

Ecological site R012XY015ID

Steep Limestone

12-20 PZ CELE3/PSSPS-FEID

Last updated: 9/21/2020

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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.

MLRA notes

Major Land Resource Area (MLRA): 012X—Lost River Valleys and Mountains

Land Resource Region: B (Northwestern Wheat and Range) MLRA: 12 (Lost River Valleys and Mountains) EPA EcoRegion: Level III (Middle Rockies)

LRU notes

012X-Lost River Valleys and Mountains Precipitation or Climate Zone: 12-20" P.Z.
<https://soils.usda.gov/survey/geography/mlra/index.html>

Classification relationships

Cercocarpus ledifolius/*Agropyron spicatum* HT in "Hironaka, M., M.A. Fosberg, A. H. Winward. 1983. Sagebrush-Grass Habitat Types of Southern Idaho. University of Idaho. Moscow, Idaho. Bulletin Number 35."

Ecological site concept

Site does not receive additional water. Soils are: Not saline or saline-sodic. Shallow to very deep, with >35% (by volume) coarse fragments, skeletal within 20" of soil surface on limestone. Not strongly or violently effervescent in the to 20" of the soil profile, however CaCO₃ is present. textures usually range from loam to silt loam in surface mineral 4". Basalt bedrock occurs at or near 40" depth Slope is > 30%. Clay content is = 35% in surface mineral 4". Site does not have an argillic horizon with > 35% clay.

Associated sites

R012XY010ID	North Slope Loamy 12-16 PZ ARTR4/FEID
R012XY012ID	Loamy 12-16 PZ ARTRV/FEID-PSSPS
R012XY021ID	Loamy 16-22 PZ ARTRV/FEID
R012XY024ID	Subalpine Slope Loamy 20+ PZ ARTRS2/FEID

R012XY025ID	Shallow Subalpine 16+ PZ ARART/FEID
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Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Cercocarpus ledifolius</i>
Herbaceous	(1) <i>Pseudoroegneria spicata</i> ssp. <i>spicata</i> (2) <i>Festuca idahoensis</i>

Physiographic features

This site occurs on steep mountain slopes intermixed with rock outcrops and talus. Slopes range from 10 to 50 percent on all aspects. Elevation ranges from 6500 to 8000 feet (1900-2500 meters).

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Elevation	1,980 – 2,440 m
Slope	10 – 50 %

Climatic features

MLRA 12 is dominated by dramatic changes in elevation which, in turn, influence local weather patterns. The intermontane valleys have elevations as low as 3800 feet, while the adjacent mountains may reach more than 12,600 feet. The average annual precipitation for the entire MLRA, based on 10 long term climate stations located throughout the MLRA, is approximately 9.38 inches. However, the dry valleys may have averages as low as 6 inches, while the upper peaks may have averages that exceed 46 inches per year.

Temperatures vary considerably over the year. The average annual temperature is 42.25 degrees F. The average low is 27.4 degrees while the average high temperature is 57 degrees.

In the summer the sun shines 78% of the time, but drops to 40% in the winter. The prevailing wind is location-dependent, and generally flows parallel to the orientation of the dominant valleys. In the summer localized afternoon upslope winds and evening downslope winds are common. The average windspeed is greatest in the spring and early summer.

The frost free period ranges from 102 to 107 days while the freeze free period ranges from 134 to 139 days across the MLRA.

Table 3 Representative climatic features

Frost-free period (average)	110 days
Freeze-free period (average)	140 days
Precipitation total (average)	280 mm

Influencing water features

This site is not influenced by adjacent wetlands, streams or run on.

Soil features

The soils on this site are shallow or very deep to bedrock. The textures range from very cobbly, gravelly to extremely gravelly, or stony loams. Rock outcrops and talus slopes are common. Coarse fragments range from sixty to ninety percent in the profile. Parent materials are limestone or quartzite; however, granitic and volcanic materials also occur. These soils are well drained with moderate permeability. The available water capacity is very low to low. Water erosion is high due to excessive slopes over 20 percent. These soils are characterized by an aridic soil moisture regime or an aridic bordering on xeric. The soil temperature regime is frigid.

Table 4. Representative soil features

Surface texture	(1) Very gravelly loam (2) Very cobbly (3) Stony
Drainage class	Well drained
Permeability class	Moderate
Soil depth	50 – 150 cm
Surface fragment cover <=3"	20 – 40 %
Surface fragment cover >3"	10 – 30 %
Available water capacity (0-101.6cm)	2.54 – 11.18 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 10 %
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	0 – 10
Soil reaction (1:1 water) (0-101.6cm)	6.6 – 7.8

Subsurface fragment volume <=3" (Depth not specified)	20 – 80 %
Subsurface fragment volume >3" (Depth not specified)	40 – 50 %

Ecological dynamics

The dominant visual aspect of this site is of curleaf mountain mahogany. Mountain big sagebrush, Wyoming big sagebrush or black sagebrush may occur in the understory. Idaho fescue and bluebunch wheatgrass are co-dominant in the understory. Composition by weight is approximately 15 percent grass, 5 percent forbs and 80 percent shrubs and tree-like shrubs. These percentages are for current annual growth for all plants, irrespective of height.

The Historic Climax Plant Community (HCPC), the Reference State (State1), moves through many phases depending on the natural and man-made forces that impact the community over time. State 1, described later, indicates some of these phases. The Reference Plant Community Phase is Phase A. The plant species composition of Phase A is listed later under "Reference Plant community Phase Plant Species Composition".

During the last few thousand years, this site has evolved in an arid climate characterized by dry summers and cold, wet winters. Herbivory has historically occurred on this site at low levels of utilization. Herbivores include mule deer, Rocky Mountain elk, lagomorphs and small rodents. Fire has historically occurred on the site at intervals of 250-500 years.

Due to the variability of soil depth, from shallow to deep, curleaf mountain mahogany has a patchy or clumpy appearance on the landscape. For this reason when the site burns, fire moves across the site leaving a mosaic of burned and unburned areas. Utah juniper can be a minor component of this site at the lower elevations.

The Historic Climax Plant Community (HCPC) of this site is dominated by curleaf mountain mahogany in the overstory and Idaho fescue and bluebunch wheatgrass in the understory. Total annual production is 900 pounds per acre (1000 kilograms per hectare) in a normal year. Production in a favorable year is 1300 pounds per acre (1444 kg/ha). Production in an unfavorable year is 600 pounds per acre (666 kg/ha).

Structurally, curleaf mountain mahogany dominates the overstory. In the understory, cool season deep rooted perennial bunchgrasses are dominant, followed by tall shrubs being more dominant than perennial forbs while shallow rooted perennial bunchgrasses are subdominant.

FUNCTION

This site is suited for grazing by domestic livestock in the summer and fall. Livestock use the site for loafing as well as foraging.

Mule deer and Rocky Mountain elk use the site for thermal and hiding cover. Birds use the mahogany trees for nesting. This site is very important for nesting and summer habitat for mountain bluebirds.

The soils on this site have moderately high runoff potential.

The site has high value for hunting, camping (on non-stony and flat places), photography and picnicking. The mahogany shrubs provide visual diversity to the landscape. The site provides a source of fuel-wood for camping, picnics or barbecues. The wood is also used to make small specialty items.

Impacts on the Plant Community

Influence of fire

Where there is a juniper seed source in the vicinity and in the absence of normal fire frequency, juniper increases to the point of severely reducing nearly all of the understory and overstory species. Juniper has a greater growth rate, its shape is more tapered and it reaches greater heights. Consequently, juniper invading curleaf mountain mahogany sites eventually over tops them. Because mature curleaf mountain mahogany is shade intolerant, its competitive ability is lost, and it becomes senescent. See "Influence of juniper invasion" below.

Because of its topographic position on the landscape, ridgetops and sideslopes, fires started by lightning strikes are fairly common. Because of the variability of soil depth, from shallow to deep, curleaf mountain mahogany has a patchy or clumpy appearance on the landscape. For this reason when the site burns, fire moves across the site leaving a mosaic of burned and unburned areas. Fires of this

nature rarely involve large acreages due to surrounding rimrocks and other features that limit the spread of fire. The site rarely, if ever, burns in its entirety.

On the area that burns, shrubs such as young curleaf mountain mahogany, big sagebrush, black sagebrush and antelope bitterbrush, when present, will be killed. Idaho fescue may also suffer mortality. Recovery after fire is generally rapid due to the proximity of a desirable seed source and favorable moisture regime.

A frequent fire regime of one every 5-10 years generally does not develop on this site. The soils are too shallow and fuels are not continuous enough for frequent fire cycles to occur.

Influence of improper grazing management

Improper grazing management can damage this site moderately. Due to the rough and rocky nature of the site, livestock do not generally prefer to use it. Livestock use the site primarily for loafing and bedding. Forage production is low. When this site is being impacted by improper grazing management, adjacent sites that are more productive and less rocky are usually being much more severely degraded.

Season-long grazing and excessive utilization can be detrimental to this site; however, this type of management leads to reduced vigor of the bunchgrasses and palatable shrubs. With reduced vigor, recruitment of these species declines. Generally juniper seedlings will replace the desirable grasses and shrubs if improper grazing management continues.

Weather influences

Above normal precipitation in the spring increases forage production slightly. Only in the areas with deeper soils do plants capitalize on extra spring-time moisture. Below normal precipitation in the spring can reduce production and ultimately cause plant mortality if drought continues.

Juniper is very resistant to drought influences. It has a root system that is capable of removing deep moisture in the fractures of the bedrock that is not available to other plants on the site. In addition, juniper is capable of photosynthesizing (growing) anytime the air temperatures are above freezing. It therefore is removing moisture from the soil for 10-11 months of the year. This gives juniper a competitive advantage for moisture over all of the other species on the site.

Insects and disease

Outbreaks can affect vegetation health, particularly bitterbrush from western tent caterpillars (*Malacosoma fragilis*). Two consecutive years of defoliation by the tent caterpillar can cause mortality in bitterbrush. Outbreaks of a curleaf mountain mahogany defoliating moth, *Stamnodes animata*, occurs at infrequent intervals. Two consecutive years of severe defoliation can also cause mortality.

Influence of noxious and invasive plants

Many of these species add to the fine-fuel component and lead to increased fire frequency. Many of the annual and perennial invasive species with deep root systems compete with desirable plants for moisture and nutrients. The result is reduced production and change in composition of the understory.

Influence of wildlife

Big game animals use this site in the spring, summer and fall. Their numbers are seldom high enough to adversely affect the plant community. Herbivory can be detrimental to young curleaf mountain mahogany and bitterbrush when livestock grazing and browsing by big game occurs at the same time and season. This will occur when both kinds of animal are using the plant in the late summer or fall. The adverse impact is excessive use of the current years' leader growth.

Watershed

Decreased infiltration and increased runoff occur with the invasion of juniper. Juniper invasion can be triggered by lack of fire, improper grazing management and prolonged drought. The increased runoff also causes sheet and rill erosion. The long term effect is a transition to a different state.

Influence of Utah juniper and/or Rocky Mountain juniper invasion

In plant communities that are invaded by juniper, the species has a competitive advantage for the following reasons:

- Juniper is very drought tolerant.
- It has the ability to extract soil moisture from a wide range of soil depths.
- Juniper has high evapo-transpiration rates.
- The species intercepts rain and snow before it reaches the soil surface.
- It has the ability to grow as long as there is soil moisture and the temperature is above freezing.
- Juniper has a relatively rapid growth rate and is long-lived. It can readily over-top shade intolerant species which leads to mortality.
- Nutrient cycling is reduced.
- As the canopy closes, juniper gains control of energy capture.

As juniper extracts water, other plants are unable to acquire sufficient water and nutrients to sustain growth and reproduction, thus reducing cover and biomass in the interspaces. After the canopy closes, there is sufficient soil moisture available for shallow-rooted, shade tolerant species to persist directly under the tree.

The following hydrological impacts occur on sites invaded by juniper:

- Infiltration in the interspaces is reduced.
- Run-off increases resulting in increased sheet and rill erosion with elevated sediment loads.
- Soil temperatures increase in the interspaces which results in accelerated drying of the soil surface.
- Increased bare ground in the interspaces.
- Soil moisture storage is reduced.

As bare ground and interconnectiveness of bare ground increases, flow rates are accelerated (reduction of flow sinuosity) and run-off out of the area increases. Degradation of these systems can result in the formation of a feedback cycle in which greater juniper cover and density results in greater plant and soil disturbance between the canopies.

In summary, a closed juniper community takes control of the following ecological processes: (1) hydrology, (2) energy capture and (3) nutrient cycling. The changes are primarily driven by the hydrological processes. The development of a closed juniper canopy always results in a transition across the threshold to a different state. Generally, when juniper canopy cover nears 20%, the plant community is approaching the threshold.

Plant Community and Sequence

Transition pathways between common vegetation states and phases:

State 1.

Phase A to B. Develops with improper grazing management and no fire.

Phase B to A. Develops through prescribed grazing.

Phase A to C. Develops after wildfire. Improper grazing management may accelerate the transition from Phase A to Phase C.

Phase C to A. Moves towards the HCPC with no fire and prescribed grazing.

Phase A to D. Develops with no fire.

Phase D to A. Removal of juniper with brush management (mechanical or prescribed fire) affects this move.

State 1 Phase D to Unknown Site. Continued lack of fire and improper grazing management cause this juniper invaded site to cross the threshold and retrogress to a new site with reduced potential due to significant soil loss and changes in the hydrologic cycle. It is economically impractical to return this site to State 1 with accelerating practices.

Practice Limitations

There are few limitations for vegetative management practices on this site. This site is commonly a loafing area for livestock and they tend to overuse it; however, the steepness of slopes, rock outcrops and talus prevents free movement of livestock. Moderate limitations exist for facilitating practices due to shallow, stony soils. Any brush control practices should be carefully evaluated because maintaining curlleaf mountain mahogany on the site has high value to the entire ecosystem. Selective cutting of mountain mahogany will encourage new mahogany growth which will be a benefit to wildlife.

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 (%)
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Table 6. Community 2.1 plant community composition

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

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

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

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

Wildlife Interpretations Animal Community – Wildlife Interpretations This rangeland ecological site provides habitat for select native wildlife species who can tolerate cold sites at high elevation. The plant community exhibits a diverse mixture of forbs throughout the short growing season offering excellent habitat for invertebrates. Mule deer and elk are the large herbivores using the site. The site provides seasonal habitat for resident and migratory animals including western toad, sagebrush lizard, shrews, ground squirrels, mice, coyote, red fox, badger, sage-grouse, Ferruginous hawk, prairie falcon, horned lark, and western meadowlark. Merriam's shrew and Idaho pocket gopher are area sensitive species in this plant community. Encroachment of noxious and invasive plant species (cheatgrass) in isolated areas can replace native plant species which provide critical feed, brood-rearing, and nesting cover for a variety of native wildlife. Water features are sparse provided by artificial water catchments and springs.

State 1 Phase 1.1 – Curleaf Mountain-Mahogany/ Bluebunch Wheatgrass/ Idaho Fescue Reference Plant Community (RPC) This plant community provides a diversity of grasses, forbs, and shrubs used throughout the growing season by native insect communities that assist in pollination. The reptile and amphibian community is represented by leopard lizard, short horned lizard, sagebrush lizard, western skink, western toad, and northern leopard frog. Amphibians are associated with springs and isolated water bodies adjacent to this plant community. Development of spring sites that collect all available water would exclude amphibian use on these sites. The diverse vertical structure offers habitat for many bird species including mountain bluebird, rock wren, grouse, and flycatchers. The plant community provides important forage for mule deer and elk in the spring, fall, and winter. Mahogany is a preferred winter browse for large mammals. The site provides thermal cover and young of year cover for mule deer and elk. A small mammal population including deer mouse, woodrat, golden-mantled ground squirrels, Wyoming ground squirrel, Merriam's shrew, Idaho pocket gopher, and yellow-bellied marmots would utilize this community. Talus slopes may be occupied by pika at the higher elevations.

State 1 Phase 1.2 – Curleaf Mountain-Mahogany/ Sandberg Bluegrass/ Bluebunch Wheatgrass/ Idaho Fescue/ Sagebrush Plant Community: This plant community is the result of improper grazing management and no fire. Overall quality of cover and forage habitat is poor due to the loss of vigor and production in mahogany, bitterbrush, Idaho fescue and bluebunch wheatgrass. Insect diversity would be similar to State 1 Phase 1.1 but the amount of available pollinator habitat may reduce some insect populations. Reptile community would be similar to State 1 Phase 1.1. Habitat for short horned lizard and sagebrush lizard may increase with the increase in sagebrush. Amphibian habitat would be tied to permanent spring sites in the area. Bird species utilizing the site would be similar to State 1 Phase 1.1. The low vigor in mahogany and bitterbrush would reduce the quality of winter habitat for mule deer and elk. The site would still provide limited thermal cover and young of year cover for large mammals. A small mammal population including deer mouse, woodrat, golden-mantled ground squirrels, Wyoming ground squirrel, Merriam's shrew, Idaho pocket gopher, and yellow-bellied marmots would utilize this community. Talus slopes may be occupied by pika at the higher elevations.

State 1 Phase 1.3- Mountain Snowberry/ Sandberg Bluegrass/ Cheatgrass Plant Community: This phase has developed due to fire. The plant community, dominated by herbaceous vegetation with no mahogany, sagebrush, or bitterbrush provides less vertical structure for animals. Insect diversity would be reduced with the loss of most shrubs, but a native forb plant community similar to State 1 Phase 1.1 would still support select pollinators. Encroachment of mountain snowberry would add spring and summer pollinator habitat to the site. Until mountain snowberry is established, diversity and populations of reptiles would be limited or excluded. This plant community provides limited brood-rearing habitat for sage-grouse if site is adjacent to sagebrush cover. The dominant herbaceous vegetation improves habitat for grassland avian species (horned lark and western meadowlark). Mountain snowberry would provide good forage habitat for mule deer and elk. Winter habitat for large mammals would be reduced or eliminated with the loss of mahogany and bitterbrush. Small mammal diversity and populations would be similar to State 1 Phase 1.1 and 1.2. The fruit of mountain snowberry provides good forage for ruffed grouse, magpies, and small mammals.

State 1 Phase 1.4 – Curleaf Mountain-Mahogany/ Bluebunch Wheatgrass/ Idaho Fescue / Utah Juniper/ Rocky Mountain Juniper Plant Community: This plant community is the result of a lack of fire. An increase in canopy cover of juniper contributes to a sparse herbaceous understory. A reduced herbaceous understory results in lower diversity and numbers of insects. The reptile community will be similar to State 1 Phase 1.1, represented by leopard lizard, short horned lizard, sagebrush lizard, and western skink. The reduced diversity of insects and understory cover may reduce the quality of the habitat for reptile populations. As juniper increases, habitat cover for Brewer's sparrow, sage thrasher, and sage sparrow may increase. The plant community supports limited forage habitat during spring, fall, and winter for mule deer and elk. Quality of winter forage for mule deer and elk is reduced with the loss of vigor and production of mahogany and antelope bitterbrush. As juniper encroachment occurs, the site will continue to provide thermal cover and young of year cover for large mammals. A small mammal population including golden-mantled ground squirrels, jackrabbits, deer mice, and Great Basin kangaroo rats may utilize this site.

State 2 - Utah Juniper/ Rocky Mountain Juniper/ Sandberg Bluegrass/ Cheatgrass Plant Community: This state has developed due to improper grazing management and no fire. The loss of native forbs and reduced vigor of understory vegetation will reduce insect diversity on the site. The lack of flowering plants will reduce use by butterflies and moths. Reptile species diversity would be similar to State 1 Phase 1.1. Quality of cover and forage habitat for reptiles would decline with the loss of understory vegetation. Birds using this site as resident or migratory habitat include Juniper titmouse, western bluebird, and Virginia's warbler. The Juniper titmouse relies heavily on juniper seeds for winter food. Hunting success by raptors may decrease due to a heavy overstory of juniper. The plant community supports limited seasonal habitat for mule deer and elk in the spring and fall. The site will provide thermal cover and young of year cover for large mammals. Juniper would provide winter feed for mule deer. Grazing Interpretations This site is suited for grazing by domestic livestock in the summer and fall. Livestock use the site for loafing as well as foraging. Estimated initial stocking rate will be determined with the landowner or decision-maker. They will be based on the inventory which includes species, composition, similarity index, production, past use history, season of use and seasonal preference. Calculations used to determine estimated initial stocking rate will be based on forage preference ratings.

Hydrological functions

Soils on this site are in hydrologic group UNKNOWN. The soils on this site have moderately high runoff potential.

Recreational uses

The site has high value for hunting, camping (on non-stony and flat places), photography and picnicking. The mahogany shrubs provide visual diversity to the landscape.

Wood products

The site provides a source of fuel-wood for camping, picnics or barbecues. The wood is also used to make small specialty items.

Other products

None.

Inventory data references

Information presented here has been derived from NRCS clipping and other inventory data. Also, field knowledge of range-trained personnel was used. Those involved in developing this site description include: Dave Franzen, co-owner, Intermountain Rangeland Consultants, LLC Jacy Gibbs, co-owner, Intermountain Rangeland Consultants, LLC Jim Cornwell, Range Management Specialist, IASCD Brendan Brazee, State Rangeland Management Specialist, NRCS, Idaho Lee Brooks, Range Management Specialist, IASCD Kristen May, Resource Soil Scientist, NRCS, Idaho

Other references

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USDI Bureau of Land Management, US Geological Service; USDA Natural Resources Conservation Service, Agricultural Research Service; Interpreting Indicators of Rangeland Health. Technical Reference 1734-6; Version 4-2005.

Approval

Kendra Moseley, 9/21/2020

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)	
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Date	02/04/2008
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

- 1. Number and extent of rills:** Rills are rare on this site due to the coarse surface fragments. If they are present, they are likely to occur on slopes greater than 20% or immediately following a wildfire.

- 2. Presence of water flow patterns:** Water-flow patterns are rare on this site due to short slope lengths. When they occur, they are short and disrupted by cool season grasses, tall shrubs and surface stones. They are not extensive.

- 3. Number and height of erosional pedestals or terracettes:** Erosional pedestals or terracettes are rare on this site. In areas where slopes approach 20 percent and where flow patterns and/or rills are present, few pedestals may be expected.

- 4. Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground ranges from 15-30% but more data is needed.

- 5. Number of gullies and erosion associated with gullies:** Gullies do not occur on this site.

- 6. Extent of wind scoured, blowouts and/or depositional areas:** Wind scoured, blowouts and/or depositional areas do not occur on this site.

- 7. Amount of litter movement (describe size and distance expected to travel):** Fine litter in the interspaces may move up to 3 feet following a significant run-off event. Coarse litter generally does not move.

8. Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):
Values should range from 3 to 5 but need to be tested.

9. Soil surface structure and SOM content (include type of structure and A-horizon color and thickness): The A or A1 horizon is typically 2 to 6 inches thick. Structure ranges from weak very fine and fine granular to weak very fine subangular blocky. Soil organic matter (SOM) ranges from 1 to 3 percent.

10. Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff: The tree-like canopy of curleaf mountain mahogany intercepts raindrops and therefore reduces that impact on the soil surface. Bunchgrasses, especially deep-rooted and surface stones slow run-off and increase infiltration. Tall shrubs accumulate snow in the interspaces.

11. Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site): Compaction layer is not present.

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

Dominant: Tree-like shrubs >>>

Sub-dominant: Cool season, deep-rooted bunchgrasses>>tall shrubs>perennial forbs >shallow rooted bunchgrasses

Other:

Additional:

13. Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence): Mortality of curleaf mountain mahogany is usually the result of insect infestations or fire. Outbreaks of a curleaf mountain mahogany defoliating moth *Stamnodes animata* occur at infrequent intervals. Two consecutive years of severe defoliation can cause curleaf mountain mahogany mortality.

14. Average percent litter cover (%) and depth (in): Ranges from 5-10% but additional data is needed.

15. Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production): Annual production is 900 pounds per acre (100kg/ha) in a year with normal precipitation and temperatures.

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: Invasive species include cheatgrass, bulbous bluegrass, rush skeletonweed, whitetop, musk and scotch thistle and diffuse and spotted knapweed. In addition, Utah juniper and Rocky Mountain juniper can invade the site.

17. **Perennial plant reproductive capability:** All functional groups have the potential to reproduce most years.
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