USDA Natural Resources
Conservation Service

Ecological site DX034A02X150
Sandy Pinedale Plateau (Sy PP)

Last updated: 2/19/2025
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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.

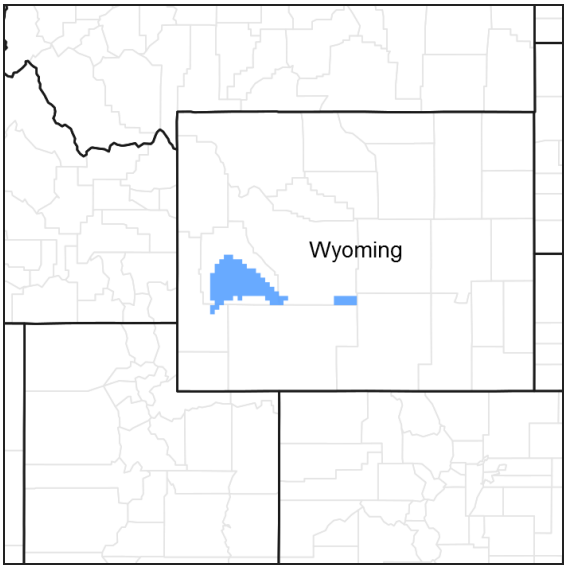


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

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
For further information regarding MLRAs, refer to:
http://soils.usda.gov/survey/geography/mlra/index.html

Land Resource Unit (LRU) 34A-C:
Moisture Regime: aridic ustic
Temperature Regime: frigid, cool
Dominant Cover: rangeland
Representative Value (RV) Effective Precipitation: 9-12 inches
RV Frost-Free Days: 30-60 days

Classification relationships

Site Name: Sandy Pinedale Plateau

Site Type: Rangeland

Site ID: R034C150WY

Precipitation or Climate Zone: 9-12” P.Z.

Relationship to Other Established Classification Systems
National Vegetation Classification System (NVC):
3 Semi-Desert
3.B.1 Cool Semi-Desert Scrub & Grassland
D040 Western North American Cool Semi-Desert Scrub & Grassland
M169 Great Basin & Intermountain Tall Sagebrush Shrubland & Steppe Group
CEGL001011 *Artemisia tridentata*/*Achnatherum lettermanii* Shrubland

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

Ecological site concept

Site does not receive any additional water.
Soils are:
not saline or saline-sodic.
moderately deep, deep, or very deep with < 3% stone and boulder cover.
not skeletal within 20” of soil surface.
not strongly or violently effervescent in surface mineral 4”.
textures usually range from very fine sandy loam to clay loam in surface mineral 6”.
Slope is < 15%.
Clay content is = 32% in surface mineral 4”.
Site does not have an argillic horizon with > 35% clay

Associated sites

DX034A01X126	**Loamy Calcareous Green River Basin (LyCa GRB)**
DX034A02X122	**Loamy Pinedale Plateau (Ly PP)**

Similar sites

DX034A01X126	**Loamy Calcareous Green River Basin (LyCa GRB)** Loamy calcareous has a CCE >15% at less than 20” depth
R034AY204WY	**Clayey Foothills and Basins West (Cy)** Clayey has heavier soil textures, clay loams with >32” clay content to depth of at least 6”. In reference state, it is dominated by rhizomatous wheatgrass.
DX034A02X122	**Loamy Pinedale Plateau (Ly PP)** Loamy has finer soil textures, sandy loam or finer to at least 6”. In the reference state, grasses are dominated by letterman’s needle grass and Indian ricegrass.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata var. wyomingensis*
Herbaceous	(1) *Achnatherum hymenoides* (2) *Achnatherum lettermanii*

Legacy ID

R034AC150WY

Physiographic features

The Sandy Pinedale Plateau (Sy) ecological site (R034AC150WY) is located within LRU “C” in MLRA “34A.” This ecological site occurs in intermontane basin landscapes on hill, draw, pediment, and fan remnant landforms (see definitions below). The slope ranges from level to 15%. This site occurs on all aspects.
fan remnant – A general term for landforms that are the remaining parts of older fan-landforms, such as alluvial fans, fan aprons, inset fans, and fan skirts, that either have been dissected (erosional fan-remnants) or partially buried (nonburied fan-remnants). An erosional fan remnant must have a relatively flat summit that is a relict fan-surface.
intermontane basin – A generic term for wide structural depressions between mountain ranges that are partly filled with alluvium and called "valleys" in the vernacular.
hills – A landscape dominated by hills and associated valleys. The landform term is singular (hill).

Table 2. Representative physiographic features

Landforms	(1) Fan remnant (2) Hill
Flooding frequency	None
Ponding frequency	None
Elevation	6,500–7,500 ft
Slope	0–15%
Water table depth	60 in
Aspect	Aspect is not a significant factor

Climatic features

Annual precipitation ranges from 9-12 inches per year. Wide fluctuations may occur in yearly precipitation and result in more dry years than those with more than normal precipitation. Temperatures show a wide range between 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. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring.

Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 mph.

Growth of native cool season plants begins about April 15 and continues to about August 15. Some green up of cool season plants usually occurs in September depending upon fall moisture occurrences.

The following information is from the “Pinedale” climate station

Table 3. Representative climatic features

Frost-free period (average)	31 days
Freeze-free period (average)	62 days
Precipitation total (average)	12 in

Climate stations used

- (1) PINEDALE [USC00487260], Pinedale, WY

Influencing water features

None

Soil features

The soils of this site are deep to moderately deep (greater than 20" to bedrock), and well-drained. Textures range from coarse loamy coarse sand to very fine sandy loam.

Major Soil Series correlated to this site includes: Raghorn, Diamondville, Golphco, and Pitchstone series.

Other Soil Series correlated to this site in MLRA 34A include: Edlin, Ryark, Comer, Sandland, Cotha, and Rawlins series.

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone and shale
Surface texture	(1) Gravelly sandy loam (2) Coarse sandy loam (3) Loamy coarse sand
Family particle size	(1) Sandy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to moderate
Soil depth	20–60 in
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	1.5–6 in
Calcium carbonate equivalent (0-40in)	0–15%
Electrical conductivity (0-40in)	0–8 mmhos/cm
Sodium adsorption ratio (0-40in)	0–5
Soil reaction (1:1 water) (0-40in)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–10%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

This ecological site is dominated (species composition by dry weight) by big sagebrush and perennial grasses with forbs as a minor component. The site consists of five states: the Reference State (1), Grazing Resistant State (2), Eroded State (3), Disturbed State (4), and Highly Disturbed State (5).

The Reference State is a collection of 3 distinct Plant Communities that exist on a continuum relative to disturbances, primarily grazing, pests, drought, and fire with no disturbance causing successional changes as well over time. These Plant Communities represent the best adapted plant communities to the soils and climate found on the site, and they represent the best estimation of ecological dynamics present on this site at the time of European settlement.

The Reference Plant Community (big sage/bunchgrass) of this site is dominated by Wyoming big sagebrush (*Artemisia tridentata* var. wyomingensis) and cool-season perennial bunchgrass species, primarily) Indian Ricegrass (*Achnatherum hymenoides*), Letterman’s needlegrass (*Achnatherum lettermanii* and Needleandthread (Hesperostipa comat)) with bluebunch wheatgrass (*Pseudoroegneria spicata*), bottlebrush squirreltail (*Elymus*

elymoides), mutton bluegrass (*Poa fendleriana*), and rhizomatous grasses like thickspike wheatgrass (*Elymus lanceolatus* ssp. lanceolatus) as a subdominant. Minor components include short-statured bunchgrasses such as Sandberg bluegrass perennial forbs, and shrubs, including green rabbitbrush (*Chrysothamnus viscidiflorus*).

After a sagebrush killing disturbance, the Plant Community transitions to the Bunchgrass Plant Community which is dominated by the mid-stature bunchgrasses mentioned above. Sagebrush is a minor component of this Plant Community, and only time without a sagebrush killing disturbance will advance this to the Bunchgrass/ big sagebrush which is a mid-seral Plant Community described because of the time this site spends with this species composition, its value to resource managers, and often it is the most prone to some sagebrush killing disturbances, such as fire, which are thought be fairly infrequent on this site (need expand and cite).

The Bunchgrass/big sagebrush Plant Community, as a mid-seral stage, is often considered to have the most diversity and provide the most ecosystem services (i.e. wildlife habitat, livestock forage, etc.) in a multiple use management system.

Mid-stature bunchgrasses act as decreaser species in the Reference Community. Low stature bunchgrasses and rhizomatous grasses tolerate higher grazing pressure and grow on less fertile soils (USDA/NRCS 2007) than mid stature bunchgrasses. They often fill in the vegetation gaps created when mid stature bunchgrasses decline, hence them collectively referred to as increaser species.

Big sagebrush, is the dominant shrub on this site. Most often Wyoming big sagebrush is the sub-species present, but this transitions to mountain big sagebrush (*Artemisia tridentata* ssp. vaseyana) at the upper end of the precipitation range for this site (12+ inches). Snow catchment is a significant hydrologic component of this site, and the hydrology changes when shrubs are removed from this site.

Prior to the introduction of livestock (cattle and sheep) during the late 1800s, elk, mule deer, and pronghorn grazed this ecological site, primarily as winter and transitional range (early spring, late fall). Significant livestock grazing has occurred on most of this ecological site for more than 100 years. The Trans-Continental Railroad in the 1860s brought the first herds, and homesteaders began settling the area through the turn of the century. Livestock grazing in this region has historically been cattle. In fact, early grazers established a “Deadline” from Fontenelle Creek across the desert to the Big Sandy River and sheep grazing was not allowed north of this line. Sheep crossing the line often died of plant poisoning from plants that were left lying along the boundary line by cattlemen. (Sommers, 1994)

Without ground disturbing activities, this site is relatively free of invasive weeds, but once mechanically or physically disturbed it is prone to weed invasion, primarily by annuals such as lambsquarter (*Chenopodium album*), Russian thistle (*Salsola kali*), flixweed (*Descurainia sophia*), and kochia (*Bassia scoparia*). The most common noxious species affecting this site after soil disturbance is whitetop (Cardraria draba) and Canada thistle (*Cirsium arvense*) at the upper end of its precipitation range. Soil disturbance can be caused by vehicles, equipment, severe over-utilization of the herbaceous vegetation, or large amounts of bare ground created by extended drought conditions combined with over-utilization. Cheatgrass, an invasive annual grass introduced and on south aspects, has been found on sites with higher gravel content that have been severely disturbed (roads, gravel pits, etc.).
The most prevalent noxious weed in the Pinedale Plateau LRU is Canada thistle (*Cirsium arvense*). It can be found in all ecological sites but is mostly associated with riparian areas and disturbances. Canada thistle invades Federal, State and private lands. Developments and disturbance of the soil usually will result in a new infestation of Canada thistle. Canada thistle is from Eurasia, it was introduced via Canada as a seed contaminate in the 18th Century. It is prevalent though out the United States as seeds are transported via wind and its aggressive rhizomatous root system sustains very dense patches.
The second most prevalent noxious weed in riparian areas is perennial pepperweed (*Lepidium latifolium*). This mustard is usually found in riparian areas but we are now locating it invading other plant communities too. The Green River and many of its tributaries have significant perennial pepperweed infestations. It is said to be introduced to the Sublette County Area as a hay contaminant, when ranches had to bring in hay from Utah, Idaho and other areas in the state during a drought in the 70's.
Another noxious mustard of concern is whitetop or hoary cress (*Cardaria draba*). This species is also found in all habitat types within the Green River Basin. It is found in irrigated hay meadows, roadsides, rangelands, but most significantly invades rangelands or fields that have had a disturbance event. This disturbance can be from over utilization of forage or native plant thinning due to drought. This deep rooted perennial mustard completes its life

cycle in early summer. There are several varieties of *Cardaria draba* in the area, which are difficult to distinguish but all seem to have the same effect but bloom at different times of the summer.

State and transition model

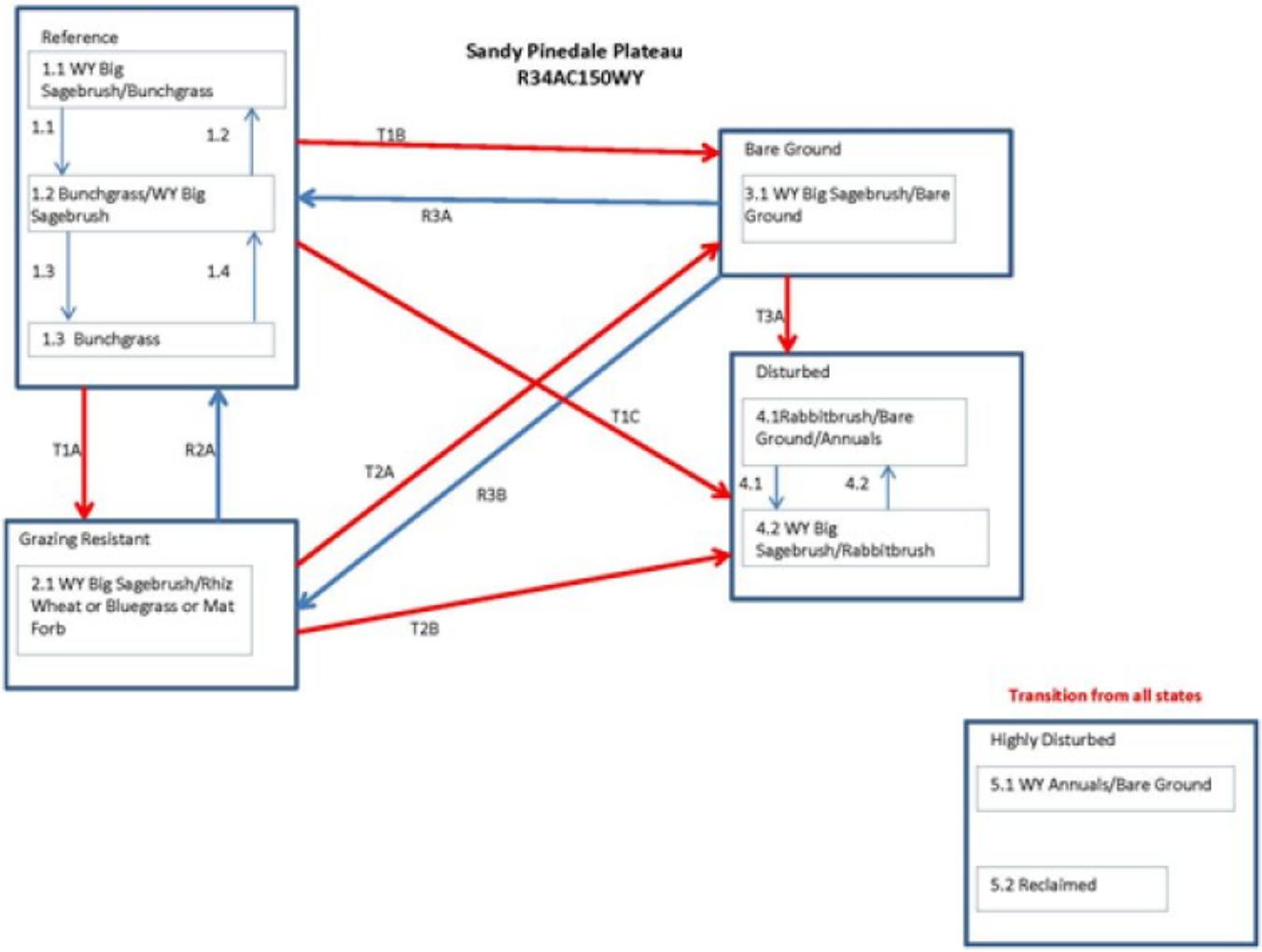


Figure 6. STM

Figure 7. Sandy LRU C STM Legend

State 1
Reference

The Reference State consists of three Plant Communities: the Big Sagebrush/Bunchgrass Community (1.1) the Bunchgrass/Big sagebrush Plant Community (1.2) and the Bunchgrass Community (1.3). Each community differs in percent composition of bunchgrasses and percent woody canopy cover. Forbs are a minor component on this site. Woody canopy cover is less than 25 percent. Dominant shrub species is Wyoming Big Sagebrush in the Reference State (1), with some instances of, mountain big sagebrush at the upper end of the precipitation range. Two important processes occurring in this state result in plant community changes within Reference State: sagebrush killing disturbances (browse, insects, drought, fire) and time without those disturbances. These processes are generally referred to as “natural succession.” The shift from the Bunchgrass Plant Community (1.3) to the Bunchgrass/Big Sagebrush Plant Community (1.2) and subsequently to the Big Sagebrush/Bunchgrass Plant Community is dependent on an increase of woody cover. Without sagebrush killing disturbance, shrubs will increase on this ecological site even with proper grazing management. Improper grazing management may accelerate the rate of increase for woody species. The shift from the Big Sagebrush/Bunchgrass or Bunchgrass/Big Sagebrush Plant Communities is dependent on sagebrush killing disturbances such as fire, drought, browse, and insects. Management actions can and are often used to mimic these processes through mechanical and chemical treatments. Prescribed fire is not often used on this site due to current land uses and lack of fuels and adequate burn windows.

Community 1.1
Big Sagebrush/Bunchgrass Community

Figure 8. 1.1

The Sandy site has the potential to be one of the most productive upland sites in the LRU. The Big Sagebrush/Bunchgrass 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. 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. 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 medium-term) reduction in forb density and diversity. The Big Sagebrush/Bunchgrass Community (1.1) can occur across the entire ecological site or can occur in a mosaic. This community can occur over time without these disturbances and accelerated with added herbaceous grazing pressure. Big sagebrush is dominant in the Big Sagebrush/Bunchgrass Community (1.1) with sagebrush canopy cover ranging from 15% to 25%. At this sagebrush canopy level in this precipitation zone, there is competition between the shrub overstory and the herbaceous understory (cite Alma Winward). A Big Sagebrush/Bunchgrass Community with a degraded understory is an “at-risk” community. In the Big Sagebrush/Bunchgrass Community (1.1), there are generally few canopy gaps, and most basal gaps are moderate (3-6 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 (1.3) and slightly lower than in the Bunchgrass/Big Sagebrush Community (1.2). It is typical for shrubs to increase as the community shifts from the Bunchgrass Community (1.1) to the Bunchgrass/Big Sagebrush Community (1.2).

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	300	400	500
Grass/Grasslike	240	320	400
Forb	60	80	100
Total	**600**	**800**	**1000**

Figure 10. Plant community growth curve (percent production by month). WY0301, 34AC, Upland Sites. All Upland Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			5	40	50			5			

Community 1.2
Bunchgrass/Big Sagebrush Community

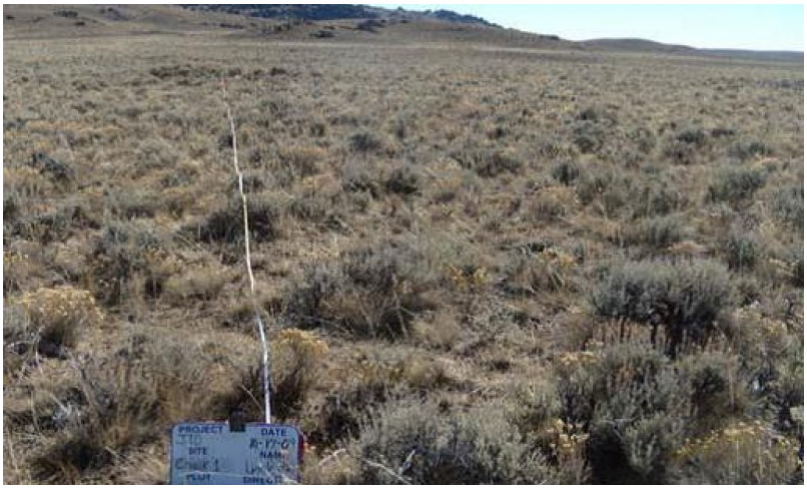


Figure 11. 1.2

The Bunchgrass/Big Sagebrush Community (1.2) can occur across the entire ecological site on a given landscape but more likely occurs in a mosaic pattern associated with the disturbance cycle at any given location. Mid-stature bunchgrasses dominate in the Bunchgrass/Big Sagebrush Community (1.2) with sagebrush sub-dominant with cover ranging from 5% to 15%. 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) In the Bunchgrass/Big Sagebrush Community (1.2), there are generally few canopy gaps, and most basal gaps are generally (3-6 feet). Rock cover on the soil surface is essentially nonexistent. Many plant interspaces have canopy or litter cover. Production of grasses is slightly lower than in the Bunchgrass Community (1.3), but shrub production is higher.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	360	480	600
Shrub/Vine	180	240	300
Forb	60	80	100
Total	**600**	**800**	**1000**

Figure 13. Plant community growth curve (percent production by month). WY0301, 34AC, Upland Sites. All Upland Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			5	40	50			5			

Community 1.3
Bunchgrass Community

Figure 14. 1.3

The Bunchgrass Community (1.3) is dominated by mid-stature cool-season bunchgrasses mixed with a minor component of forbs and shrubs. Big sagebrush is present as a part of the community, but is minor with 0 to 5% foliar cover. The Bunchgrass Community (1.3) generally occurs on this site immediately following a sagebrush killing event such as drought, insects, browse, or fire

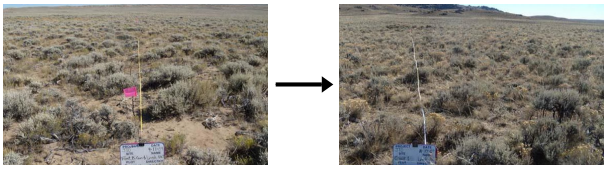
Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	420	560	700
Shrub/Vine	120	160	200
Forb	60	80	100
Total	**600**	**800**	**1000**

Figure 16. Plant community growth curve (percent production by month). WY0301, 34AC, Upland Sites. All Upland Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			5	40	50			5			

Pathway 1.1A
Community 1.1 to 1.2

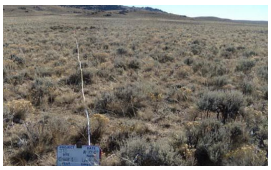


Big Sagebrush/Bunchgrass Community

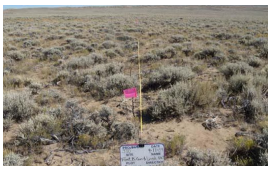
Bunchgrass/Big Sagebrush Community

The driver for community shift 1.1-1.2 is the increase in density and vigor of mid-stature bunchgrasses to the point that they dominate species composition by weight. The trigger for this is a sagebrush killing event, such as fire, chemical, mechanical or biological control of sagebrush that favors the existing herbaceous vegetation

Pathway 1.2A
Community 1.2 to 1.1



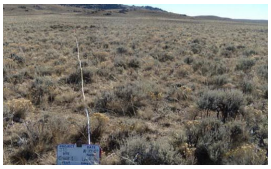
Bunchgrass/Big Sagebrush Community



Big Sagebrush/Bunchgrass Community

The driver for community shift 1.2-1.1 is natural succession. The trigger for this shift is an increase in shrub canopy cover and decline in overall bunchgrasses. The transition to the Big Sagebrush/Bunchgrass Community (1.1) can be the result of sagebrush naturally increasing its canopy cover along with yearly climatic differences. This transition can be accelerated with proper herbaceous grazing (properly stocked and a grazing system that varies the time and timing of grazing to provide for periodic deferment during the critical growth period) and natural events such as drought/wet cycles.

Pathway 1.2B
Community 1.2 to 1.3



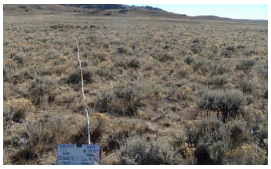
Bunchgrass/Big Sagebrush Community

Bunchgrass Community

The driver for community shift 1.2-1.3 is the increase in density and vigor of mid-stature bunchgrasses to the point that they dominate species composition by weight. The trigger for this is a sagebrush killing event, such as fire, chemical, mechanical or biological control of sagebrush that favors the existing herbaceous vegetation.

Pathway 1.3A
Community 1.3 to 1.2

Bunchgrass Community



Bunchgrass/Big Sagebrush Community

The driver for community shift 1.3-1.2 is natural succession. The trigger for this shift is an increase in shrub canopy cover and decline in overall bunchgrasses. The transition to the Bunchgrass/Big Sagebrush Community (1.2) can be the result of sagebrush naturally increasing its cover along with yearly climatic differences. This transition can be accelerated with proper herbaceous grazing (fully stocked and a system that varies the time and timing of grazing to provide for periodic deferment during the critical growth period) and natural events such as drought/wet cycles. It is typical for shrubs to increase as the community shifts from the Bunchgrass Community (1.3) to the Bunchgrass/Big Sagebrush Community (1.2).

State 2
Grazing Resistant

The Grazing Resistant State (2) is characterized by an herbaceous layer dominated by short-statured bunchgrasses such such as Sandberg bluegrass and, rhizomatous grasses and grass-likes, and/or mat forbs such as Hood's phlox, sandwort, and sulfur flowered buckwheat. Mid-stature bunchgrasses such as Indian ricegrass, needleandthread/, Letterman's needlegrass, bluebunch wheatgrass, and bottlebrush squirreltail have become scarce or absent. There is one community in the Grazing Resistant State: the Big Sagebrush/Rhizomatous Wheatgrass-Sandberg Bluegrass -Mat Forb Plant Community (2.1). The site crosses the threshold to the Grazing Resistant State (2) from the Reference State (1) when desirable mid-stature bunchgrasses lose dominance. Once the key species become scarce, it is unlikely that they have sufficient reproductive capability (seed source, tillering, or resprouting) to recover dominance in a reasonable time frame without extra energy being added to the system.

The Plant Community in the Grazing Resistant State (2) is very resilient and therefore common on Loamy sites in this MLRA. In many cases, the transition to the Grazing Resistant State (2) 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 in a stable state. While dominance by rhizomatous grasses makes the return to the Reference State (1) plant community difficult, it also makes the site resistant to further degradation except in cases where overstocked or in the case of prolonged drought with full stocking. The main factor creating high resiliency of the Big Sagebrush/Rhizomatous Wheatgrass-Sandberg Bluegrass-Mat Forb Plant Community is that the bluegrass and rhizomatous grasses are highly grazing tolerant. Sandberg bluegrass and rhizomatous grasses are low to the ground, so, even under heavy grazing, enough biomass remains for the grasses to maintain plant vigor. Rhizomatous grasses successfully reproduce through underground rhizomes. The rhizomatous grasses can form mats that provide soil protection by protecting the soil from raindrop impact, decreasing the risk of soil erosion. However, overall soil health is lower than the reference state, primarily due to a reduction in soil organic matter due to a reduction in litter. The decreased infiltration is due increased bare ground patch size and lack of litter that acts as mulch in retaining soil moisture and retarding runoff. Under high intensity early season grazing, especially by in calving pastures and in small acreage horse pastures, ground cover decreases to a point that the site will transition to the *Bare Ground* State (3).

Community 2.1
Big Sagebrush/Rhizomatous Wheatgrass- Sandberg Bluegrass-Mat Forb Plant Community

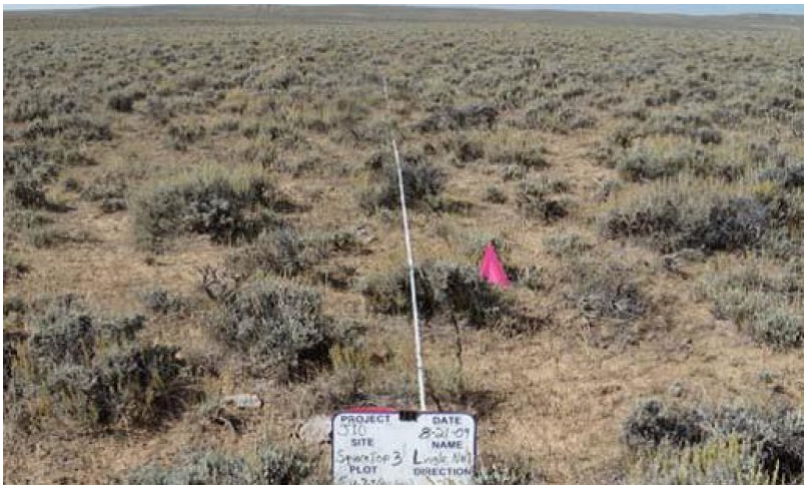


Figure 17. 2.1

The Big Sagebrush/Rhizomatous Wheatgrass-Sandberg Bluegrass-Mat Forb Plant Community (2.1) is characterized by an herbaceous component dominated by Sandberg bluegrass, rhizomatous wheatgrass and/or mat forbs, with limited mid-stature bunchgrasses. Once these key species becomes scarce, it is unlikely to have sufficient reproductive capability (seed source, tillering, or resprouting) to recover dominance in a reasonable time frame without extra energy being added to the system. The plant community is highly resilient to changes in composition, due to the dominance and competition of established bluegrass, rhizomatous wheatgrass, and/or mat forbs. However, the community can shift back to the Big Sagebrush/Bunchgrass Community (1.3) over time with fire and/or brush control and/or deferment. This community is shrub dominated. Sagebrush canopy may be as high as 25 percent or higher. The dominant shrub is Wyoming big sagebrush. The Big Sagebrush/Rhizomatous Wheatgrass-Sandberg Bluegrass-Mat Forb Community occurs if the herbaceous component has been degraded. Areas that catch and retain snow are more likely to have higher shrub cover. Range Health Indicators: Production is considerably lower than in Reference State (1), leading to lower soil organic matter content and therefore lower soil stability than in the Reference State. Ground cover is still high. Infiltration is lower than in the Reference State and the water cycle has reduced function due to decreased soil organic matter.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	110	220	358
Grass/Grasslike	70	140	227
Forb	20	40	65
Total	**200**	**400**	**650**

Figure 19. Plant community growth curve (percent production by month). WY0301, 34AC, Upland Sites. All Upland Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			5	40	50			5			

State 3
Eroded

This state contains one community, the Big Sagebrush/*Bare Ground* Community (3.1). It is characterized by sparse herbaceous plant cover dominated by big sagebrush and bare ground. Communities in the Eroded State (3) have crossed a threshold (T1B or T2A) because of soil erosion, loss of soil fertility, and/or degradation of soil properties. Soil erosion affects the hydrology, soil chemistry, soil microorganisms, and soil physics to the point where intensive restoration is required to restore the site to another state or community. Simply changing grazing management may not create sufficient change to restore the site within a reasonable period. It will require a considerable input of energy to move the site back to the Reference State (1). The Eroded State (3.0) is at high risk of weed invasion due to the high percentage of bare ground. Many invasive species are adapted to low soil fertility, high soil temperatures and low soil moisture content. This puts the community at risk of transitioning to the Disturbed State (4).

Community 3.1
Big Sagebrush/Bare Ground Community

Herbaceous canopy cover in the Big Sagebrush/*Bare Ground* Community (3.1) is significantly reduced. Annual production is approximately half of the Bunchgrass Plant Community (1.1). Perennial grass species (e.g., Indian ricegrass and needleandthread, Letterman’s needlegrass) may exist only in patches and are typically low in vigor. This community tends to be dominated by big sagebrush (>25% cover) and bare ground in large patches in the interspaces of the shrub canopy. The majority of annual production is from big sagebrush so this site provides very little value for grazing. The Big Sagebrush/*Bare Ground* Community (3.1) rarely produces sufficient quantity of fine fuels necessary to carry a fire. Therefore, fire no longer influences community dynamics. The Big Sagebrush/*Bare Ground* Community (3.1) differs from other communities, because it is characterized by sparse plant cover and soil surface erosion. Sparse vegetation creates low levels of foliar and basal cover. This, in turn, leads to low litter production, which is combined with reduced ability to retain litter on site. Soil is exposed to wind and water erosion in the plant interspaces. These factors combine to create a decrease in soil organic matter. Reduced litter cover, combined with reduced herbaceous cover, results in higher soil temperature, poor water infiltration rates, and high evaporation, thus favoring species which are more adapted to drier conditions. Soil fertility is reduced, soil compaction is increased, and resistance to soil surface erosion has declined compared to the other states. This community has lost most, if not all, of the attributes of a functioning, healthy rangeland, including good infiltration, minimal erosion and runoff, nutrient cycling, and energy flow.

Table 9. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	50	150	250
Grass/Grasslike	40	120	200
Forb	10	30	50
Total	**100**	**300**	**500**

State 4
Disturbed

This state is characterized by the amount of rabbitbrush invasion on the site. It also has a component of annual forbs and substantial bare ground. Is occurs with multiple sagebrush killing events in rapid succession outside the normal disturbance regime for this site (see Reference State for discussion). It could be mechanical (including heavy equipment/construction or a mowing/chaining/harrow type sage treatment), chemical (including 2,4-D or tebuthiron), or biological (including browse and/or insects). Fire could be a factor in maintaining this plant community perpetually by stimulating sprouting shrubs (rabbitbrush) and killing sagebrush. This is usually only a concern annual weeds are prolific on the site during wet cycles that boost their production. Removal of shrubs without proper grazing management can lead to an increase in bare ground and erosion of the upper soil horizon. Consequences of this are decreased soil fertility or even soil erosion, soil crusting, and decrease of soil surface aggregate stability.

Community 4.1
Rabbitbrush/Bare Ground/Annuals Community

Figure 21. 4.1

The plant community is in a perpetual state of disturbance when maintained. The disturbance regime of the site has been accelerated often with the addition of ground disturbing activities (i.e. gravel pits, pasture corners where livestock are gathered, continual sagebrush removal techniques and rapid succession fire. Seeding may be used to restore functional structural groups.

Community 4.2
Big Sagebrush/Rabbitbrush Community

This plant community has had the disturbance regime accelerated or altered in the past, but no recent disturbances

State 5
Highly Disturbed

Community 5.1
Annuals/Bare Ground Community

As part of succession, all sites that are severely disturbed will go through this plant community as part of their restoration. Weather is the largest determining factor in how long a site will be in this plant community phase, but is approximately 2-5 years on sites that use Best Management Practices for site restoration (http://www.uwyo.edu/wrrc/).

Community 5.2
Reclaimed Community

This plant community is highly variable based on weather conditions during restoration activities, the management

practices used to implement the restoration, the seed mix, and how soil was stockpiled during the disturbance

Transition T1A
State 1 to 2

The driver for Transition T1-2 is continuous spring grazing and/or long-term drought. Continuous spring grazing and/or drought can lead to a decline in palatable mid-stature bunchgrasses. Indian ricegrass, a short-lived perennial that requires more frequent seed production to provide an adequate seedbank, and bluebunch wheatgrass, a long-lived perennial that has elevated growth points, are typically the first species to decline (Natural Resources Conservation Service). Needleandthread as well as Letterman's needlegrass are more grazing tolerant, but will eventually decline in plant density and vigor. As bunchgrasses diminish or die during periods of stress, low- stature bunchgrasses and rhizomatous grasses gain a competitive advantage, creating a shift in species composition towards less productive, shorter species. While bare ground may not change, the pattern of bare ground will shift to larger gaps in the canopy and fewer herbaceous plants between shrubs. Many of the remaining desirable bunchgrasses will be only found in the understory of the sagebrush canopy. Once mid-stature bunchgrasses species become scarce, it is unlikely that they have sufficient reproductive capability (seed source, tillering, or resprouting) to recover dominance in a reasonable time frame without extra energy being added to the system. When the understory vegetation has been degraded to this point, the transition to the Grazing Resistant State (2) can occur from either the Bunchgrass/Big Sagebrush Plant Community (1.2) or the Big Sagebrush/Bunchgrass Plant Community (1.1). The transition is not dependent on the increase of woody canopy cover, but rather on the lack of mid-stature bunchgrasses in the canopy interspaces. Management should focus on grazing management strategies that will prevent further degradation. This can be achieved through a grazing management scheme that varies the season of use to provide periodic deferment during the critical growth period (roughly May-June). Forage quantity and/or quality in the Grazing Resistant State (2) may be substantially reduced compared to the Reference State.

Transition T1B
State 1 to 3

The driver for Transition T1-3 is continuous high intensity early season grazing and/or long-term drought. The Reference State (1) transitions to the Eroded State (3) if plant canopy cover declines significantly or total annual aboveground biomass production falls below 400 pounds per acre. The trigger for this transition is the loss of understory, which creates open spots with bare soil. Soil erosion is accompanied by decreased soil fertility driving the transitions to the *Bare Ground* State. Several other key factors signal the approach of transition T1B: an increase in soil physical crusting, a decrease in soil surface aggregate stability, and/or evidence of erosion, including water flow patterns, development of plant pedestals, and litter movement.

Transition T1C
State 1 to 4

The driver for this transition is an increase in the disturbance cycle (i.e. grazing, drought, fire, mechanical, chemical or biological treatments) often in combination with grazing management that does not provide periodic deferment during the critical growth period. The Reference State (1) may transition to the Disturbed State (4) if a soil disturbing activity has occurred to encourage aggressive invasive species, such as cheatgrass, are introduced with an increase in rabbitbrush due to ground disturbance that could be either natural (i.e. water movement) or manmade (i.e. high density/high frequency stocking, mechanical treatments or heavy equipment operations). To prevent this transition, the site will require proper reclamation using the most current science and technology available to restore native vegetation and prevent invasive dominance. In some instances, it may not be possible to prevent this transition. In cases where total topsoil loss occurs, it may be unavoidable to prevent this transition. Long-term stress conditions for native species (e.g., improper grazing management, drought, and fire) will alter plant community composition and production over time and may hasten a transition to the Disturbed State (4). The resulting lower biomass production, reduced litter, and increased bare ground in this community can promote invasion of undesirable species. The site transitions to the Disturbed State when populations of invasive species reach critical levels.

Restoration pathway R2A
State 2 to 1

The drivers for this restoration pathway are removal of woody species and restoration of native herbaceous species by mechanical or chemical treatment of sagebrush, and grazing rest or deferment. If some mid- stature bunchgrasses remain under the sage canopy, proper grazing management can move the site back to the Reference State (1) combined with a mechanical or chemical sagebrush treatment. This could take multiple generations of management or could be accelerated with rest or deferment combined with successive wet springs conducive to seed germination and seedling establishment. (Derner, Schuman, Follett, & Vance, 2014)

Transition T2A
State 2 to 3

The driver for this transition is continuous high intensity early season grazing. Examples include calving pastures and small acreage horse pastures where rotational grazing is not employed. Extended drought period may provide a trigger to accelerate this process. This state is typified by old age sagebrush stands with very little herbaceous understory. Bare ground patch size has increased to the majority of the interspaces between sagebrush plants

Transition T2B
State 2 to 4

The driver for this transition is an increase in the disturbance cycle (i.e. grazing, drought, fire, mechanical, chemical, biological treatments). Removal of shrubs without proper grazing management can lead to an increase in bare ground and erosion of the upper soil horizon, and the site can degrade to the Disturbed State (4). Consequences of this transition are decreased soil fertility or even soil erosion, soil crusting, and decrease of soil surface aggregate stability

Restoration pathway R3A
State 3 to 1

This state has lost soil or vegetation attributes to the point that recovery to the Reference State will require a combination of grazing management (changing season of use to allow frequent rest or deferment during the critical growth period) and chemical, biological or mechanical treatments, and reseeding. Seeding may become cost prohibiting as a restoration practice used alone. With reduced organic matter and loss of soil, soil amendments may be needed to have a successful seeding.

Restoration pathway R3B
State 3 to 2

The drivers for this restoration pathway are mechanical, biological and chemical treatments with only temporary rest or deferment post-treatment. Due to loss of soil fertility, structure, and organic matter, reference community plants are slow to repopulate the site. Success of this restoration is highly dependent upon climatic factors

Transition T3A
State 3 to 4

The driver for this transition is multiple sagebrush killing events in rapid succession outside the normal disturbance regime for this site (see Reference State for discussion). It could be mechanical (including heavy equipment/construction or a mowing/chaining/harrow type sage treatment), chemical (including 2,4-D or tebuthiron), or biological (including browse and/or insects). Fire is not usually possible due to lack of understory fuels to carry the fire. In fact, the Eroded State is characterized by monotypic decadent sagebrush stands because they are fireproof.

Additional community tables

Table 10. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Perennial Mid-Size Cool Season Grasses**			80–160	

	Indian ricegrass	ACHY	*Achnatherum hymenoides*	40–80	5–10
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	40–80	5–10
	needle and thread	HECO26	*Hesperostipa comata*	40–80	5–10
	squirreltail	ELEL5	*Elymus elymoides*	8–40	1–5
	muttongrass	POFE	*Poa fendleriana*	8–40	1–5
	Sandberg bluegrass	POSE	*Poa secunda*	0–40	0–5
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	8–40	1–5
2	**Rhizomatous Grasses**			40–80	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	40–80	5–10
	western wheatgrass	PASM	*Pascopyrum smithii*	40–80	5–10
3	**Misc. Grasses/Grasslikes**			40–80	
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–40	0–5
	needleleaf sedge	CADU6	*Carex duriuscula*	0–40	0–5
	threadleaf sedge	CAFI	*Carex filifolia*	0–40	0–5
	Sandberg bluegrass	POSE	*Poa secunda*	0–40	0–5
	Grass, perennial	2GP	*Grass, perennial*	0–40	0–5
Forb					
4	**Perennial Forbs**			40–72	
	lupine	LUPIN	*Lupinus*	0–40	0–5
	buckwheat	ERIOG	*Eriogonum*	8–40	1–5
	spiny phlox	PHHO	*Phlox hoodii*	8–40	1–5
	longleaf phlox	PHLOL2	*Phlox longifolia ssp. longifolia*	0–24	0–3
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–24	0–3
	flaxleaf plainsmustard	SCLI	*Schoenocrambe linifolia*	0–24	0–3
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–24	0–3
	stemless mock goldenweed	STAC	*Stenotus acaulis*	0–24	0–3
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–24	0–3
	sandwort	ARENA	*Arenaria*	0–24	0–3
	lesser rushy milkvetch	ASCO12	*Astragalus convallarius*	0–24	0–3
	milkvetch	ASTRA	*Astragalus*	0–24	0–3
	fleabane	ERIGE2	*Erigeron*	0–24	0–3
	Forb, perennial	2FP	*Forb, perennial*	8–16	1–2
	hollyleaf clover	TRGY	*Trifolium gymnocarpon*	0–8	0–1
	deathcamas	ZIGAD	*Zigadenus*	0–8	0–1
	rayless tansyaster	MAGR2	*Machaeranthera grindelioides*	0–8	0–1
	beardtongue	PENST	*Penstemon*	0–8	0–1
	sagebrush buttercup	RAGL	*Ranunculus glaberrimus*	0–8	0–1
	desertparsley	LOMAT	*Lomatium*	0–8	0–1
	Indian paintbrush	CASTI2	*Castilleja*	0–8	0–1
	pale bastard toadflax	COUMP	*Comandra umbellata ssp. pallida*	0–8	0–1
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0–8	0–1
	larkspur	DELPH	*Delphinium*	0–8	0–1
	pussytoes	ANTEN	*Antennaria*	0–8	0–1

	rockcress	ARABI2	*Arabis*	0–8	0–1
5	**Annual Forbs**			0–8	
	rockjasmine	ANDRO3	*Androsace*	0–8	0–1
	bushy bird's beak	CORA5	*Cordylanthus ramosus*	0–8	0–1
	Forb, annual	2FA	*Forb, annual*	0–8	0–1
Shrub/Vine					
6	**Shrubs**			160–320	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	160–320	20–25
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	0–320	0–25
7	**Misc Shrubs**			40	
	little sagebrush	ARARL	*Artemisia arbuscula ssp. longiloba*	0–40	0–5
	black sagebrush	ARNO4	*Artemisia nova*	0–40	0–5
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–40	0–5
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	8–40	1–5
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	8–40	1–5
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–40	0–5
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–40	0–5
	spineless horsebrush	TECA2	*Tetradymia canescens*	0–8	0–1
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	0–8	0–1
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–8	0–1
	granite prickly phlox	LIPU11	*Linanthus pungens*	0–8	0–1
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–8	0–1
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–8	0–1
	Gardner's saltbush	ATGA	*Atriplex gardneri*	0–8	0–1

Table 11. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Perennial Mid-Size cool season grasses**			136–320	
	needle and thread	HECO26	*Hesperostipa comata*	80–160	10–20
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	80–160	10–20
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	80–120	10–15
	squirreltail	ELEL5	*Elymus elymoides*	8–40	1–5
	muttongrass	POFE	*Poa fendleriana*	8–40	1–5
	Sandberg bluegrass	POSE	*Poa secunda*	0–40	0–5
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	8–40	1–5
2	**Rhizomatous Grasses**			40–80	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	40–80	5–10
	western wheatgrass	PASM	*Pascopyrum smithii*	40–80	5–10
3	**Misc Grasses/Grasslikes**			40–80	
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–40	0–5
	needleleaf sedge	CADU6	*Carex duriuscula*	0–40	0–5

	threadleaf sedge	CAFI	*Carex filifolia*	0–40	0–5
	Sandberg bluegrass	POSE	*Poa secunda*	0–40	0–5
	Grass, perennial	2GP	*Grass, perennial*	0–40	0–5
Forb					
4	**Perennial Forbs**			32–72	
	lupine	LUPIN	*Lupinus*	0–40	0–5
	buckwheat	ERIOG	*Eriogonum*	8–40	1–5
	spiny phlox	PHHO	*Phlox hoodii*	8–40	1–5
	longleaf phlox	PHLOL2	*Phlox longifolia ssp. longifolia*	0–24	0–3
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–24	0–3
	flaxleaf plainsmustard	SCLI	*Schoenocrambe linifolia*	0–24	0–3
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–24	0–3
	stemless mock goldenweed	STAC	*Stenotus acaulis*	0–24	0–3
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–24	0–3
	sandwort	ARENA	*Arenaria*	0–24	0–3
	lesser rushy milkvetch	ASCO12	*Astragalus convallarius*	0–24	0–3
	milkvetch	ASTRA	*Astragalus*	0–24	0–3
	fleabane	ERIGE2	*Erigeron*	0–24	0–3
	Indian paintbrush	CASTI2	*Castilleja*	0–8	0–1
	pale bastard toadflax	COUMP	*Comandra umbellata ssp. pallida*	0–8	0–1
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0–8	0–1
	larkspur	DELPH	*Delphinium*	0–8	0–1
	pussytoes	ANTEN	*Antennaria*	0–8	0–1
	rockcress	ARABI2	*Arabis*	0–8	0–1
	hollyleaf clover	TRGY	*Trifolium gymnocarpon*	0–8	0–1
	deathcamas	ZIGAD	*Zigadenus*	0–8	0–1
	Forb, perennial	2FP	*Forb, perennial*	0–8	0–1
	rayless tansyaster	MAGR2	*Machaeranthera grindelioides*	0–8	0–1
	beardtongue	PENST	*Penstemon*	0–8	0–1
	sagebrush buttercup	RAGL	*Ranunculus glaberrimus*	0–8	0–1
	desertparsley	LOMAT	*Lomatium*	0–8	0–1
5	**Annual Forbs**			0–8	
	Forb, annual	2FA	*Forb, annual*	0–8	0–1
	rockjasmine	ANDRO3	*Androsace*	0–8	0–1
	bushy bird's beak	CORA5	*Cordylanthus ramosus*	0–8	0–1
Shrub/Vine					
6	**Shrubs**			88–200	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	88–200	15–20
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	0–200	0–20
7	**Misc Shrubs**			16–40	
	little sagebrush	ARARL	*Artemisia arbuscula ssp. longiloba*	0–40	0–5
	black sagebrush	ARNO4	*Artemisia nova*	0–40	0–5
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–40	0–5

	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	8–40	1–5
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–40	0–5
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	8–40	1–5
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–40	0–5
	spineless horsebrush	TECA2	*Tetradymia canescens*	0–8	0–1
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	0–8	0–1
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–8	0–1
	granite prickly phlox	LIPU11	*Linanthus pungens*	0–8	0–1
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–8	0–1
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–8	0–1
	Gardner's saltbush	ATGA	*Atriplex gardneri*	0–8	0–1

Table 12. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Perennial Mid-Size cool season grasses**			160–400	
	needle and thread	HECO26	*Hesperostipa comata*	80–200	10–25
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	80–200	10–25
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	80–120	10–15
	squirreltail	ELEL5	*Elymus elymoides*	8–40	1–5
	muttongrass	POFE	*Poa fendleriana*	8–40	1–5
	Sandberg bluegrass	POSE	*Poa secunda*	0–40	0–5
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	8–40	1–5
2	**Rhizomatous Grasses**			32–80	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	32–80	4–10
	western wheatgrass	PASM	*Pascopyrum smithii*	32–80	4–10
3	**Misc Grasses/Grasslikes**			32–80	
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–40	0–5
	needleleaf sedge	CADU6	*Carex duriuscula*	0–40	0–5
	threadleaf sedge	CAFI	*Carex filifolia*	0–40	0–5
	Sandberg bluegrass	POSE	*Poa secunda*	0–40	0–5
	Grass, perennial	2GP	*Grass, perennial*	0–40	0–5
Forb					
4	**Perennial Forbs**			32–72	
	buckwheat	ERIOG	*Eriogonum*	8–40	1–5
	lupine	LUPIN	*Lupinus*	0–40	0–5
	spiny phlox	PHHO	*Phlox hoodii*	8–40	1–5
	longleaf phlox	PHLOL2	*Phlox longifolia ssp. longifolia*	0–24	0–3
	fleabane	ERIGE2	*Erigeron*	0–24	0–3
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–24	0–3
	flaxleaf plainsmustard	SCLI	*Schoenocrambe linifolia*	0–24	0–3
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–24	0–3
	stemless mock goldenweed	STAC	*Stenotus acaulis*	0–24	0–3

	goldenweed				
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–24	0–3
	sandwort	ARENA	*Arenaria*	0–24	0–3
	lesser rushy milkvetch	ASCO12	*Astragalus convallarius*	0–24	0–3
	milkvetch	ASTRA	*Astragalus*	0–24	0–3
	Indian paintbrush	CASTI2	*Castilleja*	0–8	0–1
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0–8	0–1
	larkspur	DELPH	*Delphinium*	0–8	0–1
	pussytoes	ANTEN	*Antennaria*	0–8	0–1
	rockcress	ARABI2	*Arabis*	0–8	0–1
	hollyleaf clover	TRGY	*Trifolium gymnocarpon*	0–8	0–1
	deathcamas	ZIGAD	*Zigadenus*	0–8	0–1
	Forb, perennial	2FP	*Forb, perennial*	0–8	0–1
	rayless tansyaster	MAGR2	*Machaeranthera grindelioides*	0–8	0–1
	desertparsley	LOMAT	*Lomatium*	0–8	0–1
	sagebrush buttercup	RAGL	*Ranunculus glaberrimus*	0–8	0–1
5	**Annual Forbs**			0–8	
	Forb, annual	2FA	*Forb, annual*	0–8	0–1
	rockjasmine	ANDRO3	*Androsace*	0–8	0–1
	bushy bird's beak	CORA5	*Cordylanthus ramosus*	0–8	0–1
Shrub/Vine					
6	**Shrubs**			48–120	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	48–120	5–15
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	0–120	0–15
7	**Misc Shrubs**			16–40	
	little sagebrush	ARARL	*Artemisia arbuscula ssp. longiloba*	0–40	0–5
	black sagebrush	ARNO4	*Artemisia nova*	0–40	0–5
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–40	0–5
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	8–40	1–5
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	8–40	1–5
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–40	0–5
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–40	0–5
	spineless horsebrush	TECA2	*Tetradymia canescens*	0–8	0–1
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	0–8	0–1
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–8	0–1
	granite prickly phlox	LIPU11	*Linanthus pungens*	0–8	0–1
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–8	0–1
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–8	0–1
	Gardner's saltbush	ATGA	*Atriplex gardneri*	0–8	0–1

Table 13. Community 2.1 plant community composition

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

1	**Perennial mid-size cool season grasses**			20–40	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–20	0–5
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	0–20	0–5
	squirreltail	ELEL5	*Elymus elymoides*	4–20	1–5
	needle and thread	HECO26	*Hesperostipa comata*	4–20	1–5
	muttongrass	POFE	*Poa fendleriana*	0–20	0–5
	Sandberg bluegrass	POSE	*Poa secunda*	0–20	0–5
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	0–20	0–5
2	**Rhizomatous Grasses**			36–80	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	20–80	5–20
	western wheatgrass	PASM	*Pascopyrum smithii*	20–80	5–20
3	**Misc Grasses/Grasslikes**			8–20	
	Sandberg bluegrass	POSE	*Poa secunda*	20–40	5–10
	Grass, perennial	2GP	*Grass, perennial*	0–20	0–5
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–20	0–5
	needleleaf sedge	CADU6	*Carex duriuscula*	0–20	0–5
	threadleaf sedge	CAFI	*Carex filifolia*	0–20	0–5
Forb					
4	**Perennial Forbs**			16–36	
	buckwheat	ERIOG	*Eriogonum*	4–20	1–5
	lupine	LUPIN	*Lupinus*	0–20	0–5
	spiny phlox	PHHO	*Phlox hoodii*	4–20	1–5
	longleaf phlox	PHLOL2	*Phlox longifolia ssp. longifolia*	0–12	0–3
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–12	0–3
	fleabane	ERIGE2	*Erigeron*	0–12	0–3
	sandwort	ARENA	*Arenaria*	0–12	0–3
	lesser rushy milkvetch	ASCO12	*Astragalus convallarius*	0–12	0–3
	milkvetch	ASTRA	*Astragalus*	0–12	0–3
	flaxleaf plainsmustard	SCLI	*Schoenocrambe linifolia*	0–12	0–3
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–12	0–3
	stemless mock goldenweed	STAC	*Stenotus acaulis*	0–12	0–3
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–12	0–3
	pussytoes	ANTEN	*Antennaria*	0–4	0–1
	rockcress	ARABI2	*Arabis*	0–4	0–1
	hollyleaf clover	TRGY	*Trifolium gymnocarpon*	0–4	0–1
	deathcamas	ZIGAD	*Zigadenus*	0–4	0–1
	Forb, perennial	2FP	*Forb, perennial*	0–4	0–1
	Indian paintbrush	CASTI2	*Castilleja*	0–4	0–1
	pale bastard toadflax	COUMP	*Comandra umbellata ssp. pallida*	0–4	0–1
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0–4	0–1
	larkspur	DELPH	*Delphinium*	0–4	0–1
	desertparsley	LOMAT	*Lomatium*	0–4	0–1
	rayless tansyaster	MAGR2	*Machaeranthera grindelioides*	0–4	0–1

	beardtongue	PENST	*Penstemon*	0–4	0–1
	sagebrush buttercup	RAGL	*Ranunculus glaberrimus*	0–4	0–1
5	**Annual Forbs**			0–4	
	bushy bird's beak	CORA5	*Cordylanthus ramosus*	0–4	0–1
	rockjasmine	ANDRO3	*Androsace*	0–4	0–1
	Forb, annual	2FA	*Forb, annual*	0–4	0–1
Shrub/Vine					
6	**Shrubs**			92–200	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	140–200	20–30
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	0–200	0–30
7	**Misc Shrubs**			8–20	
	little sagebrush	ARARL	*Artemisia arbuscula ssp. longiloba*	0–20	0–5
	black sagebrush	ARNO4	*Artemisia nova*	0–20	0–5
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–20	0–5
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–20	0–5
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–20	0–5
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–20	0–5
	granite prickly phlox	LIPU11	*Linanthus pungens*	0–4	0–1
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–4	0–1
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–4	0–1
	spineless horsebrush	TECA2	*Tetradymia canescens*	0–4	0–1
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	0–4	0–1
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–4	0–1
	Gardner's saltbush	ATGA	*Atriplex gardneri*	0–4	0–1
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–4	0–1

Animal community

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

Plant Community Production Carrying Capacity*
(lb./ac) (AUM/ac)
Big Sagebrush/Bunchgrass (Reference) 600-800-1000 .07
Bunchgrass/Big Sage 600-800-1000 .13
Bunchgrass 600-800-1000 .15
Big Sage/Rhizomatous Wheatgrass 200-400-650 .04
Big Sage/*Bare Ground* 100-300-500 .02
Big Sage/Rabbitbrush 100-300-500 .02
Rabbitbrush/*Bare Ground* 100-300-500 .02

Reclaimed 600-800-1000 .15
Annuals/*Bare Ground* 100-300-500 .01
* - Continuous, season-long grazing by cattle under average growing conditions.

**Calculation for stocking rates are as follows: using RV values for production, take forage palatable to grazing cattle multiply by 0.25 harvest efficiency and divide by 912.5 (air dried weight) to arrive at carrying capacity.

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

Distance to water, shrub density, and slope can affect grazing capacity within a management unit. Adjustments should be made for the area that is considered necessary for reduction of animal numbers. For example, 30% of a management unit may have 25% slopes and distances of greater than 1 mile from water; therefore the adjustment is only calculated for 30% of the unit (i.e. 50% reduction on 30% 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 graze-able acres within a management unit. Adjustments should be made that incorporate these factors when calculating stocking rates.

Wildlife:
The Sandy (Sy) ecological site in the Pinedale Plateau, LRU C, in MLRA 34A, Cool Central Desertic Basins and Plateaus provides suitable and valuable habitat to an array of wildlife species. including, but not limited to, suitable food, thermal, and escape cover for mule deer, elk, and pronghorn antelope. Sagebrush, which can approach 15% protein and 40-60% digestibility, provides important winter forage for the greater sage-grouse, mule deer, and antelope. Year-round habitat is provided for sage grouse and many other sagebrush obligate species such as the sage sparrow, Brewer's sparrow, sage thrasher, pygmy rabbit, sagebrush vole, short-horned lizard, and pronghorn antelope. Other birds that would frequent this plant community include horned larks and golden eagles. (Stiver, Rinkes, & Naugle, 2010)

Reference State:
1.1 Big Sagebrush/Bunchgrass: This plant community provides optimal winter habitat for sage-grouse, mule deer, and pronghorn antelope, as well as optimal sage-grouse nesting habitat. (Carney, et al., 2010)

1.2 Bunchgrass/WY Big Sagebrush: This plant community provides marginal nesting habitat for sage-grouse, but excellent early brood-rearing habitat. Winter use by sage-grouse is significant. It is also provides suitable habitat and forage for other sagebrush obligate species. (Carney, et al., 2010)

1.3 Bunchgrass Community: This plant community provides foraging habitat for sage-grouse when in proximity to areas with higher sagebrush cover and provides excellent forage for wintering and elk, as well as transitional range for mule deer and pronghorn. It also provides suitable habitat for burrowing animals. (Carney, et al., 2010)

Grazing Resistant State:
2.1 Big Sagebrush/Rhizomatous Wheatgrass-Sandberg Bluegrass-Mat Forb: This plant community is variable in its value to wildlife. In periods of high plant vigor it provides suitable nesting and brood-rearing habitat for sage-grouse, it is however, variable with climate conditions. In periods of less or low vigor and plant diversity such as during drought, production and plant diversity are less, lessening the value to wildlife. (Carney, et al., 2010)

Bare Ground State:
3.1 Big Sagebrush/*Bare Ground*: This plant community provides suitable winter habitat for foraging big game and sage-grouse, it is however, used little by non-game animal species. (Carney, et al., 2010)

Disturbed State:
4.1 Rabbitbrush/*Bare Ground*/Annuals: This plant community consists of small, isolated patches where wildlife use is limited or unknown, it does however, produce a high number of insects which are important for pollination and

sage-grouse early brood-rearing. (Carney, et al., 2010)

4.2 Big Sagebrush/Rabbitbrush: Depending of the sub-species of rabbitbrush found in this plant community it provides high forage value in transitional and winter ranges for big game species. (Carney, et al., 2010)

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group B (infiltration rate of 0.15-0.3 in/hr), with localized areas in hydrologic groups A (infiltration rate of 0.3 in/hr) and C (infiltration rate of 0.05-0.15 in/hr). Infiltration ranges from rapid to moderate. Runoff potential for this site varies from low to moderate depending on soil hydrologic group and ground cover. In many cases, areas with greater than 75% ground cover have the greatest potential for high infiltration and lower runoff. Areas where ground cover is less than 50% 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 and shrubs. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non-existent. Cryptogrammic crusts are present, but only cover 1-2% of the soil surface.

Recreational uses

This site provides some limited recreational opportunities for hiking, horseback riding, bird watching, and upland game hunting. The forbs have a variety of colors and shapes that appeal to photographers. This site provides valuable open space when located in large, unfragmented landscapes.

Wood products

None

Other products

None

Inventory data references

Information presented was derived from 1988 Range Site Descriptions: (Loamy Green River and Great Divide Basins (7-9GR) and Loamy Foothills and Basins West (10-14W) Cool Desertic Basins and Plateaus,), NRCS clipping data, literature, field observations (based on two sampled sites and observations from numerous others), and personal contacts with range-trained personnel (i.e., agency specialists, landowners, land managers, and scientists).

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Approval

Kirt Walstad, 2/19/2025

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)	Agency/State Correlation: This site has been correlated in the following states with the following agencies: Wyoming NRCS Wyoming BLM Wyoming State Lands Sublette County Conservation District Wyoming Game and Fish Department University of Wyoming Cooperative Extension Service Individual Contributions Bryan Christensen, NRCS Karen Clause, WY NRCS Dan Mattke, WY NRCS Kellie Roadifer, BLM Mike Henn, WY State Lands Loren Racich, SCCD Jill Randall, WYG&F Julie Kraft, Sublette Co. Weed and Pest Windy Kelley, University of Wyoming Cooperative Extension Service
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Date	09/05/2014
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None to Rare. Some very minor rills may occur after a major thunderstorm event or spring runoff. Rills may also occur in areas of greater slope (>10%) and near areas with exposed bedrock, but should heal during the following growing season

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2. **Presence of water flow patterns:** Barely observable. Some minor evidence of water flow patterns may be found

winding around perennial plant bases with little evidence of erosion and they are short (< 6 ft).

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3. **Number and height of erosional pedestals or terracettes:** None to Rare. Plant roots are covered and most litter remains in place around plant crowns.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground can range from 10-30%.

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

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

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7. **Amount of litter movement (describe size and distance expected to travel):** Herbaceous litter expected to move only in small amounts (to leeward side of shrubs) due to wind. Large woody debris from sagebrush will show no movement.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil Stability Index ratings range from 1 (interspaces) to 6 (under plant canopy), but average values should be 2.7 or greater.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil data is limited for this site. Described A-horizons vary from 2-30 inches (5-76 cm) with OM of 1 to 2%.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Plant community consists of 40% grasses, 10% forbs, and 60% shrubs. Evenly distributed plant canopy (45-75%) and litter plus moderate to moderately rapid infiltration rates result in minimal runoff. Basal cover is typically less than 5% for this site and does very little to effect runoff on this site.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. A coarse, dry subsurface will often refuse a probe, causing misidentification of a compaction layer. Most soil profiles must be described by hand dug holes.

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

    Dominant: Mid-size, cool season bunchgrasses perennial shrubs

    Sub-dominant: cool season rhizomatous grassesperennial forbsshort cool season bunchgrasses

Other:

Additional:

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

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14. **Average percent litter cover (%) and depth (in):** Litter ranges from 15-30% of total canopy measurement with total litter (including beneath the plant canopy) from 30-70% expected. Herbaceous litter depth typically ranges from 3-10mm. Woody litter can be up to a couple inches (4-6 cm).

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** English: 600-1000 lb/ac (800lb/ac average); Metric 672-1121 kg/ha (897 kg/ha average).

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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:** Annual weeds such as desert alyssum, kochia, mustards, lambsquarter, and Russian thistle are common invasive species in disturbed sites. Cheatgrass (Bromus tectorum) and hoary alyssum (Berteroa incana) are emerging invasive species to this site. Other noxious weeds that could potentially invade this site: Canada thistle (*Cirsium arvense*) and whitetop (*Cardaria draba*).

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17. **Perennial plant reproductive capability:** All species are capable of reproducing, with rhizomatous wheatgrass reproducing from tillers as well as seed, except in drought years.
