

Ecological site DX032X01A104

Clayey (Cy)

Big Horn Basin Core

Last updated: 5/13/2025

Accessed: 08/16/2026

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

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

LRU notes

Land Resource Unit (LRU): 32X01 (WY): This LRU is the core of the Big Horn Basin, comprised of the eroded basin floor. As the LRU shifts towards the outer edges, aspect and relation to the major bodies of water and taller landforms create minor shifts in soil chemistry influencing the variety of ecological sites and to 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: Typic Aridic, prior to 2012, there are map units that cross over to ustic aridic or ustic aridic was correlated into this core area. As progressive mapping continues and when the ability to do update projects, these overlapping map units will be corrected. Temperature Regime: Mesic Dominant Cover: Rangeland, with Saltbush flats the dominant vegetative cover for this LRU/ESD. Representative Value (RV) Effective Precipitation: 5-9 inches (127 – 229 mm) RV Frost-Free Days: 110-150 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 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 Textures range from clay loam and finer in top 4" (10 cm) of mineral soil surface
 - o Clay content is ≥35% in top 4" (10 cm) of mineral soil surface
 - o All subsurface horizons in the particle size control section have a weighted average of ≥35% clay. (The particle size control section is the segment of the profile from either the start of an argillic horizon for 50 cm's or from 25-100 cm's).
 - o Moderately deep to very deep (20-80+ in. (50-200+ cm)
 - o Not skeletal (35% rock fragments) within 20" (50 cm) of mineral soil surface
 - o None to Slightly effervescent throughout top 20" (50 cm) of mineral soil surface
 - o Non-saline, sodic, or saline-sodic

Associated sites

R032XY144WY	Saline Upland (SU) 5-9" Big Horn Basin Precipitation Zone Saline Upland sites tend to occur in a mosaic with clayey sites on landforms developed by inter-bedded marine sedimentary bedrock.
R032XY150WY	Sandy (Sy) 5-9" Big Horn Basin Precipitation Zone, Sandy occurs with Clayey on land forms developed by inter-bedded sedimentary bedrock. Sandy sites tend to follow the sandstone outcrops or down-wind of these outcrops.
R032XY158WY	Shallow Clayey (SwCy) 5-9" Big Horn Basin Precipitation Zone Shallow Clayey is lower in productivity and tends to fall on the upper rims of escarpments or on the eroded scarp faces, where clayey will be lower on these landforms.
R032XY138WY	Saline Lowland (SL) 5-9" Big Horn Basin Precipitation Zone Saline lowland sites will fall on the step or terrace below clayey sites, and are influenced by a water table and/or stream overflow.
R032XY122WY	Loamy (Ly) 5-9" Big Horn Basin Precipitation Zone Loamy sites tend to follow the middle portion of most land forms developed by inter-bedded sedimentary bedrock, with clayey sites falling at the base of shale, or lower in the land form where shales are exposed.

Similar sites

R032XY304WY	Clayey (Cy) 10-14" East Precipitation Zone Clayey 10-14
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Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Artemisia tridentata ssp. wyomingensis</i> (2) <i>Elymus elymoides</i>
Herbaceous	(1) <i>Artemisia tridentata ssp. wyomingensis</i>

Legacy ID

R032XA104WY

Physiographic features

This site occurs on nearly level to 30% slopes.

Table 2. Representative physiographic features

Landforms	(1) Intermontane basin > Hill (2) Intermontane basin > Alluvial fan (3) Intermontane basin > Stream terrace
Flooding duration	Extremely brief (0.1 to 4 hours)
Flooding frequency	None to rare
Ponding duration	Brief (2 to 7 days)
Ponding frequency	None to occasional
Elevation	1,130 – 1,830 m
Slope	0 – 30 %
Aspect	Aspect is not a significant factor

Climatic features

Annual precipitation and modeled relative effective annual precipitation ranges from 5 to 9 inches (127 – 229 mm). The normal precipitation pattern shows peaks in May and June and a secondary peak in September. The noted peaks account for approximately 50% of the mean annual precipitation. Much of the moisture that falls in the latter part of the summer is lost by evaporation and much of the moisture that falls during the winter is lost by sublimation.

Average snowfall is about 20 inches annually. Wide fluctuations may occur in yearly precipitation and result in more dry years than those with more than normal precipitation. 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 approximately on April 1st and continues through to July 1st. 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/>. "Basin", "Emblem", "Greybull", "Lovell", "Worland FAA AP" and "Worland" are the representative weather stations for LRU A. 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)	110-120 days
Freeze-free period (characteristic range)	130-140 days
Precipitation total (characteristic range)	180-200 mm

Frost-free period (actual range)	110-120 days
Freeze-free period (actual range)	130-150 days
Precipitation total (actual range)	150-200 mm
Frost-free period (average)	110 days
Freeze-free period (average)	140 days
Precipitation total (average)	180 mm

- (1) BASIN [USC00480540], Basin, WY
- (2) EMBLEM [USC00483031], Burlington, WY
- (3) GREYBULL [USC00484080], Greybull, WY
- (4) LOVELL [USC00485770], Lovell, WY
- (5) WORLAND [USW00024062], Worland, WY
- (6) WORLAND [USC00489770], Worland, 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/overland flow. No streams are classified within this ecological site.

Soil features

The soils of this site are moderately deep (greater than 20" to bedrock) to very deep, moderately well to well-drained soils that formed in alluvium or alluvium over residuum. These soils have slow to moderate permeability. The surface soil will vary from 2 to 5 inches deep. These soils may develop severe cracks. The soil characteristics having the most influence on plants are the heavy texture, available moisture, and potential for elevated quantities of soluble salts.

Table 4. Representative soil features

Parent material	(1) Alluvium – interbedded sedimentary rock (2) Residuum – calcareous shale
Surface texture	(1) Clay loam (2) Clay (3) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Moderately well drained to well drained

Permeability class	Slow to moderate
Soil depth	50 – 150 cm
Available water capacity (0-101.6cm)	7.62 – 15.24 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 10 %
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	0 – 10
Soil reaction (1:1 water) (0-101.6cm)	7.4 – 10

Ecological dynamics

Potential vegetation on this site is dominated by mid cool-season perennial grasses. Other significant vegetation includes big sagebrush, winterfat, birdfoot sagebrush, and a variety of forbs. The expected potential composition for this site is about 70% grasses, 10% forbs and 20% woody plants. The composition and production will vary naturally due to historical use, fluctuating precipitation and fire frequency.

As this site deteriorates species such as blue grama, birdfoot sagebrush, and big sagebrush will increase. Weedy annuals will invade. Cool-season grasses such as bluebunch wheatgrass, western wheatgrass, bottlebrush squirreltail, and Indian ricegrass will decrease in frequency and overall production.

Big sagebrush may become dominant on some areas with an absence of fire. Wildfires are actively controlled in recent times so chemical control using herbicides has replaced the historic role of fire on this site. Recently, prescribed burning has regained some popularity.

Due to the amount and pattern of the precipitation, the big sagebrush component typically is not resilient once it has been removed if a healthy and vigorous stand of grass exists and is maintained. The exception to this is where the herbaceous component is severely degraded at the time of treatment, growing conditions are unfavorable after treatment, and/or recovery periods are inadequate due to poor grazing management.

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

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				21-63	
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	21-63	–
2				63-127	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	63-127	–
3				63-127	
	squirreltail	ELELE	<i>Elymus elymoides ssp. elymoides</i>	63-127	–
4				21-63	
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	21-63	–
5				0-63	
	Grass, perennial	2GP	<i>Grass, perennial</i>	0-21	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0-21	–
	sedge	CAREX	<i>Carex</i>	0-21	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	0-21	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0-21	–
Forb					
6				21-63	
	Forb, perennial	2FP	<i>Forb, perennial</i>	0-21	–
	textile onion	ALTE	<i>Allium textile</i>	0-21	–
	desertparsley	LOMAT	<i>Lomatium</i>	0-21	–
	phlox	PHLOX	<i>Phlox</i>	0-21	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	0-21	–
Shrub/Vine					
7				0-43	
	big sagebrush	ARTR2	<i>Artemisia tridentata</i>	0-43	–
8				0-21	
	birdfoot sagebrush	ARPE6	<i>Artemisia pedatifida</i>	0-21	–
9				0-21	
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	0-21	–
10				0-21	
	winterfat	KRASC	<i>Krascheninnikovia</i>	0-21	–
11				0-21	
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0-21	–

Table 6. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 7. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 9. Community 5.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 10. Community 6.1 plant community composition

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

Rhizomatous Wheatgrasses/Bottlebrush Squirreltail (HCPC) : The predominance of grasses in this plant community favors grazers and mixed-feeders, such as bison, elk, and antelope. Suitable thermal and escape cover for deer may be limited due to the low quantities of woody plants. However, topographical variations could provide some escape cover. When found adjacent to sagebrush dominated states, this plant community may provide brood rearing/foraging areas for sage grouse, as well as lek sites. Other birds that would frequent this plant community include Western meadowlarks, horned larks, and golden eagles. Many grassland obligate small mammals would occur here. Perennial Grass/Mixed Shrub Plant Community: The combination of an overstory of sagebrush and an understory of grasses and forbs provides a very diverse plant community for wildlife. The crowns of sagebrush tend to break up hard crusted snow on winter ranges, so mule deer and antelope may use this state for foraging and cover year-round, as would cottontail and jack rabbits. It provides important winter, nesting, brood-rearing, and foraging habitat for sage grouse. Brewer's sparrows nest in big sagebrush plants, and a host of other nesting birds utilize stands in the 20-30% cover range. Mixed Shrub/Bare Ground Plant Community: This plant community can provide important winter foraging for elk, mule deer and antelope, as sagebrush can approach 15% protein and 40-60% digestibility during that time. This community provides excellent escape and thermal cover for large ungulates, as well as nesting habitat for upland game birds. However, it provides little foraging opportunities for upland game birds, as fewer forbs are available. Many grassland obligate small mammals would occur here. Blue Grama Sod Plant Community: These communities provide limited foraging for antelope and other grazers. They may be used as a foraging site by sage grouse if proximal to woody cover and if the Historic Climax Plant Community or the Big Sagebrush/Perennial Grass Plant Community is limited. Generally, these are not target plant communities for wildlife habitat management. Salt Tolerant Shrub/Bare Ground Plant Community: This plant community exhibits a low level of plant species diversity due to the accumulation of salts near the soil surface. It does, however, provide thermal and escape cover for large animals and upland birds. Upland game birds may find little foraging opportunities, as fewer forbs are available. Many grassland obligate small mammals would occur here. Salt Tolerant Shrub/Rhizomatous Wheatgrass Plant Community: This plant community can provide winter foraging for elk, mule deer and antelope. This community provides escape and thermal cover for large ungulates, as well as nesting habitat for upland game birds. However, it provides little foraging opportunities for upland game birds, as fewer forbs are available. Many grassland obligate small mammals would occur here. Animal Community – Grazing Interpretations The following table lists suggested stocking rates for cattle under continuous season-long grazing under normal growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of the conservation planning process. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Because of this, a field visit is recommended, in all cases, to document plant composition and production. More precise carrying capacity estimates should eventually be calculated using this information along with animal preference data, particularly when grazers other than cattle are involved. Under more intensive grazing management, improved harvest efficiencies can result in an increased carrying capacity. If distribution problems occur, stocking rates must be reduced to maintain plant health and vigor. Plant Community Production Carrying Capacity* (lb./ac) (AUM/ac) Historic Climax Plant Community 200-500 .20 Perennial Grasses/Mixed Shrub 150-400 .16 Mixed Shrub/Bare Ground 75-325 .10 Blue Grama Sod 50-150 .05 Salt Tolerant Shrub/Bare Ground 75-275 .07 Salt Tolerant Shrub/Rhizomatous Wheatgrasses 200-425 .16 * - Continuous, season-long grazing by cattle under average growing conditions. Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage for cattle, sheep, or horses. During the dormant period, the forage for livestock use needs to be supplemented with protein because the quality does not meet minimum livestock requirements.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group C, with localized areas in hydrologic group D. Infiltration ranges from slow to moderately slow. Runoff potential for this site varies from moderate to high depending on soil hydrologic group and ground cover. In many cases, areas with greater than 75% 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% have the greatest potential to have reduced infiltration and higher runoff (refer to Part 630, NRCS National Engineering Handbook for detailed hydrologic 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. Cryptogamic crusts are present, but only cover 1-2% of the soil surface.

Recreational uses

This site provides hunting opportunities for upland game species. The wide variety of plants which bloom from spring until fall have an esthetic value that appeals to visitors.

Wood products

No appreciable wood products are present on the site.

Other products

None noted.

Inventory data references

Information presented here has been derived from NRCS inventory data. Field observations from range trained personnel were also used. Other sources used as references include: USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, and USDA NRCS Soil Surveys from various counties. Inventory Data References Data Source Number of Records Sample Period State County SCS-RANGE-417 19 1965-1986 WY Park & others State Correlation This site occurs entirely within Wyoming. Field Offices Cody, Greybull, Lovell, Powell, Thermopolis, Worland

Approval

Kirt Walstad, 5/13/2025

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)	Ray Gullion
Contact for lead author	ray.gullion@wy.usda.gov
Date	02/19/2008
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. Number and extent of rills: Rills should not be present

2. Presence of water flow patterns: Barely observable

3. Number and height of erosional pedestals or terracettes: Essentially non-existent

4. Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):
Bare ground is 25-35% occurring in small areas throughout site

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: None

7. Amount of litter movement (describe size and distance expected to travel): Little to no plant litter movement. Plant litter remains in place and is not moved by erosional forces.

8. Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):
Plant cover and litter is at 60% or greater of soil surface and maintains soil surface integrity. Soil Stability class is anticipated to be 5 or greater.

9. Soil surface structure and SOM content (include type of structure and A-horizon color and thickness): Use Soil Series description for depth and color of A-horizon

10. Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff: Grass canopy and basal cover should reduce raindrop impact and slow overland flow providing increased time for infiltration to occur. Healthy deep rooted native grasses enhance infiltration and reduce runoff. Infiltration is Slow.

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

Sub-dominant:

Other:

Additional: Mid stature Cool Season Rhizomatous Grasses > Mid stature Cool Season Bunch Grasses > Shrubs > Short stature Grasses > Forbs

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

14. Average percent litter cover (%) and depth (in): Average litter cover is 20-30% with depths of 0.1 to 0.25 inch

15. Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):
300 lbs/ac

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: Birdfoot sagebrush, blue grama, prickly pear, big sagebrush, annuals, exotics, and Species found on Noxious Weed List

17. Perennial plant reproductive capability: All species are capable of reproducing.
