USDA Natural Resources
Conservation Service

Ecological site R058AE015MT
Shale (Sh) RRU 58A-E 10-14" p.z.

Accessed: 05/19/2024

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.

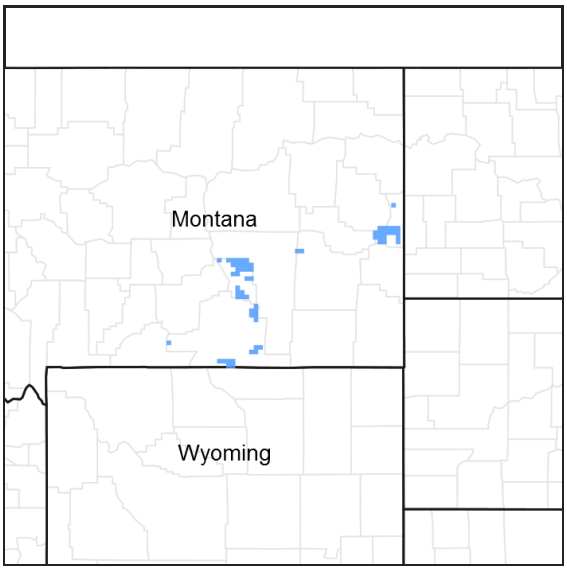


Figure 1. Mapped extent

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

Associated sites

R058AE192MT	**Coarse Clay (CC) RRU 58A-E 10-14" p.z.**
R058AE199MT	**Shallow Clay (SwC) RRU 58A-E 10-14" p.z.**

Similar sites

R058AE011MT	**Saline Upland (SU) RRU 58A-E 10-14" p.z.** The Saline Upland site is dominated by salt tolerant plants.
R058AE014MT	**Dense Clay (DC) RRU 58A-E 10-14" p.z.** The Dense Clay site has moderately deep to deep nongranular heavy clays that are overlain by thin ineffectual layers.
R058AE013MT	**Claypan (Cp) RRU 58A-E 10-14" p.z.** The Claypan site is moderately deep to very deep soils that have a hard claypan layer at about 2-8 inches from the surface. These sites are all more productive and have a more diverse plant community.
R058AE192MT	**Coarse Clay (CC) RRU 58A-E 10-14" p.z.** The Coarse Clay differs mainly by having a more diverse community of plants that are typically on a Sandy site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This ecological site occurs on hills and plains in shale uplands. Slopes range from 0 to 45 percent, but are mainly less than 8 percent. This site occurs on all exposures and aspect is not significant. This site is very barren and extremely low producing.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Plain
Flooding frequency	None
Ponding frequency	None
Elevation	579–1,067 m
Slope	0–45%
Water table depth	152 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRAs 58A and 60B are considered to have a continental climate characterized by cold winters, hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature are typical. The climate is the result of this MLRA's location in the geographic center of North America. There are few natural barriers on the northern Great Plains and the winds move freely across the plains and account for rapid changes in temperature. Seasonal precipitation is often limiting for plant growth. Annual fluctuations in species composition and total production are typical depending on the amount and timing of rainfall.
Temperatures can be very extreme in this part of Montana. Summer daytime temperatures are typically quite warm, generally averaging in the mid to upper 80º's F for July and August. Summertime temperatures will typically reach in the 100º's F at some point during the summer, and can reach 90º F any month between May and September. Conversely, winter temperatures can be cold, averaging in the mid teens to mid 20º's F for December and January. There will typically be several days of below zero temperatures each winter. It is not uncommon for temperatures to reach 30–40º F below zero, or even colder, most any winter.

Spring can be windy throughout these MLRA's, with winds averaging over 10 mph about 15 percent of the time. Speeds of 50 mph or stronger can occasionally occur as a weather system crosses this part of Montana.

MLRAs 58AE and 60BE have been divided into two distinct precipitation zones for the purpose of developing ecological site descriptions: 10–14" Mean Annual Precipitation (MAP) and 15–19" MAP.

10–14 inch zone:

The majority of the rangeland in these areas falls within the 11 to 13 inch range. During an average year, 70 to 75 percent of the annual precipitation falls between April and September, which are the primary growing season months.

Snowfall is not heavy in the area, averaging 28 total inches in the 10-14 inch MAP (Yellowstone Valley). Heavy snowfall occurs infrequently, usually late in the winter or early spring. Snow cover is typically 1 to 3 inches.

The frost free (32º F.) season averages about 105 to 145 days each year in the uplands, to nearly 170 days along the Yellowstone River Valley.

For local climate station information, refer to http://www.wcc.nrcs.usda.gov/cgibin/state.pl?state=mt.

Table 3. Representative climatic features

Frost-free period (average)	145 days
Freeze-free period (average)	170 days
Precipitation total (average)	356 mm

Influencing water features

There are no influencing water features for this site.

Soil features

The soils are formed in alluvium or residuum from semiconsolidated, often acid, shales. Shale fragments are common on the surface. These soils are mainly 10 to 40 inches deep and very drougthy. Soil colors are often dark due to the parent material (e.g., lithochromic) and not from organic matter. Textures tend to be clayey.

Table 4. Representative soil features

Surface texture	(1) Silty clay
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Slow
Soil depth	25–102 cm
Available water capacity (0-101.6cm)	0–5.08 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	8–16 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	5–13
Soil reaction (1:1 water) (0-101.6cm)	3.6–6.5

Ecological dynamics

This site developed under Northern Great Plains climatic conditions, which included the natural influence of large herbivores and occasional fire. The plant community upon which interpretations are primarily based is the Historic Climax Plant Community (HCPC). This community is given as a reference to understand the original potential of this site, and is not always considered to be the management goal for every acre of rangeland. The following descriptions should enable the landowner or manager to better understand which plant communities occupy their land, and assist with setting goals for vegetation management. It can also be useful to understand the environmental and economic values of each plant community.

Due to the severe soil limitations of this site, species diversity and total annual production is very low. Soil erosion is high due to the high proportion of bare ground.

Continual adverse impacts to this site over a period of years will result in the decrease of the medium grasses and shrubs, such as western wheatgrass, greasewood, and Nuttall’s saltbush.

Continued disturbances will cause the loss of the greasewood, winterfat, and shadscale. The shrubs will be

replaced by longleaf sagebrush once the ecological threshold has been crossed.

Plants that are not a part of the climax community that are most likely to invade are plains pricklypear and broom snakeweed.

State and transition model

MLRA: 58A – Sedimentary Plains, East
MLRA: 60B – Pierre Shale Plains, East
R058AE075MT, R060BE575MT

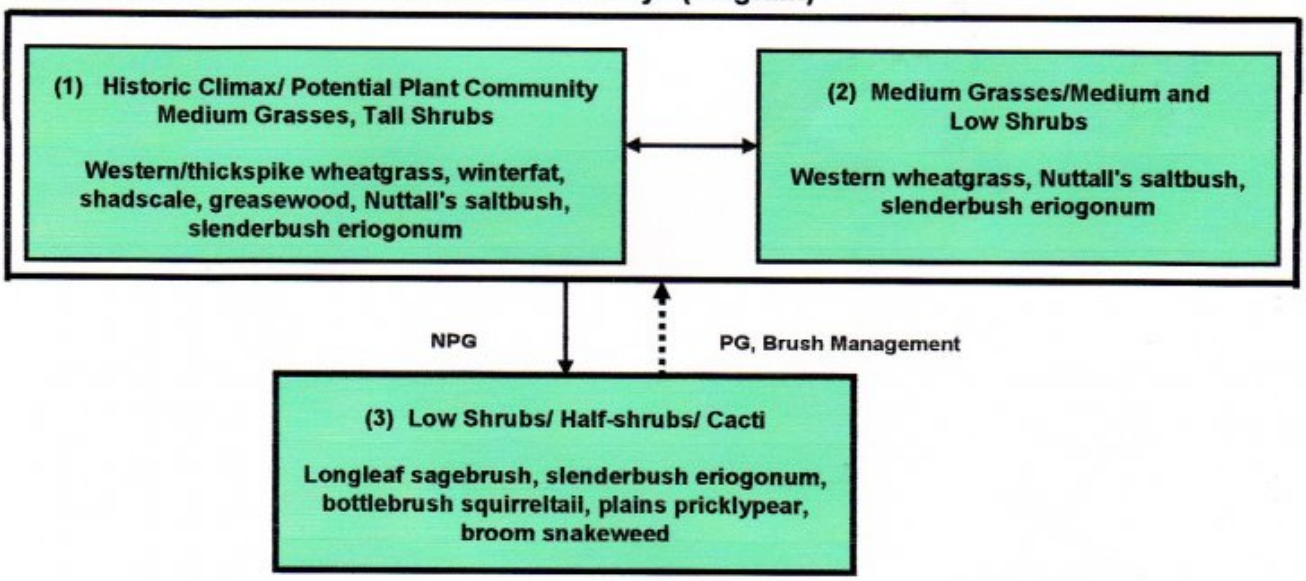
Plant Community 3: Low Shrubs/ Half-shrubs / Cacti: With continual adverse impacts to Plant Community 2, the plant community tends to become dominated by species such as **longleaf sagebrush, slenderbush eriogonum, and bottlebrush squirreltail.** There may still be remnant amounts of some of the mid-seral species such as western or thickspike and Montana wheatgrass. **Broom snakeweed** often invades this site.

Grass biomass production and litter become reduced on the site as the grasses disappear, increasing evaporation and reducing moisture retention. Additional open space in the community can result in undesirable invader species. This plant community provides for extremely low soil stability.

These communities will respond positively to improved grazing management, but significant economic inputs and time would be required to move them toward a higher successional stage and a more productive plant community.

10b. Plant Communities and Transitional Pathways (State and Transition Model): Transitions in plant community composition occur along a gradient that is not linear. Many processes are involved in the changes from one community to another. Changes in climate, elevation, soils, landform, fire patterns and frequency, and grazing all play a role in determining which of the plant communities will be expressed. The following model outlines some of the various plant communities that may occur on this site and provides a diagram of the relationship between plant community and type of use or disturbance.

Plant Communities and Transitional Pathways (diagram)



Smaller boxes within a larger box indicate that these communities will normally shift among themselves with slight variations in precipitation and other disturbances. Moving outside the larger box indicates the community has crossed a threshold (heavier line) and will require intensive treatment to return to Community 1 or 2. Dotted lines indicate a reduced probability for success.

NOTE: Not all species present in the community are listed in this table. Species listed are representative of the plant functional groups that occur in the community.

PG = Prescribed Grazing: Use of a planned grazing strategy to balance animal forage demand with available forage resources. Timing, duration, and frequency of grazing are controlled and some type of grazing rotation is applied to allow for plant recovery following grazing.

NPG = Non-Prescribed Grazing: Grazing which has taken place that does not control the factors as listed above, or animal forage demand is higher than the available forage supply.

State 1
Plant Community 1: Medium Grasses/ Tall Shrubs

Community 1.1
Plant Community 1: Medium Grasses/ Tall Shrubs

This is the interpretive plant community and is considered to be the Historic Climax Plant Community (HCPC) for this site. This plant community contains a low diversity of medium cool season grasses (western and thickspike wheatgrass, Montana wheatgrass, Sandberg bluegrass, and bottlebrush squirreltail). A few forbs occur in small percentages. Shrubs that occur on this site include winterfat, shadscale, greasewood, and Nuttall's saltbush. Due to the severe soil limitations of this site, species diversity and total annual production is very low. Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation and temperature). Plant litter is very limited due to low annual productivity. This plant community provides for limited soil stability as bare ground is commonly greater than 75% cover.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	135	235	336
Shrub/Vine	78	137	196
Forb	11	20	28
Total	**224**	**392**	**560**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	10-15%
Grass/grasslike foliar cover	10-15%
Forb foliar cover	1-5%
Non-vascular plants	0%
Biological crusts	0-1%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 7. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	1-2%
Grass/grasslike basal cover	1-5%
Forb basal cover	1-2%
Non-vascular plants	0%
Biological crusts	0-1%
Litter	5-10%
Surface fragments >0.25" and <=3"	0-1%
Surface fragments >3"	0%

Bedrock	0%
Water	0%
Bare ground	75-85%

Table 8. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	–	–
>0.15 <= 0.3	–	–	–	–
>0.3 <= 0.6	–	10-15%	10-15%	1-5%
>0.6 <= 1.4	–	–	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

State 2
Plant Community 2: Medium Grasses/ Medium and Low Shrubs

Community 2.1
Plant Community 2: Medium Grasses/ Medium and Low Shrubs

Slight variations in the Historical Climax Plant Community result in a community where the diversity of shrubs is lowered. Species that tend to dominate include western wheatgrass, Nuttall's saltbush, and slenderbush eriogonum.

State 3
Plant Community 3: Low Shrubs/ Half-shrubs / Cacti

Community 3.1
Plant Community 3: Low Shrubs/ Half-shrubs / Cacti

With continual adverse impacts to Plant Community 2, the plant community tends to become dominated by species such as longleaf sagebrush, slenderbush eriogonum, and bottlebrush squirreltail. There may still be remnant amounts of some of the mid-seral species such as western or thickspike and Montana wheatgrass. Broom snakeweed often invades this site. Grass biomass production and litter become reduced on the site as the grasses disappear, increasing evaporation and reducing moisture retention. Additional open space in the community can result in undesirable invader species. This plant community provides for extremely low soil stability. These communities will respond positively to improved grazing management, but significant economic inputs and time would be required to move them toward a higher successional stage and a more productive plant community.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Native grasses**			135–280	
	tufted wheatgrass	ELMA7	*Elymus macrourus*	45–168	–
	western wheatgrass	PASM	*Pascopyrum smithii*	45–168	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–112	–
	Montana wheatgrass	ELAL7	*Elymus albicans*	11–84	–
2	**Native grasses**			2–56	
	Grass, perennial	2GP	*Grass, perennial*	2–28	–
	saltgrass	DISP	*Distichlis spicata*	2–28	–
	squirreltail	ELEL5	*Elymus elymoides*	2–28	–
	Sandberg bluegrass	POSE	*Poa secunda*	2–28	–
Forb					
3	**Native forbs**			11–28	
	Forb, perennial	2FP	*Forb, perennial*	2–28	–
	buckwheat	ERIOG	*Eriogonum*	2–28	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	2–28	–
	desertparsley	LOMAT	*Lomatium*	2–28	–
	American vetch	VIAM	*Vicia americana*	2–28	–
Shrub/Vine					
4	**Native shrubs and half-shrubs**			78–196	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	2–112	–
	Nuttall's saltbush	ATNU2	*Atriplex nuttallii*	2–112	–
	Shrub, broadleaf	2SB	*Shrub, broadleaf*	2–112	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	2–112	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	2–112	–
	longleaf wormwood	ARLO7	*Artemisia longifolia*	11–56	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	11–56	–
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	0–28	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–28	–
5	**Native shrubs and half-shrubs**			1–2	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	1–2	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	1–2	–

Animal community

Livestock Grazing Interpretations:

This plant community is not well suited to managed livestock grazing due to low forage production. The steeper slopes may also limit livestock travel and result in poor grazing distribution, especially in areas away from water. Management objectives should include maintenance or improvement of the vegetation community. Short grazing periods and adequate re-growth after grazing are recommended for plant recovery. Season long use of this site can be detrimental, causing an increase in bare ground and altering the plant community over time.

Whenever Plant Community 2 occurs (medium grasses and shrubs), grazing management strategies need to be implemented to avoid further deterioration.

It is not feasible to improve the site when the dominant community type is similar to 3. Often, when this site is in this condition, there is a significant amount of erosion pavement or bare ground present. Community 3 has lost most of the attributes of healthy rangeland, including good infiltration, minimal erosion and runoff, nutrient cycling and energy use.

WILDLIFE INTERPRETATIONS:

The following is a description of habitat values for the different plant communities that may occupy the site:

Plant Community 1: Medium Grasses/ Tall Shrubs (HCPC):
The high percentage of nutritious shrubs and half-shrubs favors browsers and mixed feeders like mule deer and pronghorn, particularly on winter range. Seed production from shadscale, greasewood and other shrubs and half-shrubs supports seed-eating small mammals such as deer mice and kangaroo rats. Ground-nesting bird habitat is limited. Common nighthawks, loggerhead shrikes and Brewer's sparrows are potential breeding birds. A variety of raptors hunt small mammals, insects and birds in this habitat.

Plant Community 2: Medium Grasses/ Medium and Low Shrubs:
Big game habitat value declines with the loss of winterfat and other browse plants. General habitat diversity declines with a partial loss of vegetative structural diversity. If big sagebrush increases, Brewer's sparrow may benefit.

Plant Community 3: Low Shrubs/ Half-shrubs/ Cacti:
Wildlife habitat values are quite low in this community following the loss of plant species products and structural diversity.

Hydrological functions

The soils associated with this ecological site are generally in Hydrologic Soil Group D. The infiltration rates for these soils will normally be slow. The runoff potential for this site is high to very high, depending on slope and ground cover/health. Runoff curve numbers generally range from 85 to 94.

The hydrologic condition of this site has a significant affect on runoff. The hydrologic condition considers the effects of cover, including litter, and management on infiltration. Good hydrologic condition indicates that the site usually has a lower runoff potential. (Reference: Engineering Field Manual, Chapter 2 and Montana Supplement 4).

Recreational uses

This site supports sparse vegetation and recreational access is often difficult. This site provides valuable open space and visual aesthetics.

Other information

The following is an example of how to calculate the recommended stocking rate. This example does not use production estimates from this specific ecological site. You will need to adjust the annual production values and run the calculations using total annual production values from the ecological sites encountered on each individual ranch/pasture. Before making specific recommendations, an on-site evaluation must be made.

Example of total annual production amounts by type of year:
Favorable years = 2200 lbs/acre
Normal years = 1480 lbs/acre
Unfavorable years = 1200 lbs/acre

It is recommended that on slopes of 30% or less, stocking rate should be derived from the total annual production

pounds minus 500 pounds for residual dry matter and 25% harvest efficiency. On slopes over 30%, stocking rate is derived from total annual production pounds minus 800 pounds for residual dry matter and 25% harvest efficiency. Refer to the NRCS National Range and Pasture Handbook for a list of Animal Unit Equivalents.

Sample Calculations using Favorable Year production amounts:

< 30% slopes: AUM/AC = [(2200-500)(0.25)]/915 lbs/month for one AU = 0.46 AUM/AC
AC/AUM = (1.0 AU)/(0.46AUM/AC) = 2.2 AC/AUM

> 30% slopes: AUM/AC = [(2200-800)(0.25)]/915 lbs/month for one AU = 0.38 AUM/AC
AC/AUM = (1.0 AU)/(0.38 AUM/AC) = 2.6 AC/AUM

NOTE: 915 lbs/month for one Animal Unit is used as the baseline for maintenance requirements. This equates to 30 lbs/day of air-dry forage (1200 lb cow at 2.5% of body weight).

Inventory data references

NRCS-Production & Composition Record for Native Grazing Lands (Range-417): 3

BLM-Soil & Vegetation Inventory Method (SVIM) Data: 6

NRCS-Range Condition Record (ECS-2): 2

NRCS-Range/Soil Correlation Observations & Soil 232 notes: 9

Contributors

Bob Leinard
JVF, REL, RSN, MJR, SKW, SVF, POH

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)	T. DeCock; R Kilian; K Kilwine
Contact for lead author	Tammy DeCock
Date	06/11/2014
Approved by	Jon Siddoway
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** On Slopes > 15% rill may be long (>5 feet) and continuous. If rills are present on slopes < 15% they should be < 3feet long and not continuous.

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2. **Presence of water flow patterns:** Water flow paths may be obvious, regular and continuous with debris dams occurring only on lesser slopes.

3. **Number and height of erosional pedestals or terracettes:** Pedestals up to 0.5 inches and terracettes at debris dams are common.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is < 75%. Bare ground will occur in quite large areas.

5. **Number of gullies and erosion associated with gullies:** Active gullies may be present on steeper slopes.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None.

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

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Surface Soil Aggregate Stability under plant canopy should typically be 3 or greater. Surface Soil Aggregate Stability not under plant canopy should typically be 2 or slightly less.

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

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Sparse plant canopy, slow infiltration rates, and the high amount of bare ground contribute to a naturally high runoff rate even in Reference condition.

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 would be expected but soil surface is typically crusted when dry.

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, rhizomatous grasses = shrubs and half shrubs

    Sub-dominant:

    Other: Minor Species: forbs = cool season, short-stature bunch grasses and sedges = Warm season, mid-stature, rhizomatous grasses = Warm season, tall-stature, rhizomatous grasses = Cool season, mid-stature, bunch grasses

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Some plant mortality and decadence (10 to 15%) is expected on this site.

14. **Average percent litter cover (%) and depth (in):** Litter cover is in contact with soil surface with little evidence of biological activity.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 425 to 500 #/acre (13 to 14 inch precip. Zone) 200 to 350 #/ac (10 to 12 inch precip. Zone).

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:** Halogeton, Leafy spurge, knapweeds, whitetop, Dalmatian toadflax, yellow toadflax, St. Johnswort, perennial pepperweed, Yellow sweetclover

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