

Ecological site R058AE014MT
Dense Clay (DC)
RRU 58A-E 10-14" p.z.

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General information

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

Associated sites

R058AE002MT	Clayey (Cy) RRU 58A-E 10-14" p.z.
R058AE011MT	Saline Upland (SU) RRU 58A-E 10-14" p.z.
R058AE013MT	Claypan (Cp) RRU 58A-E 10-14" p.z.

Similar sites

R058AE015MT	Shale (Sh) RRU 58A-E 10-14" p.z. The Shale site differs by having soils that are usually shallow with very little soil profile evident.
R058AE013MT	Claypan (Cp) RRU 58A-E 10-14" p.z. The ClayPan site differs by generally having 2-8 inches of soil over the hard argillic layer, less bare ground, and higher production.
R058AE011MT	Saline Upland (SU) RRU 58A-E 10-14" p.z. The Saline Upland site differs by not having the very hard layer near the surface and by having a plant community of mainly salt tolerant species. In addition, the electroconductivities significantly limit, if not prohibit, the potential for any form of mechanical treatment or reseeding on the Saline Upland. Soils in the Saline Upland site generally are given a Capability Class rating of 7. (Soils in the Dense Clay site are generally Capability Class 6.)

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This site occurs on old lake plains, sedimentary plains, terraces, and fans. Slopes range from 0 to 15 percent, but are mainly less than 8. This site occurs on all exposures and aspect is not significant. Alkali accumulations are apparent and salt tolerant plants are a major component of the vegetative community.

Table 2. Representative physiographic features

Landforms	(1) Lake plain (2) Plain (3) Terrace
Flooding frequency	None
Ponding frequency	None
Elevation	580 – 1,070 m
Slope	0 – 20 %
Water table depth	150 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 80°s F for July and August. Summertime temperatures will typically reach in the 100°s F at some point during the summer, and can reach 90° F any month between May and September. Conversely, winter temperatures can be cold, averaging in the mid teens to mid 20°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 30–40° 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 (32° 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)	150 days
Freeze-free period (average)	170 days
Precipitation total (average)	360 mm

Influencing water features

Soil features

These are moderately deep to very deep nongranular clay soils that are strongly to very strongly alkaline. They are hard to very hard when dry and very sticky when wet. They typically have a thin vesicular crust on the surface. The subsoil is mainly massive, or has very strong columnar structure. Permeability and root development are severely limited by the surface crust, hard subsoil, and alkalinity.

Table 4. Representative soil features

Surface texture	(1) Clay (2) Silty clay (3) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Very slow
Soil depth	100 – 150 cm
Available water capacity (0-101.6cm)	12.7 – 25.4 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 10 %
Electrical conductivity (0-101.6cm)	0 – 10 mmhos/cm

Sodium adsorption ratio (0-101.6cm)	10 – 30
Soil reaction (1:1 water) (0-101.6cm)	7.8 – 9.6

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 described 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.

This site is considered moderately resilient to disturbance as it has moderate to high soil limitations for plant growth. Changes may occur to the Historic Climax Plant Community due to management actions and/or climatic conditions. Under continued adverse impacts, a moderate decline in vegetative vigor and composition will occur. Under favorable vegetative management treatments, this site can more readily return to a community that resembles the Historic Climax Plant Community.

Continual adverse impacts to the site over a period of years results in a departure from the HCPC, with a decrease of the taller, more palatable species such as western and thickspike wheatgrasses, green needlegrass, and Nuttall's saltbush. These plants will begin to be replaced by short grasses such as Sandberg bluegrass and blue grama. Continued deterioration results in a community dominated by Wyoming big sagebrush, plains pricklypear, bottlebrush squirreltail, blue grama, and Sandberg bluegrass with a corresponding increase in the amount of bare ground.

Plants that are not a part of the climax community that are most likely to invade are annual bromes, annual forbs, and broom snakeweed.

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	Native grasses			230-504	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	118-404	–
	tufted wheatgrass	ELMA7	<i>Elymus macrourus</i>	118-404	–
	green needlegrass	NAVI4	<i>Nassella viridula</i>	4-101	–
	Montana wheatgrass	ELAL7	<i>Elymus albicans</i>	0-101	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	4-50	–
2	Native grasses and sedges			4-101	
	Grass, perennial	2GP	<i>Grass, perennial</i>	4-50	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	4-50	–
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	4-50	–
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	4-50	–
	plains reedgrass	CAMO	<i>Calamagrostis montanensis</i>	4-50	–
	saltgrass	DISP	<i>Distichlis spicata</i>	4-50	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	4-50	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	4-50	–

	Sandberg bluegrass	POSE	<i>Poa secunda</i>	4-50	–
	alkali sacaton	SPAI	<i>Sporobolus airoides</i>	4-50	–
Forb					
3	Native forbs			20-50	
	Forb, perennial	2FP	<i>Forb, perennial</i>	4-50	–
	common yarrow	ACMI2	<i>Achillea millefolium</i>	4-50	–
	onion	ALLIU	<i>Allium</i>	4-50	–
	aster	ASTER	<i>Aster</i>	4-50	–
	milkvetch	ASTRA	<i>Astragalus</i>	4-50	–
	buckwheat	ERIOG	<i>Eriogonum</i>	4-50	–
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	4-50	–
	desertparsley	LOMAT	<i>Lomatium</i>	4-50	–
	prairie thermopsis	THRH	<i>Thermopsis rhombifolia</i>	4-50	–
Shrub/Vine					
4	Native shrubs and half-shrubs			137-353	
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	39-252	–
	Nuttall's saltbush	ATNU2	<i>Atriplex nuttallii</i>	39-252	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	4-101	–
	greasewood	SAVE4	<i>Sarcobatus vermiculatus</i>	4-101	–
	Shrub, broadleaf	2SB	<i>Shrub, broadleaf</i>	4-101	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	4-50	–
5	Native shrubs and half-shrubs			1-2	
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	1-2	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	1-2	–

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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Animal community

Livestock Grazing Interpretations: Managed livestock grazing is suitable on this site as it has the potential to produce a moderate amount of high quality forage. Management objectives should include maintenance or improvement of the plant community. Shorter grazing periods and adequate re-growth after grazing are recommended for plant maintenance and recovery. Heavy stocking and season long use of this site can be detrimental and will alter the plant community composition and production over time. Whenever Plant Community 2 occurs (shrubs and medium grasses), grazing management strategies need to be implemented to avoid further deterioration. This community is still stable, productive, and healthy provided it receives proper management. This community will respond fairly quickly to improved grazing management including increased growing season rest of key forage plants. Grazing management alone can usually move this community back to one more similar to potential if a good seed source of the taller grasses still exists. Plant Community 3 has severely reduced forage production (225 pounds per acre) and is comprised mostly of non-palatable species for livestock. Once this site is occupied by Plant Community 3, it will be more difficult to restore it to a community that resembles the potential with grazing management alone. Additional growing season rest in conjunction with mechanical treatment are often necessary for re-establishment of the desired species and to restore the stability and health of the site. The presence of sodium severely limits the potential for response to any treatments. Wildlife Interpretations: The following is a description of habitat values for the different plant communities that may occupy the site: Plant Community 1: Tall and Medium Grasses/ Forbs/ Shrubs (HCPC): The prevalence of Nuttall's saltbush, winterfat and Wyoming big sagebrush favors mixed feeders like the pronghorn. Nutritious early to mid-season forage is also available for grass feeders, including bison and elk. Sage grouse may use this open habitat for lek sites and feeding on sagebrush. Small mammal species composition will be dominated by seed-eaters, particularly deer mice. Brewer's sparrows and mountain plovers are examples of breeding bird species potentially using this community spring-fall. Relatively low amounts of litter and residual grass cover limit use by a number of ground-nesting bird species. Plant Community 2: Medium Shrubs/ Medium and Short Grasses: The reduction in tall grasses, Nuttall's saltbush and winterfat reduces habitat value for pronghorn and other ungulates, as well as seed-eating small mammals. An increase in

big sagebrush cover may improve winter and nesting habitat for sage grouse and spring-fall habitat for Brewer's sparrows and sage thrashers, but the decrease in litter and residual grass cover generally reduces nesting habitat quality for ground-nesting birds. Plant Community 3: Shrubs/ Cacti/ Annual Grasses and Forbs: Sagebrush specialists, including pronghorn, sage grouse and Brewer's sparrow may use this community seasonally; pronghorn during winter, sage grouse during winter and the nesting season, and Brewer's sparrow spring through fall migration. Seed-eating small mammals, especially deer mice, may thrive on annual forb seed production. The community has relatively low value for most wildlife species considering the lack of vegetative structural diversity, residual grass carry-over and litter cover.

Hydrological functions

The runoff potential for this site is very high depending on slope and ground cover/health. Runoff curve numbers generally range from 84 to 93. The soils associated with this ecological site are generally in Hydrologic Soil Group D. The infiltration rates for these soils will normally be very slow. Good hydrologic conditions exist on rangelands if plant cover (grass, litter, and brush canopy) is greater than 70%. Fair conditions exist when cover is between 30 and 70%, and poor conditions exist when cover is less than 30%. Sites in high similarity to HCPC (Plant Communities 1 and 2) generally have enough plant cover and litter to optimize infiltration, minimize runoff and erosion, and have a good hydrologic condition. The deep root systems of the potential vegetation help maintain or increase infiltration rates and reduce runoff. Sites in low similarity (Plant Community 3) are generally considered to be in poor hydrologic condition as the majority of plant cover is from shallow-rooted species and shrubs. Erosion is minor for sites in high similarity. Rills and gullies should not be present. Water flow patterns, if present, will be barely observable. Plant pedestals are essentially non-existent. Plant litter remains in place and is not moved by erosion. Soil surfaces should not be compacted or crusted. Plant cover and litter helps retain soil moisture for use by the plants. Maintaining a healthy stand of perennial vegetation will optimize the amount of precipitation that is received. (Reference: Engineering Field Manual, Chapter 2 and Montana Supplement 4).

Recreational uses

This site provides recreational opportunities for big game and upland bird hunting, and hiking. The forbs have flowers that appeal to photographers. 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: $AUM/AC = [(2200-500)(0.25)]/915 \text{ lbs/month for one AU} = 0.46$ AUM/AC $AC/AUM = (1.0 \text{ AU})/(0.46 AUM/AC) = 2.2$ $AC/AUM > 30\% \text{ slopes: } AUM/AC = [(2200-800)(0.25)]/915 \text{ lbs/month for one AU} = 0.38$ AUM/AC $AC/AUM = (1.0 \text{ AU})/(0.38 AUM/AC) = 2.6$ 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): NRCS-Range/Soil Correlation Observations & Soil 232 notes: 38

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
Contact for lead author	Tammy DeCock
Date	06/11/2014
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:** Water flow patterns are obvious and numerous and may reach up to 10 inches wide and 2 feet long.

3. **Number and height of erosional pedestals or terracettes:** Erosional pedestals up to ½ inch may be present. Terracettes should be minor.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is < 60%. Bare ground will occur in quit large areas.

5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present. Existing gullies should be “healed” with a good vegetative cover.

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. If litter movement occurs, it is only for a short distance.

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 5 or greater. Surface Soil Aggregate Stability not under plant

canopy should typically be 3 or slightly less.

9. Soil surface structure and SOM content (include type of structure and A-horizon color and thickness): Use soil survey series description.
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10. Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff: Sparse plant canopy (20% maximum), very slow to slow infiltration rates, and the high amount of bare ground contribute to a naturally high runoff rate even in HCPC.
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11. Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site): No compaction layer should be evident. This site is often typified by a vesicular surface (less than 2 inches) over a very hard subsoil.
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12. Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):

Dominant: Cool season, mid-stature, rhizomatous grasses

Sub-dominant: Shrubs and half shrubs >> Cool season, Mid-stature, Bunch grasses = Cool season, short-stature, bunch grasses and sedges = Warm season, mid-stature, bunch grasses

Other: Minor components: Cool season, short-stature, rhizomatous grasses and sedges = forbs = Warm season, mid-stature, rhizomatous grasses

Additional: (Blue grama should be grouped with warm season, short-stature, rhizomatous grasses due to its growth form)

13. Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence): Some plant mortality and decadence (5 to 10%) is expected on this site.
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14. Average percent litter cover (%) and depth (in): Litter cover is in contact with soil surface.
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15. Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production): 800 to 900 #/acre (13 to 14 inch precip. Zone) 350 to 700 #/ac (10 to 12 inch precip. Zone).
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16. Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:

Halogeton, knapweeds, whitetop, perennial pepperweed.

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