USDA Natural Resources
Conservation Service

Ecological site BX013X01B012
Gravelly Bear River Valley 10-14" P.Z.

Last updated: 9/07/2023
Accessed: 04/20/2024

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): 013X–Eastern Idaho Plateaus

Major Land Resource Area (MLRA) 13, Eastern Idaho Plateaus, consists of approximately 5 million acres in Idaho with a small part in Utah and Wyoming. It consists of 6 Land Resource Units (LRU). These units are divisions of the MLRA based on geology, landscape, common soils, water resources and plant community potentials. The elevation ranges from approximately 4500 to 6600 feet (1370 to 2010 m) on the plateaus and foothills to as much as 9500 feet (2895 m) on the mountains. Annual precipitation ranges from 10 to 48 inches (254-1220 mm), with the driest areas in the Bear River Valley on the far eastern portion and the wettest areas on the mountain summits. The Fort Hall Indian Reservation and several national forests are in this MLRA, including the Caribou, Cache, and Targhee National Forests. Yellowstone and Grand Teton National Parks occur just outside the northeast boundary.

LRU notes

The Bear River Valley LRU is located on the far eastern side of MLRA 13 between the Bear River Divide and the Monte Cristo Range, from Woodruff, Utah at the southern end to Cokeville, Wyoming at the northern end. The total area of the LRU is approximately 340,000 acres. It shares a boundary with MLRA 47 - Wasatch and Uinta Mountains, 43B - Central Rocky Mountains and 46 - Northern Rocky Mountain Foothills (proposed in Wyoming). This LRU differs from the others in its geology, which is comprised mostly of alluvium and colluvium from the Stump Formation. Its weather patterns are such that the soil moisture regime is xeric, meaning there is a slight peak in winter precipitation in this LRU, with typical yearly precipitation between 10 to 15 inches (254-380 mm). The soil temperature regime of this LRU is frigid with mean annual soil temperatures ranging from 44 to 48 degrees Fahrenheit (6.7-8.8 C). The elevation range is from 5700 to 7000 feet (1730-2130 m). The soils in the Bear River Valley are dominated by young aged very deep soils developed from sandstone and shale parent material re-worked with recent alluvium. Soils are dominated by Alfisols with young argillic horizons and by Fluvents in more recent alluvium.
The Bear River runs through this LRU, allowing for ample amounts of irrigation water used in the lowland areas to produce hay with smaller tributaries originating from the neighboring mountains.

Classification relationships

Relationship to Other Established Classification Systems
National Vegetation Classification System (NVC):
3 Semi-Desert
3.B.1 Cool Semi-Desert Scrub & Grassland
3.B.1.Ne Western North American Cool Semi-Desert Scrub & Grassland Division
M171 Great Basin-Intermountain Dry Shrubland & Grassland Macrogroup
G311 Intermountain Semi-Desert Grassland Group
A1262 Indian Ricegrass-Bluebunch Wheatgrass-Sandhill Muhly Grassland Alliance
CEGL001666 Bluebunch Wheatgrass/Cushion Plants Grassland Association

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

Ecological site concept

Gravelly Bear River Valley 10-14" P.Z. (Gr-BRV) is an upland ecological site occurring on summit and shoulder landscape positions limited by high amounts of cobbles and/or gravels (>50%) on the soil surface and typically skeletal (>35% by volume rock fragments) within the top 10 inches (25 cm) that is restricted in water holding capacity (<4" AWC).
• This site does not receive any additional water
• These soils are:
o not saline or saline-sodic
o moderately deep or deep, 20-60 inches (50-150 cm)
o typically skeletal (greater than 35 percent by volume rock fragments) within 10 inches (25 cm) of the soil surface
o not violently effervescent in the top 10 inches (25 cm), but could be strongly effervescent in subsurface layers greater than 10 inches (25 cm) below the surface
o with surface textures that range from gravelly to very gravelly sandy loam to sandy clay loam in top 6 inches (15cm) mineral surface
• have high amounts (>50%) of gravels and/or cobbles on the soil surface
• have slopes that range from 10-45 percent
• have clay content less than 32% in mineral soil surface layer (6 inches)
• occur on summit and shoulder landscape positions
Climate:
xeric moisture regime
frigid temperature regime

Associated sites

BX013X01B063	**Shallow Loamy Calcareous Bear River Valley 10-14" P.Z.** This site has similar soil texture, but has high calcium carbonate equivalent within 10 inches of the soil surface. Production and species composition potential are different.
BX013X01B062	**Shallow Loamy Bear River Valley 10-14" P.Z.** This site has similar soil texture, but depth is shallow (10-20 inches) and rock fragments typically increase with depth with outcropping bedrock commonly seen on the soil surface. Production and species composition potential are different.

Similar sites

R034AY212WY	**Gravelly Foothills and Basins West (Gr)** Previous version of this site used in Wyoming

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia frigida*
Herbaceous	(1) *Pseudoroegneria spicata*

Legacy ID

R013XA112WY

Physiographic features

This site occurs on summit and shoulder positions on hillslope and fan remnant landforms at elevations between 5,700 and 7,000 feet. The slopes typically range from 10 to 45 percent, but the site could be found on any slope or

aspect. Flooding and ponding do not occur on this site.

Landscape Definition:
hills -- A landscape dominated by hills and associated valleys.

valley -- An elongate, relatively large, externally drained depression of the Earth's surface that is primarily developed by stream erosion or glacial activity.

Landform Definition:
hillslope -- A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of the hill.

ridge -- A long, narrow elevation of the land surface, usually sharp crested with steep sides and forming an extended upland between valleys. The term is used in areas of both hill and mountain relief.

summit - (a) The topographically highest position of a hillslope profile with a nearly level (planar or only slightly convex) surface. Compare - shoulder, backslope, footslope, and toeslope, crest. (b) A general term for the top, or highest area of a landform such as a hill, mountain, or tableland. It usually refers to a high interfluve area of relatively gentle slope that is flanked by steeper slopes, e.g., mountain fronts or tableland escarpments.

shoulder - The hillslope profile position that forms the convex, erosional surface near the top of a hillslope. If present, it comprises the transition zone from summit to backslope. Compare - summit, crest, backslope, footslope, and toeslope.

Table 2. Representative physiographic features

Landforms	(1) Hills > Hillslope (2) Ridge (3) Valley > Fan remnant
Flooding frequency	None
Ponding frequency	None
Elevation	5,700–7,000 ft
Slope	10–45%
Aspect	Aspect is not a significant factor

Climatic features

Annual precipitation in the Bear River Valley ranges from 10 to 14 inches per year. Wide fluctuations may occur in yearly precipitation and result in more below average years than those with above average precipitation. Temperatures show a wide range between summer and winter and between daily maximums and minimums. This is predominantly due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Roughly 25 to 30 percent of the precipitation occurs during the critical growth period, but the majority of precipitation accumulates outside the growing season, creating xeric-like conditions. The wettest rainfall month is May. The dominant plants (sagebrush and cool season grasses) are well adapted to these conditions. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 mph. The growing season is short (60 to 90 days) and cool (critical growth period): primary growth typically occurs between May and June. Growth of native cool-season plants begins about mid-April and continues to approximately early July. Some green-up of cool-season plants usually occurs in September with adequate fall moisture.

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

Table 3. Representative climatic features

Frost-free period (characteristic range)	40-90 days

Freeze-free period (characteristic range)	50-110 days
Precipitation total (characteristic range)	10-14 in
Frost-free period (actual range)	35-90 days
Freeze-free period (actual range)	30-110 days
Precipitation total (actual range)	8-16 in
Frost-free period (average)	60 days
Freeze-free period (average)	80 days
Precipitation total (average)	12 in

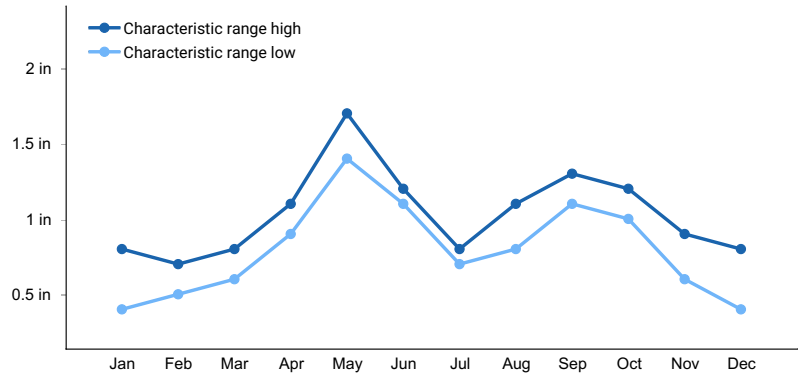


Figure 1. Monthly precipitation range

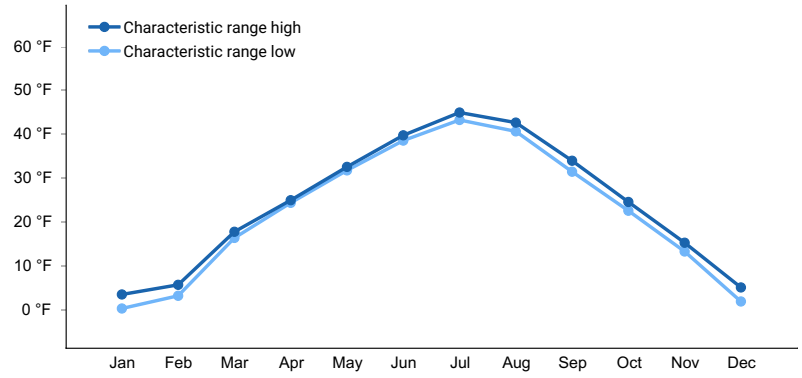


Figure 2. Monthly minimum temperature range

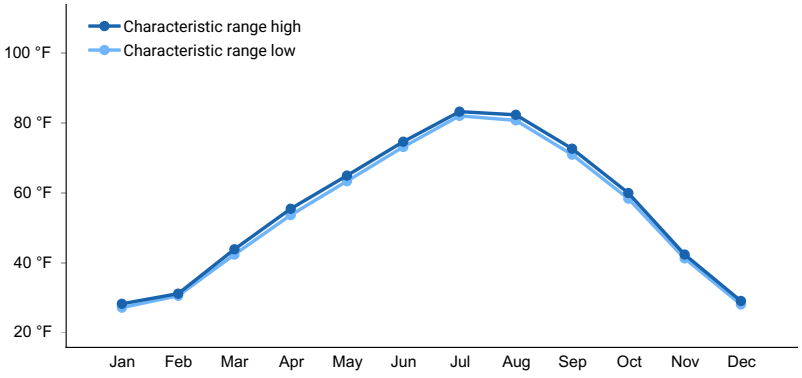


Figure 3. Monthly maximum temperature range

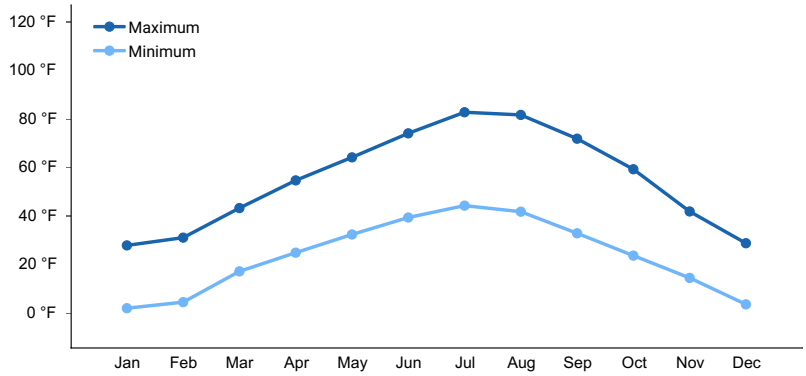


Figure 4. Monthly average minimum and maximum temperature

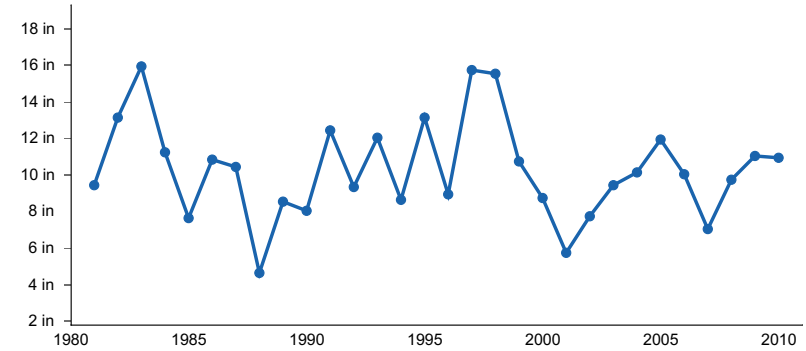


Figure 5. Annual precipitation pattern

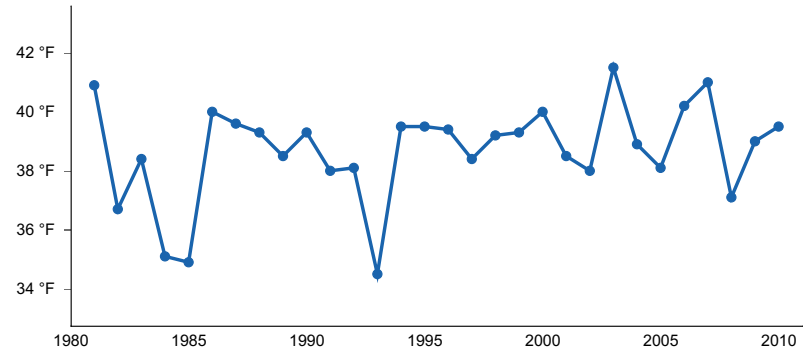


Figure 6. Annual average temperature pattern

Climate stations used

- (1) WOODRUFF [USC00429595], Woodruff, UT
- (2) RANDOLPH [USC00427165], Randolph, UT
- (3) SAGE 4 NNW [USC00487955], Cokeville, WY

Influencing water features

There are no influencing water features associated with this ecological site.

Wetland description

N/A

Soil features

The soils of this site are moderately deep to deep (20 to 60 inches) and formed in slope alluvium and colluvium derived from limestone, sandstone, and conglomerate rocks. Surface and subsurface textures are gravelly loams and sandy loams. Rock fragments are usually high on the soil surface and throughout the soil profile. These soils

are well drained to somewhat excessively well-drained and permeability is moderate to moderately-rapid. The soil moisture regime is xeric and the soil temperature regime is frigid.

Major Soil Series correlated to this site include: Chausse, Cooley, and St. Marys
Taxonomy: Loamy-skeletal, mixed, superactive, frigid Typic Calcixerepts; Loamy-skeletal, mixed, superactive, frigid Calcic Haploxerolls; and Loamy-skeletal, mixed, superactive, frigid Calcic Haploxerepts

Table 4. Representative soil features

Parent material	(1) Slope alluvium–conglomerate (2) Colluvium–interbedded sedimentary rock
Surface texture	(1) Gravelly, very gravelly loam (2) Gravelly, very gravelly sandy loam (3) Gravelly, very gravelly sandy clay loam
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderate to moderately rapid
Depth to restrictive layer	21–60 in
Soil depth	20–60 in
Surface fragment cover <=3"	20–40%
Surface fragment cover >3"	0–20%
Available water capacity (0-40in)	2.5–6 in
Calcium carbonate equivalent (12-20in)	5–15%
Clay content (0-6in)	14–32%
Electrical conductivity (0-20in)	0–2 mmhos/cm
Sodium adsorption ratio (0-20in)	0–3
Soil reaction (1:1 water) (0-20in)	7.6–8
Subsurface fragment volume <=3" (6-20in)	25–40%
Subsurface fragment volume >3" (6-20in)	0–15%

Ecological dynamics

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

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

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

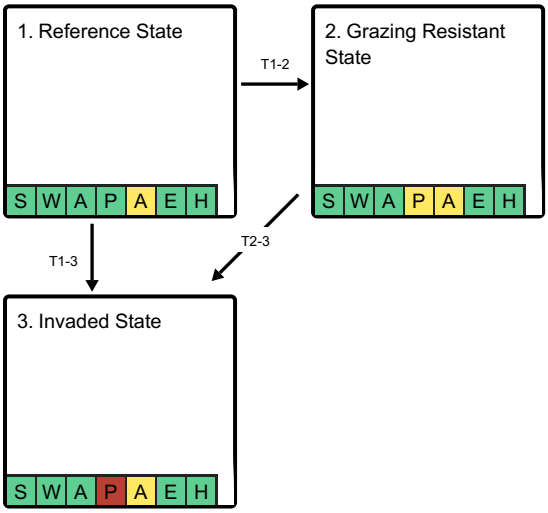
Species composition by dry weight remains an important descriptor of the herbaceous community and of site productivity as a whole and includes both herbaceous and woody species. Calculating similarity index requires data on species composition by dry weight.

Although there is considerable qualitative experience supporting the pathways and transitions within the State-and-Transition Model, no quantitative information exists that specifically identifies threshold parameters between reference states and degraded states in this ecological site. For information on STMs, see the following citations: Bestelmeyer et.al. 2003, Bestelmeyer et.al. 2004, Bestelmeyer et.al. 2010, Bestelmeyer and Brown 2005, Briske et.al. 2008, and Stringham et,al. 2003.

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

State and transition model

Ecosystem states



T1-2 - Herbivory (continuous or season-long, low to moderate stocking)

T1-3 - Extreme disturbance (e.g. catastrophic fire, drought, soil removal)

T2-3 - Extreme disturbance (e.g. extreme herbivory, catastrophic fire, drought, soil removal)

State 1 submodel, plant communities

1.1. Bunchgrass Plant Community

State 2 submodel, plant communities

2.1. Short-stature Grass/Mat-forming Forb Plant Community

State 3 submodel, plant communities

3.1. Annual Plant Community

State 1
Reference State

The Reference State consists of one plant community, the Bunchgrass Plant Community (1.1). The dominant grass is bluebunch wheatgrass (*Pseudoroegneria spicata*). Shrubs are sub-dominant and predominantly include fringed sagewort (*Artemisia frigida*), winterfat (*Krascheninnikovia lanata*), and Wyoming big sagebrush (*Artemisia tridentata* ssp. wyomingensis). Wyoming big sagebrush is typically absent on windward aspects (westerly) and present on leeward aspects (easterly). Forbs are sub-dominant and predominantly include pussytoes (Antennaria spp.), buckwheat (Eriogonum spp.), and Hood's phlox (*Phlox hoodii*). Because this site is grass dominated, reference conditions do not result in disturbances that shift plant community phases.

Characteristics and indicators. This site occurs mostly on summits and shoulders, and often on windblown slopes. It is characterized by large rock fragments on the surface, typically alluvium (gravels and cobbles).

Resilience management. This site has moderate resilience due to its xeric soil moisture regime and frigid temperature regime (Chambers et.al. 2014). Precipitation is typically adequate and more effective with cooler temperatures, but timing of precipitation lowers resilience. Moisture is often not present when needed to support recovery efforts. The site can usually recovery after disturbance but is susceptible to delays in recovery during extreme climatic events such as drought. The site has moderately low resistance to invasion by annual grasses

because of climate suitability. Winter precipitation patterns favor annual invasion while cooler temperatures provide some resistance. The site is susceptible to invasion during hotter climatic periods. On the LRU scale, this site is lower in resistance to invasives when it occurs on southern aspects due to the coarse surface textures and rock fragments.

Dominant plant species

- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass

Dominant resource concerns

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

Community 1.1
Bunchgrass Plant Community

The Bunchgrass Plant Community is characterized by the dominance of assorted native perennial bunchgrasses, primarily bluebunch wheatgrass, and a scattering of Wyoming big sagebrush if on leeward aspects. There are generally few canopy gaps, and most basal gaps are generally small (one to two feet). Rock cover on the soil surface is common and armors the site from soil erosion. Although overall productivity potential is low, there is abundant litter cover due to grass dominance.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	240	310	450
Forb	55	70	100
Shrub/Vine	55	70	100
Total	**350**	**450**	**650**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	1-10%
Grass/grasslike foliar cover	35-50%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	0-1%
Litter	20-30%
Surface fragments >0.25" and <=3"	10-30%
Surface fragments >3"	0-10%
Bedrock	0%
Water	0%
Bare ground	10-20%

Table 7. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	0-1%
Grass/grasslike basal cover	1-5%
Forb basal cover	1-10%

Non-vascular plants	0%
Biological crusts	0-1%
Litter	40-60%
Surface fragments >0.25" and <=3"	20-40%
Surface fragments >3"	0-20%
Bedrock	0%
Water	0%
Bare ground	10-20%

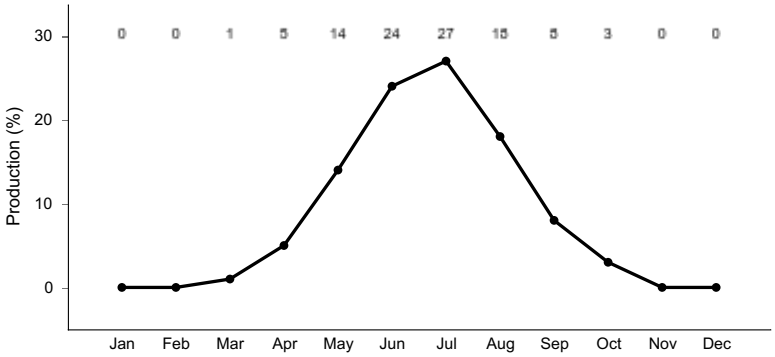


Figure 8. Plant community growth curve (percent production by month). WY13X01Bu, MLRA 13-Bear River Valley-upland. Forage Production (herbaceous only) Developed by using the Rangeland Analysis Platform (RAP).

State 2
Grazing Resistant State

The Grazing Resistant State has seen a shift in functional/structural group dominance. Due to herbivory pressure, there is a shift from mid-stature cool-season bunchgrasses to short-stature cool-season bunchgrasses such as Sandberg bluegrass and rhizomatous wheatgrasses like thickspike wheatgrass and western wheatgrass. Mat-forming forbs such as pussytoes (Antennaria spp.), Hood's phlox (*Phlox hoodii*), and buckwheat (Eriogonum spp.) increase and can become dominant.

Characteristics and indicators. There are fewer mid-size bunchgrasses and they are typically found under shrub canopy, when present, where they are protected from herbivory. The shrub canopy inter-spaces are occupied by grazing tolerant grasses as well as mat-forming forbs that, combined with surface rock fragments, armor the site from soil erosion. Drier site conditions result in lower productivity and less herbaceous production potential. Decreased infiltration is caused by increased mat-forming forbs and lack of litter that acts as mulch in retaining soil moisture and retarding runoff. In many cases, the transition to the Grazing Resistant State may have occurred many decades ago during an era of higher stocking rates and continuous grazing during the growing season. However, continual grazing during the critical growth period (roughly May-June) at proper stocking rates will facilitate the transition to this state and maintain it as a stable state.

Resilience management. Site resilience is lower than the Reference State. Site hydrology has been modified due to moisture being utilized by shallower rooting species. Therefore, the site is drier earlier in the season and unable to recover as quickly after a disturbance. This state is more drought-prone, and therefore more vulnerable to invasion by annual invasive species. However, mat-forming forbs provide some amount of resiliency. Site resistance to invasion by annual grasses is lower due to niches in the under-story for establishment as well as site water availability during the time suited for winter annuals such as cheatgrass (*Bromus tectorum*). Episodic and limited moisture is more suited to annual life forms.

Dominant plant species

- Sandberg bluegrass (*Poa secunda*), grass
- thickspike wheatgrass (*Elymus lanceolatus ssp. lanceolatus*), grass

- western wheatgrass (*Pascopyrum smithii*), grass

Dominant resource concerns

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

Community 2.1
Short-stature Grass/Mat-forming Forb Plant Community

This plant community is characterized by a dominance of short-stature grasses such as Sandberg bluegrass, rhizomatous grasses and grass-likes, and mat-forming forbs. Total annual production ranges from 250 to 550 pounds per acre (lbs/ac) with a RV of 350 lbs/ac. Biotic integrity is affected by the change in functional/structural group dominance. This plant community is at-risk of transitioning to the Invaded State with additional disturbance such as heavy grazing, catastrophic wildfire, or ground-disturbing activity.

State 3
Invaded State

The Invaded State has seen a shift in dominance toward annual invasive grasses. It often occurs after a disturbance that occurs in conjunction with drought conditions. Anthropogenic activity such as a gravel pits that are abandoned can lead to this state.

Characteristics and indicators. In this state, sagebrush canopy varies, but the under-story is dominated by annual invasive and weedy species. Biotic integrity is affected by functional/structural groups not expected for the site, invasive plants, and the loss of perennial species and functional/structural groups. The site is more prone to drought with large fluctuations in annual production in response to weather events. The site is less diverse with lower quality habitat for wildlife and pollinators, and the risk of wildfire is increased from fine fuel production.

Resilience management. Site resilience is lower than all other states because the site hydrology has been modified resulting in greater runoff during spring melt and rainfall events. Therefore, the site is drier and unable to recover as quickly after a disturbance. Site resistance to invasion by annual grasses is lost due to niches in the under-story for establishment as well as site water availability during the time suited for winter annuals such as cheatgrass (*Bromus tectorum*). Episodic and limited moisture is more suited to annual life forms.

Dominant plant species

- cheatgrass (*Bromus tectorum*), grass
- herb sophia (*Descurainia sophia*), other herbaceous

Dominant resource concerns

- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Wildfire hazard from biomass accumulation
- Terrestrial habitat for wildlife and invertebrates
- Inadequate livestock water quantity, quality, and distribution

Community 3.1
Annual Plant Community

This plant community results from a severe disturbance with presence of annual seedbank source. Repeated disturbances, such as fire, can maintain this plant community, but that is a rare occurrence for this site due to landscape position and low productivity potential. This site has low potential for recovery once dominated by annuals. Seeding is recommended to restore herbaceous perennial functional structural groups. Productivity in this plant community phase is highly variable based on current year's weather, and can range from 100 lbs./ac. or less, up to 450 lbs./ac., with representative value of 200 lbs./ac.

Transition T1-2
State 1 to 2

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

Constraints to recovery. Recovery is inhibited by continued herbivory pressure, reduced seedbank, and drought conditions. Annual grasses are likely in small amounts.

Context dependence. Drought and annual invasion are most likely variables to prevent restoration.

Transition T1-3
State 1 to 3

Extreme disturbance, including catastrophic fire, drought, or other soil removal disturbance, resulting in removal of perennial vegetation followed by annual invasion, typically associated with post-drought conditions.

Constraints to recovery. Recovery is inhibited by risk of annual invasion and drought conditions.

Context dependence. Drought and annual invasion are variables that prevent restoration.

Transition T2-3
State 2 to 3

Extreme disturbance, including extreme herbivory, catastrophic fire, drought, or other soil removal disturbance, resulting in removal of perennial vegetation followed by annual invasion, typically associated with post-drought conditions.

Constraints to recovery. Recovery is inhibited by fire risk and annual invasion.

Context dependence. Drought and annual invasion are variables that prevent restoration.

Additional community tables

Table 8. 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**			120–225	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	23–225	5–50
	needle and thread	HECO26	*Hesperostipa comata*	23–90	5–30
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	5–90	1–10
	squirreltail	ELEL5	*Elymus elymoides*	5–90	1–5
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–90	0–5
	prairie Junegrass	KOMA	*Koeleria macrantha*	5–45	1–5
	Sandberg bluegrass	POSE	*Poa secunda*	0–45	0–5
	muttongrass	POFE	*Poa fendleriana*	0–45	0–5
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–45	0–5
2	**RHIZOMATOUS GRASSES**			23–45	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	23–45	5–10
	western wheatgrass	PASM	*Pascopyrum smithii*	23–45	5–10
3	**MISC. GRASSES/GRASSLIKES**			23–45	
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–23	0–5

	needleleaf sedge	CADU6	*Carex duriuscula*	0–23	0–5
	Sandberg bluegrass	POSE	*Poa secunda*	5–23	1–5
Forb					
4	**PERENNIAL FORBS**			35–63	
	pussytoes	ANTEN	*Antennaria*	5–23	1–5
	buckwheat	ERIOG	*Eriogonum*	5–23	1–5
	spiny phlox	PHHO	*Phlox hoodii*	5–23	1–5
	longleaf phlox	PHLO2	*Phlox longifolia*	0–14	0–3
	flaxleaf plainsmustard	SCLI	*Schoenocrambe linifolia*	0–14	0–3
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–14	0–3
	stemless mock goldenweed	STAC	*Stenotus acaulis*	0–14	0–3
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0–14	0–3
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–14	0–3
	locoweed	OXYTR	*Oxytropis*	0–14	0–3
	beardtongue	PENST	*Penstemon*	0–14	0–3
	fleabane	ERIGE2	*Erigeron*	0–14	0–3
	milkvetch	ASTRA	*Astragalus*	0–14	0–3
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–14	0–3
	agoseris	AGOSE	*Agoseris*	0–14	0–3
	onion	ALLIU	*Allium*	0–5	0–1
	Indian paintbrush	CASTI2	*Castilleja*	0–5	0–1
	Douglas' dustymaiden	CHDO	*Chaenactis douglasii*	0–5	0–1
	pale bastard toadflax	COUMP	*Comandra umbellata ssp. pallida*	0–5	0–1
	rockcress	ARABI2	*Arabis*	0–5	0–1
	sandwort	ARENA	*Arenaria*	0–5	0–1
	cryptantha	CRYPT	*Cryptantha*	0–5	0–1
	larkspur	DELPH	*Delphinium*	0–5	0–1
	ipomopsis	IPOMO2	*Ipomopsis*	0–5	0–1
	bitter root	LERE7	*Lewisia rediviva*	0–5	0–1
	desertparsley	LOMAT	*Lomatium*	0–5	0–1
	hollyleaf clover	TRGY	*Trifolium gymnocarpon*	0–5	0–1
	violet	VIOLA	*Viola*	0–5	0–1
	deathcamas	ZIGAD	*Zigadenus*	0–5	0–1
	stonecrop	SEDUM	*Sedum*	0–5	0–1
5	**ANNUAL FORBS**			0–5	
	rockjasmine	ANDRO3	*Androsace*	0–5	0–1
	bushy bird's beak	CORA5	*Cordylanthus ramosus*	0–5	0–1
Shrub/Vine					
6	**SAGEBRUSH**			23–45	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–45	0–5
	prairie sagewort	ARFR4	*Artemisia frigida*	5–23	5–15
	little sagebrush	ARARL	*Artemisia arbuscula ssp. longiloba*	0–14	0–3

7	**MISC. SHRUBS**			10–23	
	winterfat	KRLA2	*Krascheninnikovia lanata*	5–23	1–5
	granite prickly phlox	LIPU11	*Linanthus pungens*	0–14	0–3
	Gardner's saltbush	ATGA	*Atriplex gardneri*	0–14	0–3
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	5–14	1–3
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–14	0–3
	slender buckwheat	ERMIL2	*Eriogonum microthecum var. laxiflorum*	0–14	0–3
	spineless horsebrush	TECA2	*Tetradymia canescens*	0–14	0–3
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	0–14	0–3
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–5	0–1

Animal community

The following table lists suggested stocking rates for cattle under continuous season-long grazing under normal growing conditions with a harvest efficiency (HE) of 25 percent. These are conservative estimates that should be used only as guidelines in the initial stages of the conservation planning process. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). A field visit is required to document actual plant composition and production. More precise carrying capacity estimates, considering forage preference and accessibility (slope, distance to water, etc.), should be calculated using field data, particularly when grazers other than cattle are involved. Under more intensive grazing management, improved harvest efficiencies (up to 35 percent) can result in an increased carrying capacity, but recovery time for upland sites is much longer. If distribution problems occur, stocking rates should be reduced or facilitating conservation practices (i.e., cross-fencing, water development) implemented to maintain plant health and vigor.

Stocking rates are expressed in Animal Unit Months (AUMs) which is defined as the amount of forage consumed by a 1,000 lb. cow with a less than 4 month old calf at her side.

Plant Community Production (lbs./ac.) Initial Suggested Stocking Rate (AUMs/ac.)* Ac./AUM
1.1 Bunchgrass: 350-450-650 0.09 11
2.1 Short-stature grass/Mat-forming forbs: 250-350-550 0.04 25
3.1 Annual: 100-200-450 0.03 33

* Continuous, season-long grazing by cattle under average growing conditions.

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

Not all kinds of livestock or wildlife have the same forage demand as a 1000-pound lactating cow. In addition, forage demand varies within a species depending on its class, i.e., its growth rate (e.g. heifers and steers vs. mature cow), lactating and maintenance (e.g., dry cow vs cow with calf). For this reason, animal unit equivalents (AUE) are provided in the National Range & Pasture Handbook to assist with this approximate determination of forage demand based on the kind, class and size of animal (NRPH, 2003). For cattle with a different average weight than a 1000 pound average, AUE can be adjusted (i.e., every 100 pounds of animal weight equates to about 0.10 Animals Units thus a 1200-pound cow with a calf would be 1.2 AUE .

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

Distance to water, shrub density, and slope can affect grazing capacity within a management unit. Accessibility adjustments should be made for the planning area as necessary. For example, 30 percent of a management unit

may have 25 percent slopes and distances of greater than one mile from water, resulting in a 50% reduction in grazing access; therefore, the adjustment is calculated for 30 percent of the unit (i.e. 50 percent reduction on 30 percent of the management unit). Fencing, slope length, management, access, terrain, kind and class of livestock, and breeds are all factors that can increase or decrease the percent of grazing access within a management unit. Adjustments should be made that incorporate these factors when calculating the carrying capacity of a management unit.

Wildlife Interpretations:
Sagebrush grassland habitats are critically important for wildlife. The LRU provides crucial winter range for mule deer, elk, pronghorn and moose. Portions of the LRU fall within overlapping crucial winter range delineated for three species of big game. Nearly all of the LRU in Wyoming supports a designated migration corridor and numerous associated stopover habitats, where thousands of mule deer from the Wyoming Range Herd Unit move north and south between summer and winter ranges. Healthy vegetative communities within migration stopover areas are extremely important as forage and cover where mule deer may spend several days resting and feeding to refuel before moving again. The middle segment of the LRU (east and west of the Bear River) is within sage grouse core habitat, providing breeding leks, nesting, early brood rearing, late brood rearing, and winter habitats. Maintaining intact high quality sagebrush grassland habitats with a diversity of successional stages is vitally important for meeting the needs of wildlife using this landscape.
Wildlife Habitat Threats:
Winter moisture characteristics of the BRV LRU promote environmental conditions ideal for cheatgrass establishment and persistence. Cheatgrass presence is increasing and competing with native perennial grasses and forbs to deteriorate habitat function for big game, sage grouse and other sagebrush obligate wildlife. Advanced cheatgrass invasion is expected to alter fire regimes to a shorter Fire Return Interval outside the natural range of variability, where sagebrush stands burn frequently resulting in a reduction of browse and cover availability for wildlife. Eventually, shrub cover dominance could revert to green (aka yellow rabbitbrush in USDA PLANTS) or rubber rabbitbrush, significantly impacting wildlife dependent on sagebrush in this landscape for survival.
Current and future anthropogenic impacts to sagebrush grasslands include agriculture expansion, energy development, water storage projects, and subdivision/residential development. Increasing demand for expanding private lands hay production has seen conversion of sagebrush stands in and near sage grouse core habitat to center pivot sprinkler irrigation. Sage grouse may use these new fields during the late brood rearing period, but there is a loss of important sagebrush cover for escape, lekking, nesting, and winter cover/forage as critical life stage habitat needs for sage grouse. Energy transmission projects have recently created interest and opportunities for solar farm development in the LRU. These solar energy projects could permanently convert site specific sagebrush-grassland habitat to industrial development locations with negative cumulative impacts for sage grouse, wintering big game, and other sagebrush dependent wildlife. Aesthetic values of the Cokeville area may attract future demand for small acreage home developments, especially in the Smith’s Fork River Valley and Raymond Mountain foothills. Increased fencing and sagebrush removal usually associated with residential development could be extremely detrimental to big game migration and migration stopover habitats.
Wildlife Habitat Uses:
This site supports fringed sagewort, which is a preferred forage for wintering wildlife. When located on south and west aspect slopes and windswept ridge tops during winter months with little to no snow accumulation, it is an important browse component for pronghorn, mule deer, and elk. Associated bunchgrasses and rhizomatous grasses may exhibit low productivity, but serve as readily available winter forage for elk due to the same site characteristics.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is highly variable and is dominated by soils in hydrologic groups B and C. Infiltration ranges from moderately slow to moderate, largely due to high amounts of rock framents on the soil surface. Runoff potential for this site varies from moderate to high depending on soil hydrologic group, slope 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 plant cover is less than 50% and rock fragment is greater 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 are not typically present due to vegetative cover and rock fragments on the surface that armor the site. Water flow patterns should be barely distinguishable. Pedestals are only slightly present in association with

bunchgrasses . Herbaceous litter expected to move only in short distances (to leeward side of shrubs) due to wind. Woody litter will show short movement (less than 3 feet) associated with large precipitation events on steeper slopes (>8%).Chemical and physical crusts are rare to non-existent. Biological crusts are present, but only cover up to 1% of the soil surface.

Recreational uses

This site provides hunting opportunities for upland game species. The wide variety of plants which bloom in the spring have an aesthetic value that appeals to recreationists and combined with landscape position attract pollinators such as butterflies.

Inventory data references

Information presented here has been derived from historic and recent clipping data and other inventory data. Field observations from range trained personnel were also used.

References

. 2021 (Date accessed). USDA PLANTS Database. http://plants.usda.gov.

. 2021 (Date accessed). USNVC [United States National Vegetation Classification]. 2019. United States National Vegetation Classification Database, V2.03. Federal Geographic Data Committee, Vegetation Subcommittee, Washington DC.. USNVC: http://usnvc.org/.

. 2003. National Range and Pasture Handbook (NRPH). United States Department of Agriculture, Natural Resources Conservation Service, Washington, D.C..

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. Jornal of Range Management 56:114–126.

Bestelmeyer, B., J.R. Brown, J.E. Herrick, D.A. Trujillo, and K.M. Havstad. 2004. Land Management in the American Southwest: a state-and-transition approach to ecosystem complexity. Environmental Management 34:38–51.

Bestelmeyer, B. and J. Brown. 2005. State-and-Transition Models 101: A Fresh look at vegetation change.

Bestelmeyer, B.T., K. Moseley, P.L. Shaver, H. Sanchez, D.D. Briske, and M.E. Fernandez-Gimenez. 2010. Practical guidance for developing state-and-transition models. Rangelands 32:23–30.

Bonnin, G.M., D. Martin, T. Lin, M. Parzybok, M. Yekta, and D. Riley. 2011 (Date accessed). “Precipitation-Frequency Atlas of the United States” NOAA Atlas 14, Volume 1 Version 5.0. https://hdsc.nws.noaa.gov/hdsc/pfds/.

Briske, D.D., B.T. Bestelmeyer, T.K. Stringham, and P.L. Shaver. 2008. Recommendations for Development of Resilience-Based State-and-Transition Models. Rangeland Ecology & Management 61:359–367.

Chambers, J.C., J.L. Beck, T.J. Christiansen, K.J. Clause, J.B. Dinkins, K.E. Doherty, K.A. Griffin, D.W. Havlina, K.F. Henke, L.L. Kurth, J.D. Maestas, M. Manning, K.E. Mayer, B.A. Mealor, C. McCarthy, M.A. Perea, and D.A. Pyke. 2016. Using resilience and resistance concepts to manage threats to sagebrush ecosystems, Gunnison sage-grouse, and Greater sage-grouse in their eastern range: A strategic multi-scale approach.. Gen. Tech. Rep.

RMRS-GTR-356.. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO. 1–143.

Miller, J.F., R.H. Frederick, and R.J. Tracey. 1973. “Precipitation-Frequency Atlas of the United States” NOAA Atlas 2, Volume 5 (Idaho). National Weather Service, Silver Spring, Maryland.

Miller, J.F., R.H. Frederick, and R.J. Tracey. 1973. “Precipitation-Frequency Atlas of the United States” NOAA Atlas 2, Volume 2 (Wyoming). National Weather Service, Silver Spring, Maryland.

Ott, J., F.F. Kilkenny, and D.D. Summers. 2019. Long-term vegetation recovery and invasive annual suppression in native and introduced postfire seeding treatments.. Rangeland Ecology & Management 72:640–653.

Schoeneberger, P.J. and D.A. Wysocki. 2017. Geomorphic Description System, Version 5.0..

Stringham, T.K., W.C. Kreuger, and P.L. Shaver. 2003. State and Transition Modeling: an ecological process approach. Journal of Range Management 56:106–113.

Other references

Site concept, plant community data, and interpretations are based on ecological site descriptions (ESDs) from MLRA 34A-Foothills and Basins West (10-14W).
This ESD replaces R034AY212WY Gravelly MLRA 34A-Foothills and Basins West (Gr 10-14W), but only within geographic extent of the Bear River Valley LRU.
Further data collection and ecological site refinement are ongoing until the ESD has reached "Approved" status.

Contributors

Bryan Christensen
Karen Clause

Approval

Kirt Walstad, 9/07/2023

Acknowledgments

Utah State University
Wyoming Game and Fish

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	04/20/2024
Approved by	Kirt Walstad

Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

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

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

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

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

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

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

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

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

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

    Dominant:

    Sub-dominant:

Other:

Additional:

---

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

---

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

---

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

---

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

---

17. **Perennial plant reproductive capability:**
