Ecological site DX032X01B167
Shallow To Gravel (SwGr)
Big Horn Basin
Rim

Last updated: 3/26/2025
Accessed: 06/17/2026

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 032X–Northern Intermountain Desertic Basins

032X – Northern Intermountain Desertic Basins – This MLRA is comprised of two major Basins, the Big Horn and Wind River. These two basins are distinctly different and are split by land resource units (LRUs) to allow individual ecological site descriptions (ESDs). These warm basins are surrounded by uplifts and rimmed by mountains, creating a unique set of plant responses and communities. U nique characteristics of the geology and geomorphology single out these two basins. Further information regarding MLRAs, refer to: United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. Available electronically at: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_053624#handbook.

LRU notes

Land Resource Unit (LRU): 32X01B (WY): This LRU is the Big Horn Basin within MLRA 32. This LRU is lower in elevation, slightly warmer and receives slightly less overall precipitation than the Wind River Basin (LRU 02). LRU 01 was originally divided into two LRUs - LRU A which was the core and LRU B which was the rim. With the most current standards, this LRU is divided into two Subsets. This subset is Subset B, referred to as the Rim, is a transitional band between the basin floor and the lower foothills. The subset encircles Subset A (originally LRU A). As the LRU shifts towards the south and tracks east, changes in geology and relation to the mountain position, creates a minor shift in soil chemistry influencing the variety of ecological sites and plant interactions. The extent of soils currently correlated to this ecological site does not fit within the digitized boundary. Many of the noted soils are provisional and will be reviewed and corrected in mapping update projects. Other map units are correlated as small inclusions within other MLRA's/LRU's based on elevation, landform, and biological references. Moisture Regime: Ustic Aridic – Prior to 2012, many of the soils within this group were correlated as Frigid Ustic Aridic or as Mesic Typic Aridic, with few mapped within this cross over zone. As progressive soil survey mapping continues, these "crossover" or transitional areas are being identified and corrected. Temperature Regime: Mesic Dominant Cover: Rangeland, with Saltbush flats the dominant vegetative cover for this LRU/ESD. Representative Value (RV) Effective Precipitation: 10-14 inches (254 – 355 mm) RV Frost-Free Days: 105-125 days

Classification relationships

Relationship to Other Established Classification Systems: National Vegetation Classification System (NVC): 3 Xeromorphic Woodland, Scrub & Herb Vegetation Class 3.B Cool Semi-Desert Scrub & Grassland Subclass 3.B.1 Cool Semi-Desert Scrub & Grassland formation 3.B.1.NE Western North American Cool Semi-Desert Scrub & Grassland Division M169 Great Basin & Intermountain Tall Sagebrush Shrubland & Steppe Macrogroup G302 Artemisia Tridentata - Artemisia tripartita - Purshia tridentata Big Sagebrush Steppe Group CEGL001535 - Artemisia tridentata ssp. wyomingensis/Pseudoroegneria spicata Herbaceous Vegetation or CEGL001009 - Artemisia tridentata ssp. wyomingensis/Pseudoroegneria spicata Shrubland Ecoregions (EPA): Level I: 10 North American Deserts Level II: 10.1 Cold Deserts Level III: 10.1.18 Wyoming Basin Level IV: 10.1.18.g Big Horn Salt Desert Shrub Basin

Ecological site concept

• Site receives no additional water. • Slope is 30%. • Soils are: o Not saline or saline-sodic. o Moderately deep to very deep o None to Slight effervescence throughout top 20" (51 cm) of mineral soil surface. o 3% stone and boulder cover and 20% cobble and gravel cover. o Not skeletal (35% rock fragments) within 10" (51 cm) of mineral soil surface, but rock fragments increase with depth. The particle size control section may classify as loamy skeletal or fine-loamy over sandy/sandy-skeletal. o Textures range from very fine sandy loam to clay loam in top 4" (10 cm) of mineral soil surface. Clay content is = 32% in top 4" (10 cm) of mineral soil surface. Each following

subsurface horizon has a clay content of 35%. This site is a variance from the loamy to the gravelly where the surface cap is loamy over a sandy-skeletal profile, creating a site that is more droughty and less productive than the Loamy, but has more productivity and higher selection of plant species than the gravelly site.

Associated sites

DX032X01B112	**Gravelly (Gr) Big Horn Basin Rim** See description in the Similar Sites Section.
DX032X01B122	**Loamy (Ly) Big Horn Basin Rim** See description in the Similar Sites Section.
DX032X01B150	**Sandy (Sy) Big Horn Basin Rim** Sandy ecological sites will occur in similar positions as the Shallow to Gravel site, however, is in zones where fewer gravels were deposited.

Similar sites

DX032X01A167	**Shallow To Gravel (SwGr) Big Horn Basin Core** Shallow to Gravel Big Horn Basin Rim has higher production over all and threadleaf sedge and fringed sagewort begin to be more prominent players in the plant community.
DX032X01B109	**Cobbly Upland (CoU) Big Horn Basin Rim** Cobbly Upland is very similar in characteristics, but instead of transition to coarser soils within the skeletal (gravelly) portion of the solemn, the soils maintain a finer texture throughout the profile, increasing water retention. Production is higher, plant communities maintain a higher grass component, composition is more similar to a loamy or clayey site.
DX032X01B112	**Gravelly (Gr) Big Horn Basin Rim** Gravelly sites occur where finer depositions did not occur (relict gravel bars, scour areas) or have been eroded away. Water holding capacity is extremely low and so pin cushion forbs and dwarf shrubs are the primary ground cover. Grasses are limited are low in stature.
DX032X01B122	**Loamy (Ly) Big Horn Basin Rim** Loamy sites occur on areas with greater deposition of finer materials(relict or possibly current) leaving a thicker solemn without rock fragments. Water retention is higher and so have greater production, denser canopy cover (less bare ground), and is more resilient in extended periods of drought.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata ssp. wyomingensis* (2) *Atriplex confertifolia*

Herbaceous	(1) *Pseudoroegneria spicata* (2) *Hesperostipa comata*

Legacy ID

R032XB167WY

Physiographic features

The Shallow to Gravel ecological site generally occurs on slopes ranging from nearly level to moderately steep (0-30 percent). Fan remnants, relict stream terraces, and alluvial fans are the major landforms where this site exists.

The complexes of soil components mapped across most landforms typically are separated by depth to rock fragments in the soil profile or depth to bedrock (lithic or paralithic). Many of these landforms are erosional remnants and have soils ranging from shallow to very deep. The variability of soils across the landform is influenced by the geology and its inherent chemistry.

The variability of soils will create pockets of calcareous, saline, or sodic soils as well as areas that are not influenced by chemistry. Higher infiltration rates associated with the Shallow to Gravel ecological site result in leaching of salts, carbonates, and other chemistry to a depth that no longer influences this plant community.

The Shallow to Gravel ecological site is most prominent on the central extent of fans. Loamy and Clayey ecological sites increase in occurrence as the landscape shifts away from steeper slopes with prominent rock outcrop, towards the distal end of the landform. Wind effects are common with this site and can relate to the proximity to taller landforms and will see the ecological site shift to Gravelly.

Table 2. Representative physiographic features

Landforms	(1) Intermontane basin > Fan remnant (2) Intermontane basin > Stream terrace (3) Intermontane basin > Alluvial fan
Runoff class	Low to very high
Elevation	1,280 – 1,770 m
Slope	0 – 30 %
Aspect	Aspect is not a significant factor

Climatic features

Annual precipitation and modeled relative effective annual precipitation ranges from 10 to 14 inches (254–355 mm). The normal precipitation pattern shows peaks in May and June and a secondary peak in September. This amounts to about 50 percent of the mean annual precipitation. Much of the moisture that falls in the latter part of the summer is lost by evaporation, and much of the moisture that falls during the winter is lost by sublimation. Average snowfall totals about 20 inches annually. Wide fluctuations may occur in yearly precipitation and result in more dry years than those with more than normal precipitation.

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

National Water and Climate Center at http://www.wcc.nrcs.usda.gov/. Clark 3NE, Cody, Cody 12SE, Heart Mtn, and Powell Fld Stn are the representative weather stations within LRU D. The following graphs and charts are a collective sample representing the averaged normals and 30-year annual rainfall data for the selected weather stations from 1981 to 2010.

Table 3 Representative climatic features

Frost-free period (characteristic range)	90-100 days
Freeze-free period (characteristic range)	110-120 days
Precipitation total (characteristic range)	180-230 mm
Frost-free period (actual range)	90-110 days
Freeze-free period (actual range)	110-130 days
Precipitation total (actual range)	180-250 mm
Frost-free period (average)	100 days
Freeze-free period (average)	120 days
Precipitation total (average)	230 mm

- (1) CODY [USC00481840], Cody, WY
- (2) POWELL FLD STN [USC00487388], Powell, WY
- (3) HEART MTN [USC00484411], Powell, WY
- (4) CLARK 3NE [USC00481775], Powell, WY
- (5) CODY 12SE [USC00481850], Meeteetse, WY

Influencing water features

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

Soil features

The soils of this site are moderately deep (greater than 20 inches to bedrock) to very deep, well drained soils that formed in alluvium, colluvium or slope alluvium over residuum. These soils have slow to moderately rapid permeability. The surface soil will vary from 3 to 6 inches deep. The soil characteristic having the most influence to the plant community is high volume of coarse fragments lower in the profile, which reduces plant density and available moisture.

Major soil series correlated to this site include: Claprych, Eaglenest, Fenton, Hiland, Luman, Naturita, Old Smith, Shingle, Strych, Zigweid-like. This list of soil series is subject to change upon completion and correlation of the initial soil surveys in the area: WY629, WY603, and WY617; as well as revisions to completed soil surveys in the area: WY043 and MT611.

Table 4. Representative soil features

Parent material	(1) Alluvium – igneous, metamorphic and sedimentary rock (2) Slope alluvium – interbedded sedimentary rock (3) Colluvium (4) Residuum – conglomerate
Surface texture	(1) Gravelly fine sandy loam (2) Loam (3) Sandy clay loam
Family particle size	(1) Fine-loamy over sandy or sandy-skeletal (2) Loamy-skeletal over sandy or sandy-skeletal (3) Loamy-skeletal
Drainage class	Well drained to somewhat excessively drained
Permeability class	Slow to moderately rapid
Soil depth	50 cm
Surface fragment cover <=3"	0 – 20 %
Surface fragment cover >3"	0 – 20 %
Available water capacity (Depth not specified)	5.08 – 14.99 cm
Calcium carbonate equivalent (Depth not specified)	0 – 10 %
Clay content (0-25.4cm)	20 – 40 %
Electrical conductivity (Depth not specified)	Not specified

Soil reaction (1:1 water) (Depth not specified)	7.8 – 8.4
Subsurface fragment volume <=3" (25.4-198.1cm)	20 – 50 %
Subsurface fragment volume >3" (25.4-198.1cm)	0 – 20 %

Ecological dynamics

Potential vegetation on this site is dominated by mid-stature cool-season perennial grasses. Other significant vegetation includes Wyoming Big Sagebrush, and a variety of forbs. The expected potential composition for this site is 70% grasses, 15% forbs, and 15% woody plants. The composition and production will vary naturally due to historic use, fluctuating precipitation and fire frequency.

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

Wyoming Big Sagebrush may become dominant on areas with little use on sagebrush, and in the long-term absence of fire and sufficient amount of precipitation. Wildfires are infrequent or rare, but do play a minor roll in this ecological site. Fire has been actively controlled, and as a result dense, aged stands of Wyoming big sagebrush persist. Recently, prescribed burning and mowing has regained some popularity to aid in wildlife habitat improvement (sage grouse).

Wyoming big sagebrush component lacks resilience due to the mesic and aridic nature of this subset. Once sagebrush is reduced significantly or removed from the canopy, hydrologic loss limits sagebrush's ability to re-establish as well as sustaining a viable composition. On these open canopies, blue grama may become dominant with stress from frequent and severe grazing (year-long). As a result, a dense sod cover of blue grama will become established.

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

The range in plant community composition is influenced by the depth of the soil profile, chemistry, as well as the soil texture within established breaks. When aligning the ecological site concepts with the soil classification guidelines, there are soils that classify to a particle-size class that does not fit the pre-conceived notion of the ecological site that it would typically follow. Plants respond to the mixed texture of the top 8 to 10 inches (20-25 cm) of the soil profile.

Many of the soils that have been mapped in the Big Horn Basin have a sandy cap over an accumulation of clays in the profile, better referred to as an argillic horizon, but then as you move further down into the soil profile, the soils become coarser as the clays decrease. The depth of the start of this clay bulge (or argillic) can have a significant influence on the classification of the soils, swaying the classification to a fine-loamy when the plant response to the soils will maintain a sandy response. The reverse is also common where the clay bulge is high enough in the profile or the sandy cap is not present, and the clay percent drops below 18% below the 10 inches (25 cm) swaying the classification to coarse-loamy while the plants maintain a loamy response. The shallow depth to the sandy gravel layer allows moisture to move through the site quicker making the community act more droughty.

The following is a State and Transition Model (STM) Diagram for this ecological site. An STM has five fundamental components: states, transitions, restoration pathways, community phases and community pathways. The state, designated by the bold box, is a single community phase or suite of community phases. The reference state is recognized as State 1. It describes the ecological potential and natural range of variability resulting from the natural disturbance regime of the site. The designation of alternative states (State 2, etc) in STMs denotes changes in ecosystem properties that cross a certain threshold.

Transitions are represented by the arrows between states moving from a higher state to a lower state (State 1 - State 2) and are denoted in the legend as a “T” (T1-2). They describe the variables or events that contribute directly to loss of state resilience and result in shifts between states. Restoration pathways are represented by the arrows between states returning back from a lower state to a higher state (State 2 - State1 or better illustrated by State 1

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	**Mid-stature, Cool-season Bunchgrass**			112-224	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	22-168	5-20
	needle and thread	HECO26	*Hesperostipa comata*	22-112	10-20
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0-28	0-5
2	**Rhizomatous, Cool-season Grasses**			6-56	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0-56	0-10
	western wheatgrass	PASM	*Pascopyrum smithii*	0-56	0-10
3	**Short-stature, Cool-season Bunchgrass**			0-56	
	squirreltail	ELEL5	*Elymus elymoides*	0-28	0-5
	prairie Junegrass	KOMA	*Koeleria macrantha*	0-28	0-5
	Sandberg bluegrass	POSE	*Poa secunda*	0-28	0-5
4	**miscellaneous grass and grass-likes**			0-28	
	blue grama	BOGR2	*Bouteloua gracilis*	0-28	0-5
	threadleaf sedge	CAFI	*Carex filifolia*	0-28	0-5
	Grass, perennial	2GP	*Grass, perennial*	0-28	0-5
Forb					
5	**Perennial Forbs**			0-56	
	Forb, perennial	2FP	*Forb, perennial*	0-28	0-5
	milkvetch	ASTRA	*Astragalus*	0-28	0-5
	fleabane	ERIGE2	*Erigeron*	0-28	0-5
	desertparsley	LOMAT	*Lomatium*	0-28	0-5
	spiny phlox	PHHO	*Phlox hoodii*	0-28	0-5
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0-28	0-5
	prairie sagewort	ARFR4	*Artemisia frigida*	0-28	0-5
Shrub/Vine					
6	**Dominant Shrubs**			28-168	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	28-168	5-15
7	**Miscellaneous Shrubs**			0-56	
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0-28	0-5

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 9. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 10. Community 4.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 11. Community 4.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 12. Community 5.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Animal community

Animal Community – Wildlife Interpretations: 1.1 – Bluebunch Wheatgrass/NeedleandThread (Reference Community): The predominance of grasses in this plant community favors grazers and mixed-feeders, such as bison, elk, and antelope. Suitable thermal and escape cover for deer may be limited due to the low quantities of woody plants. However, topographical variations could provide some escape cover. When found adjacent to sagebrush-dominated states (1.2 or 3.1), this plant community provides brood-rearing and foraging areas for sage grouse, as well as lek sites. The mosaic pattern of varying density of sagebrush in a smaller scale provides cover and line-of-sight to forage. Other birds that would frequent this plant community include western meadowlarks, horned larks, and golden eagles. Many grassland-obligate small mammals would occur here. 1.2 - Perennial Native Grasses/Wyoming Big Sagebrush (At-Risk Community): The predominance of grasses in this plant community favors grazers and mixed-feeders, such as bison, elk, and antelope. Suitable thermal and escape cover for deer may be limited due to the low quantities of woody plants. However, topographical variations could provide some escape cover. This plant community provides brood rearing and foraging areas for sage grouse, as well as lek sites. The mosaic pattern of varying density of sagebrush in a smaller scale provides cover and line of sight to forage. Other birds that would frequent this plant community include western meadowlarks, horned larks, and golden eagles. Many grassland-obligate small mammals would occur here. 2.1 - Sagebrush/Bare Ground Plant Community: This plant community can provide important winter foraging for elk, mule deer, and antelope, as sagebrush can approach 15 percent protein and 40-60 percent digestibility during that time. This community provides excellent escape and thermal cover for large ungulates, as well as nesting habitat for sage grouse. 3.2 - Sod-formers/Sagebrush Plant Community: This community provides limited foraging for antelope and other grazers. They may be used as a foraging site by sage grouse where Reference State Community Phases are limited. Generally, these are not target plant communities for wildlife habitat management. State 4 - Invaded: Initial invasion may have similarities to Community Phase 1.2 (Perennial Native Grasses/Wyoming Big Sagebrush) are to some extent enhanced for some species with the added forage provided by the invasive species. However, as the invasive species increase, decreasing the desirable species, the wildlife species benefits are decreased as well. Limited nesting and cover is provided by the existing overstory cover of the Wyoming big sagebrush and other shrubs. Early spring and fall green-up of cheatgrass provides foraging opportunities for many of our grazers and mixed feeders. Removal of sagebrush and other shrubs further decreases the value for many wildlife species. 5.1 - Disturbed/Altered Lands Plant Community: The variability of this site prevents a detailed review of wildlife benefits. However, many of the introduced grasses, forbs, and shrubs can provide adequate cover, food, and nesting sites for those wildlife species that would have selected the site prior to disturbance. Limitations and enhancements should be considered by specific locations. Animal Community – Grazing Interpretations: The following table lists suggested stocking rates for cattle under continuous season-long grazing with normal growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of the conservation planning process. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Because of this, a field visit is recommended in all cases, to document plant composition and production. More precise carrying capacity estimates should eventually be calculated using this information along with animal preference data, particularly when grazers other than cattle are involved. Under more intensive grazing management, improved harvest efficiencies can result in an increased carrying capacity. If distribution problems occur, stocking rates must be reduced to maintain plant health and vigor. Plant Community Production Carrying Capacity* The carrying capacity is calculated as the production (normal year) X .25 efficiency factor / 912.5 # / AUM (Animal Unit Month: the amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for one month) to calculate the AUMs/Acre. Plant Community Description/Title Lbs./Acre AUM's/Acre* Acres/AUM Below Ave. Normal Above Ave. 1.1 Bluebunch Wheatgrass/NeedleandThread 200-375-550 0.10 9.7 1.2 Perennial Native Grasses/Wyoming Big Sagebrush 200-350-600 0.09 10.4 2.1 Mixed Shrubs/Bare Ground ** ** ** ** ** 3.1 Sod-formers/Mixed Shrubs ** ** ** ** ** 4.1 Invaded ** ** ** ** ** 5.1 Disturbed/Degraded ** ** ** ** ** * - Carrying capacity is figured for continuous, season-long grazing by cattle under average growing conditions. ** - Sufficient data for most sites, especially for the invaded and reclaimed communities, has not be collected or evaluated, at this time, so no projection of a stocking rate recommendation or production range will be established at this time. Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide year-long 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 carrying capacity (grazing capacity) within a management unit. Adjustments should be made for the area that is considered necessary for reduction of animal numbers. For example, 30 percent of a management unit may have 25 percent slopes and distances of greater than one mile from water; therefore, the adjustment is only calculated for 30 percent of the unit (i.e. 50 percent reduction on 30 percent of the management unit). Fencing, slope length, management, access, terrain, kind and class of livestock, and breeds are all factors that can increase or decrease the percent of graze-able acres within a management unit. Adjustments should be made that incorporate these factors when calculating stocking rates.

Hydrological functions

Water (time and timing of precipitation) is the principal factor limiting forage production on this site. The Sandy ecological site is dominated by soils in hydrologic group B, with localized areas in hydrologic group C. Infiltration potential for this site varies from moderately rapid to rapid depending upon soil hydrologic group and ground cover. Runoff varies from low to moderate. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where short-grasses form a strong sod and dominate the site. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Part 630, NRCS National Engineering Handbook for detailed hydrology information). Rills and gullies should not typically be present. Water flow patterns should be barely distinguishable if at all present. Pedestals are only slightly present in association with bunchgrasses. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non- existent. Cryptogrammic crusts are present, but only cover 1-2 percent of the soil surface.

Recreational uses

This site provides hunting opportunities for upland game species. The wide varieties of plants which bloom from spring until fall have an aesthetic value that appeals to visitors. Outside of plants, the extent offers a variety of cultural resources to view on the landscape based on the location of many of these sites on higher ground on the benches and fans which also provides a rich source of geology for exploration. The Shallow to Gravel ecological site has minimal limitations when associated with roadways and trails, and provides a sound base for travel in relation to erosion potential and functionality. Surface fragments may limit comfort for tent camping.

Wood products

No appreciable wood products are present on the site.

Other products

Herbs: The forb species of the Sandy ecological site have medicinal characteristics and have been used by the Native Americans in this area and more recently by the naturopathic profession. Ornamental Species: The forbs commonly found as well as the shrub component of these communities have been used in landscaping and xeriscaping.

Inventory data references

Information presented in this description was derived from NRCS inventory data. Field observations from range-trained personnel also were used. Those involved in the development of the new concept for the Sandy ecological site include Tricia Hatle, Range Management Specialist, US Department of the Interior-Bureau of Land Management (USDI-BLM); Karen Hepp, Range Management Specialist, USDI-BLM; and Marji Patz, Ecological Site Specialist, NRCS. Other sources used as references include USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, USDI and USDA Interpreting Indicators of Rangeland Health Version IV, and USDA NRCS Soil Surveys from various counties. Quality control and quality assurance completed by NRCS: Dan Mattke, Area Resource Soil Scientist; Daniel Wood, MLRA Soil Survey Leader; John Hartung, Wyoming State Rangeland Management Specialist; James Bauchert, Wyoming State Soil Scientist; and Scott Woodall, Regional Quality Assurance Ecological Site Specialist. For specific data inquiries, contact the Powell, Wyoming Soil Survey Office (USDA-NRCS). Inventory Data References: Ocular field estimations observed by trained personnel were completed at each site. Then sites were selected where a 100-feet tape was stretched, and the following sample procedures were completed by inventory staff. For full sampling protocol and guidelines with forms please refer to the Wyoming ESI Operating Procedures, compiled in 2012 for the Powell and Rock Springs Soil Survey Office, USDA-NRCS. • Double Sampling Production Data (9.6 hoop used to estimate 10 points, clipped a minimum of three of these estimated points, with two 21-foot X 21-foot square extended shrub plots). • Line Point Intercept (overstory and understory captured with soil cover). Height of herbaceous and woody cover is collected every three feet along established transect.) • Continuous Line Intercept (Woody Canopy Cover, with minimum gap of 0.2 foot for all woody species and succulents. Intercept height collected at each measurement.), • Gap Intercept (Basal Gap measured with a minimum gap requirement of 0.7 foot.), • Sample Point (Ten 1-meter square point photographs taken at set distances on transect. Read using the sample point computer program established by the High Plains Agricultural Research Center, WY). • Soil Stability (Slake Test – surface and subsurface samples collected and processed according to the soil stability guidelines provided by the Jornada Research Center, NM.)

Other references

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

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

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

Bestelmeyer, B., J.E. Herrick, J.R. Brown, D.A. Trujillo, and K.M. Havstad. 2004. Land management in the American Southwest: a state-

and-transition approach to ecosystem complexity. Environmental Management 34(1):38-51.

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

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

United States Department of Agriculture, Natural Resources Conservation Service. (electronic) National Water and Climate Center. Available online at http://www.wcc.nrcs.usda.gov/. Accessed November 2014.

United States Department of Agriculture, Natural Resources Conservation Service. 2009. Plant Guide: Cheatgrass. Prepared by Skinner et al., National Plant Data Center.

Pellant, M., P. Shaver, D. A. Pyke, and J. E. Herrick. 2005. Interpreting indicators of rangeland health. Version 4. Technical Reference 1734-6. USDI-BLM.

Ricketts, M. J., R. S. Noggles, and B. Landgraf-Gibbons. 2004. Pryor Mountain Wild Horse Range Survey and Assessment. USDA-Natural Resources Conservation Service.

Schoeneberger, P.J., D.A. Wysocki, E.C. Benham, and Soil Survey Staff. 2012. Field book for describing and sampling soils, Version 3.0. Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE .

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

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

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

United States Department of Agriculture, Natural Resources Conservation Service. 1997. National Range and Pasture Handbook. (http://www.glti.nrcs.usda.gov/technical/publications/nrph.html). Accessed October 2014.

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

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

U.S. Department of Agriculture, Natural Resources Conservation Service (USDA/NRCS), Soil Survey Staff. 2010. Keys to Soil Taxonomy, 11th Edition.

USDA/NRCS Soil survey manuals for various counties within MLRA 32X. Web soil survey is available online at: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm.

Western Regional Climate Center. 2014. Electronic station metadata. Available online at: http://www.wrcc.dri.edu/summary/climsmwy.html.

Approval

Kirt Walstad, 3/26/2025

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)	Marji Patz
Contact for lead author	marji.patz@usda.gov; 307-271-3130
Date	04/20/2020
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** **Bare ground can range from 25-35%.**

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

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

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

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** **Soil Stability Index ratings range from 1 (interspaces) to 6 (under plant canopy), but average values should be 5.0 or greater.**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Refer to soil series description and map unit information for specific information. Described A-horizons vary from 1-4 inches (3-10 cm) with OM of 1 to 2%.

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Evenly distributed plant canopy (40-65%) and litter plus moderate to moderately rapid infiltration rates result in minimal runoff. Basal cover is typically less than 15% for this site and does very little to effect runoff on this site. Canopy cover is sufficient to reduce raindrop impact.

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction of soil surface crusting should be present.

---

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: Cool-season, mid-stature grasses >>

    Sub-dominant: Sub-dominant: perennial shrubs >

    Other: Short stature grasses/grass-likes > Forbs

    Additional:

---

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

---

14. **Average percent litter cover (%) and depth (in):** Litter ranges from 10-25% of total canopy measurement with total litter (including beneath the plant canopy) from 25-50% expected. Herbaceous litter depth typically ranges from 3-7 mm. Woody litter can be up to 2 inches (2-5 cm).

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Estimated annual production for ranges from 200 - 550 lbs./ac (168-448 kg/ha), with an average of 375 lbs./ac (420 kg/ha).

---

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:** The increase of bare ground above 40% is an indicator that a threshold is being crossed. Corresponding increase will be noted in one or more of the following species is common: blue grama, Sandberg bluegrass, pricklypear cactus, Wyoming big sagebrush, and broom snakeweed. Annual weeds such as kochia, mustards, lambsquarter, Russian thistle, and pepperweed are common invasive species in disturbed sites. Common noxious weeds that invade are: cheatgrass (downy brome), knapweed, whitetop and others found on the Noxious Weed List for Wyoming and specific

counties (Big Horn, Hot Springs, Park, and Hot springs, Wyoming; and Carbon County, Montana).

---

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