderate to 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. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Part 630, NRCS National Engineering Handbook for detailed hydrology information).

Rills and gullies should not typically be present. Water flow patterns should be barely distinguishable if at all present. Pedestals are only slightly present in association with bunchgrasses. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non-existent. Biotic 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 that bloom in the spring have an aesthetic value that appeals to recreationists.

Inventory data references

Information presented here has been derived from historic and recent clipping data and other inventory data. Field observations from range trained personnel were also used. Inventory Data Resources include:
1 National Resource Inventory (NRI) point (2004)
2 Bureau of Land Management Assessment, Inventory, and Monitoring (BLM-AIM) points (2017)
9 Tier I NRCS Ecological Site Inventory (NRCS-ESI) points (2004-2013), including 3 Pasture
2 BLM-ESI points (2009)

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Other references

Site concept, plant community data, and interpretations are based on ecological site descriptions (ESDs) from MLRA 34A-Foothills and Basins West (10-14W).
This ESD replaces R034AY230WY Overflow MLRA 34A-Foothills and Basins West (Ov 10-14W), but only within geographic extent of the Pinedale Plateau LRU.
Further data collection and ecological site refinement are ongoing until the ESD has reached "Approved" status.

Contributors

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Approval

Kirt Walstad, 2/24/2025

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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	05/01/2024
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):

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
