USDA Natural Resources
Conservation Service

Ecological site R010XC057OR
SR Shallow Escarpment 9-12 PZ

Last updated: 3/10/2025
Accessed: 05/12/2025

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): 010X–Central Rocky and Blue Mountain Foothills

This MLRA is characterized by gently rolling to steep hills, plateaus, and low mountains at the foothills of the Blue Mountains in Oregon and the Central Rocky Mountains in Idaho. The geology of this area is highly varied and ranges from Holocene volcanics to Cretaceous sedimentary rocks. Mollisols are the dominant soil order and the soil climate is typified by mesic or frigid soil temperature regimes, and xeric or aridic soil moisture regimes. Elevation ranges from 1,300 to 6,600 feet (395 to 2,010 meters), increasing from west to east. The climate is characterized by dry summers and snow dominated winters with precipitation averaging 8 to 16 inches (205 to 405 millimeters) and increasing from west to east. These factors support plant communities with shrub-grass associations with considerable acreage of sagebrush grassland. Big sagebrush, bluebunch wheatgrass, and Idaho fescue are the dominant species. Stiff sagebrush, low sagebrush, and Sandberg bluegrass are often dominant on sites with shallow restrictive layers. Western juniper is one of the few common tree species and since European settlement has greatly expanded its extent in Oregon. Nearly half of the MLRA is federally owned and managed by the Bureau of Land Management. Most of the area is used for livestock grazing with areas accessible by irrigation often used for irrigated agriculture.

Classification relationships

US National Vegetation Classification:

Note: (this is a the closest approximation, however, this association is described as occuring on deep soils with an Idaho fescue dominated herbaceous component)

Group: G302- Intermountain Mesic Tall Sagebrush Steppe & Shrubland
Alliance: A318-. *Artemisia tridentata* ssp. wyomingensis Mesic Steppe & Shrubland Alliance
Association: CEGL001048 - *Artemisia tridentata* ssp. wyomingensis - *Peraphyllum ramosissimum* / Festuca idahoensis Shrubland

Landfire Biophysical Setting:

0711250: Inter-Mountain Basins Big Sagebrush Steppe

Ecological site concept

In reference condition, this site supports a plant community dominated by Idaho fescue (Festuca idahoensis), bluebunch wheatgrass (*Pseudoroegneria spicata*), and antelope bitterbrush (*Purshia tridentata*), with Wild crab apple (*Peraphyllum ramosissimum*) often present. Abiotically, this site is typified by very shallow soils over fractured bedrock on eroded terrace and escarpment landforms. Bedrock fracturing allows for big sagebrush to persist where site conditions would otherwise favor rigid sagebrush (Artemisia rigida). The climate of the site is typified by 9 to 12 inches of annual precipitation, a mesic soil temperature regime and an aridic soil moisture regime. Historical

ecological dynamics would have been driven by infrequent fire, insect outbreaks and periodic drought. Presently, livestock grazing and exotic plant invasion have altered ecological dynamics and influence the composition of many of these communities.

Associated sites

R010XC021OR	**SR Clayey 9-12 PZ** Deeper soils
R010XC035OR	**SR Shallow 9-12 PZ** Shallow rather than very shallow soils, higher production

Similar sites

R010XC035OR	**SR Shallow 9-12 PZ** Shallow rather than very shallow, higher production
R010XC052OR	**SR Shallow South Schist 9-12 PZ** Shallow soil over metamorphic rock rather than very shallow soils, south aspects
R010XC041OR	**SR Very Shallow Rockland 12-16 PZ** Higher precipitation
R010XC042OR	**SR Juniper Tableland 12-16 PZ** Higher precipitation
R010XC056OR	**SR Terrace Escarpment 9-12 PZ** Shallow to deep rather than very shallow soils
R010XC038OR	**SR Very Shallow 9-12 PZ** Lithic or duripan restrictive layer rather than paralithic contact
R010XC039OR	**SR Very Shallow 12-16 PZ** Higher precipitation
R010XC036OR	**SR Shallow Cool 9-12 PZ** Shallow rather than very shallow, higher production
R010XC050OR	**SR Shallow South 9-12 PZ** Shallow rather than very shallow soils, south aspects

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata ssp. wyomingensis* (2) *Peraphyllum ramosissimum*
Herbaceous	(1) *Pseudoroegneria spicata ssp. spicata* (2) *Achnatherum thurberianum*

Physiographic features

This site occurs on hillsides, escarpments and eroded terraces. It is largely distributed across the foothills of the Blue mountains at the northern edge of the Great Basin. This site occurs on all aspects and on slopes ranging from 2 to 40 percent. Elevations typically range from 3,400 to 4,100 feet (1,050 to 1,250 meters). No water table is present within the upper 100 inches of soil and the site is not subject to ponding or flooding.

Table 2. Representative physiographic features

Landforms	(1) Foothills > Terrace (2) Foothills > Escarpment
Flooding frequency	None
Ponding frequency	None
Elevation	3,400–4,100 ft

Slope	2–40%
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

The mean annual precipitation ranges from 9 to 12 inches (230 to 300mm), most of which occurs as snow during October through March. The mean annual air temperature ranges from 45 to 49° F (7 to 9.5° C). The average frost-free period is from 80 to 100 days. The soil temperature regime is mesic and the soil moisture regime is aridic. The period of primary plant growth is from April through July. Climate graphs are based on the nearest available climate stations to representative site locations and are provided to indicate general climate patterns.

Table 3. Representative climatic features

Frost-free period (characteristic range)	80-100 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	9-12 in
Frost-free period (average)	90 days
Freeze-free period (average)	
Precipitation total (average)	11 in

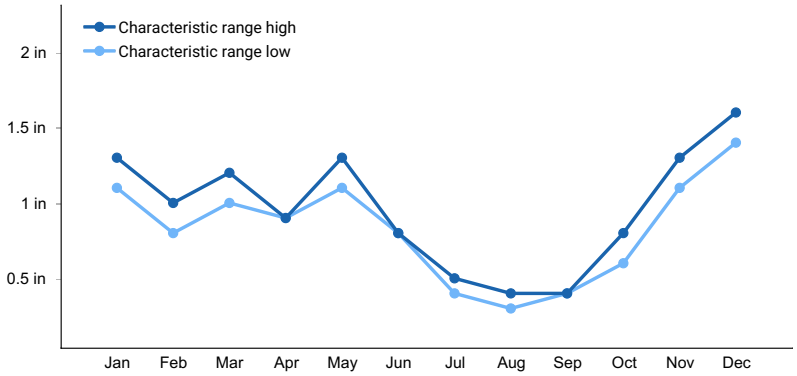

Figure 1. Monthly precipitation range

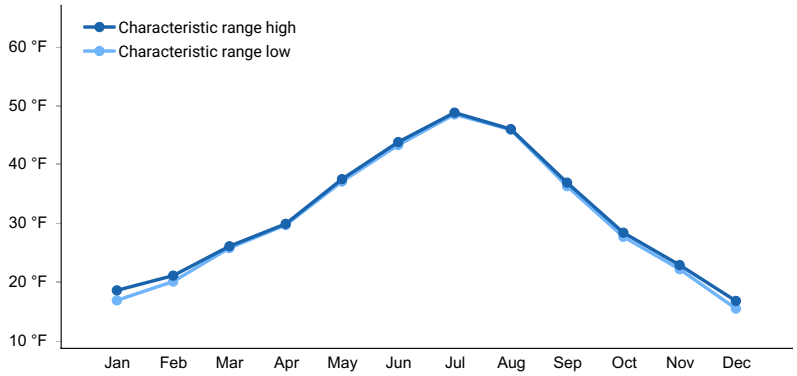

Figure 2. Monthly minimum temperature range

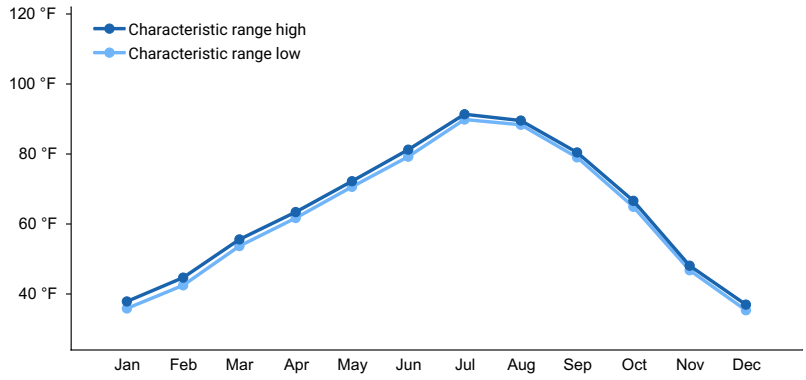

Figure 3. Monthly maximum temperature range

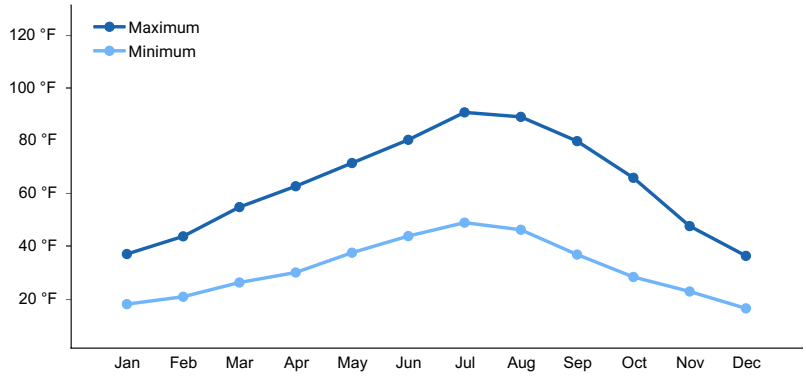

Figure 4. Monthly average minimum and maximum temperature

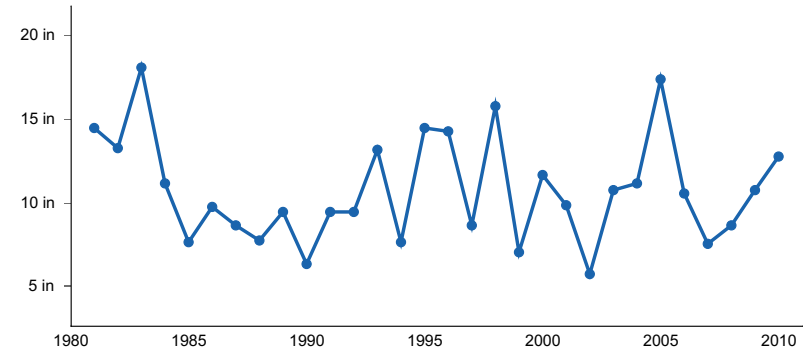

Figure 5. Annual precipitation pattern

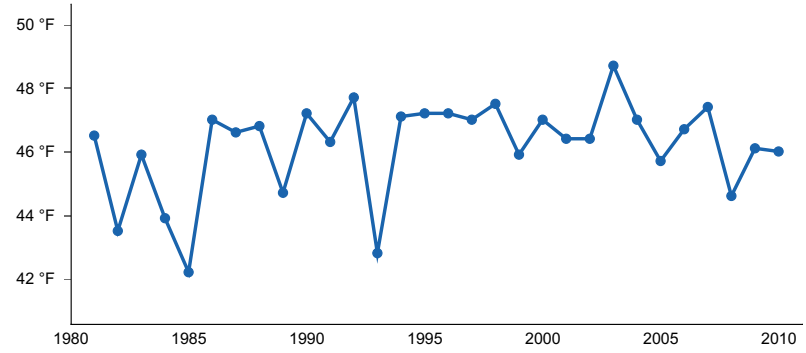

Figure 6. Annual average temperature pattern

Climate stations used

- (1) DREWSEY [USC00352415], Drewsey, OR
- (2) RIVERSIDE 7 SSW [USC00357208], Burns, OR

Influencing water features

This site is not influenced by adjacent or on site water features.

Wetland description

Not applicable

Soil features

The soils of this site are typically very shallow but may range to shallow. These are well to moderately well drained soils that formed in residuum and loess from tuffaceous rocks, and diatomaceous and lacustrine sediments. The profile contains 10 to 50 percent rock fragments mainly as gravels and cobbles. Percent clay ranges from 12 to 40 percent. The soil surface range from 1 to 5 inches (2.5 to 13 cm) thick and are typically gravelly loams. The subsurface ranges from 4 to 9 inches (10 to 23 cm) thick and are typically loams and gravelly loams. Bedrock is typically paralithic, sedimentary rock with fractures that allow root penetration. Permeability is moderately slow. Shrink-swell potential is moderate. Water erosion potential is high and wind erosion is slight.

Table 4. Representative soil features

Parent material	(1) Residuum–tuff (2) Loess–tuff (3) Lacustrine deposits–diatomite (4) Lacustrine deposits
Surface texture	(1) Gravelly loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow
Depth to restrictive layer	5–10 in
Soil depth	5–10 in
Surface fragment cover <=3"	0–45%
Surface fragment cover >3"	0–45%
Available water capacity (0-20in)	0.9–1.4 in
Soil reaction (1:1 water) (0-20in)	6.6–7.3
Subsurface fragment volume <=3" (0-20in)	30–90%
Subsurface fragment volume >3" (0-20in)	0–15%

Table 5. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	5–20 in
Soil depth	5–20 in
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-20in)	Not specified

Soil reaction (1:1 water) (0-20in)	Not specified
Subsurface fragment volume <=3" (0-20in)	Not specified
Subsurface fragment volume >3" (0-20in)	Not specified

Ecological dynamics

In its reference condition, this site is dominated by bluebunch wheatgrass (*Pseudoroegneria spicata*), Thurber's needlegrass (*Achnatherum thurberianum*) and Wyoming big sagebrush (*Artemisia tridentata* ssp. wyomingensis). Wild crab apple (*Peraphyllum ramosissimum*) is a common shrub associate on this site. A diversity of forbs are also often present. Western juniper (*Juniperus occidentalis*) may be present in trace amounts, but under normal a disturbance regime is controlled by periodic fire.

Variability in site characteristics will alter plant composition. Needlegrasses increase over coarser textured soil surfaces. Wild crab apple increases over fractured soft tuffaceous sedimentary rock and diatomaceous earth. Antelope bitterbrush (*Purshia tridentata*) also increases over fractured substratums and on coarse textured soil surfaces. Despite the very shallow soils on this site, paralithic, fractured bedrock allows for Wyoming big sagebrush to persist on the site rather than species typically associated with very shallow soils such as rigid sagebrush.

Wyoming big sagebrush is fire intolerant species that is readily killed by most fires and does not resprout. It will be reduced on a site following fire and may be eliminated with frequent fires. Periodic insect outbreaks of Aroga moth (Aroga websteri) are an important component of the natural disturbance regime for big sagebrush, resulting in complete or partial mortality of sagebrush plants and potentially impacting thousands of acres (Innes 2019). Thurber's needlegrass is considered to be the least fire-resistant needlegrass, Thurber's is often damaged by moderately severe fire. It recovers slowly following fire and regenerates primarily by seed rather than resprouting from crowns (Archer 2000). Bluebunch wheatgrass is considered to be a highly fire adapted grass species with low buds often protected from fire. Recovery following fire is rapid and it often increases relative to other plants post fire, especially after spring burning. While burning may improve the nutritional quality of bluebunch, defoliation during the regeneration period can be very detrimental to the stand and grazing should be avoided immediately after (Zlatnik 1999).

Western juniper (*Juniperus occidentalis*) is a native conifer species in western North America but its density and range have dramatically increased since the late 1800s likely due to a combination of factors, namely: reductions in fire frequency; heavy livestock grazing; and increased atmospheric carbon dioxide (Fryer and Tirmenstein 2019). Juniper is sensitive to fire and most young trees are killed by even low severity fire. As Juniper trees mature and bark thickens, however, they become resistant to low severity fire yet are still killed by crown fires or high severity surface fires. Encroachment of juniper in the presence of an altered disturbance regime may have consequences for understory plant diversity and production, site hydrology and soil integrity with erosional states possible due to high levels of invasion.

Climate cycles would have been an important driver of ecological dynamics historically, with drought periods possibly leading to reductions in sagebrush cover and wet years increasing fire occurrence due to increased perennial grass production and fine fuels loads. Historically these communities would have likely encountered infrequent mixed and replacement severity fires with an average fire return interval of 50 years (yet with a high degree of variability depending on the site) (Landfire 2007). Livestock grazing has altered the plant community composition of much of the extent of this site.

If the site deteriorates in response to prolonged heavy grazing, big sagebrush, Sandberg bluegrass (*Poa secunda*) and bottlebrush squirreltail (*Elymus elymoides*) increase in plant density while bluebunch wheatgrass and Thurber's needlegrass decrease. Under an altered disturbance regime and degraded site conditions, invasions of exotic forb species and annual grass species may occur on this site. Exotic annual grasses such as cheatgrass (*Bromus tectorum*) and medusahead (*Taeniatherum caput-medusae*) may invade and become problematic. Exotic annual grass invasion may increase the size and frequency of fires and extend the season when fires are likely by augmenting early season fine fuel loads and fuel continuity. Sites may be particularly fire prone following years of above average precipitation during which invasive annual grass production can increase dramatically (Pilliod et al.

2017). In addition to exotic species, native shrub species such as broom snakeweed (*Gutierrezia sarothrae*) and rabbitbrush (Chrysothamnus spp.) may also increase following disturbance and may be important members of early seral communities.

An understanding of the site specific ecological dynamics for this site are incomplete. Thresholds between states and phases have yet to be quantified and restoration pathways and outcomes are not fully understood. Little is known about the ecological dynamics of wild crab apple and how it may respond to disturbance. Current and anticipated effects of climate change are not included in this model, yet this site may experience significant impacts as climate continues to change. The model below represents an approximation of ecological dynamics informed by disturbance response groups described in Stringham et al. 2017 and is likely to undergo refinements and revisions as more data becomes available. The reference plant community described below has been determined by study of rangeland relic areas or areas protected from excess disturbance.

State and transition model

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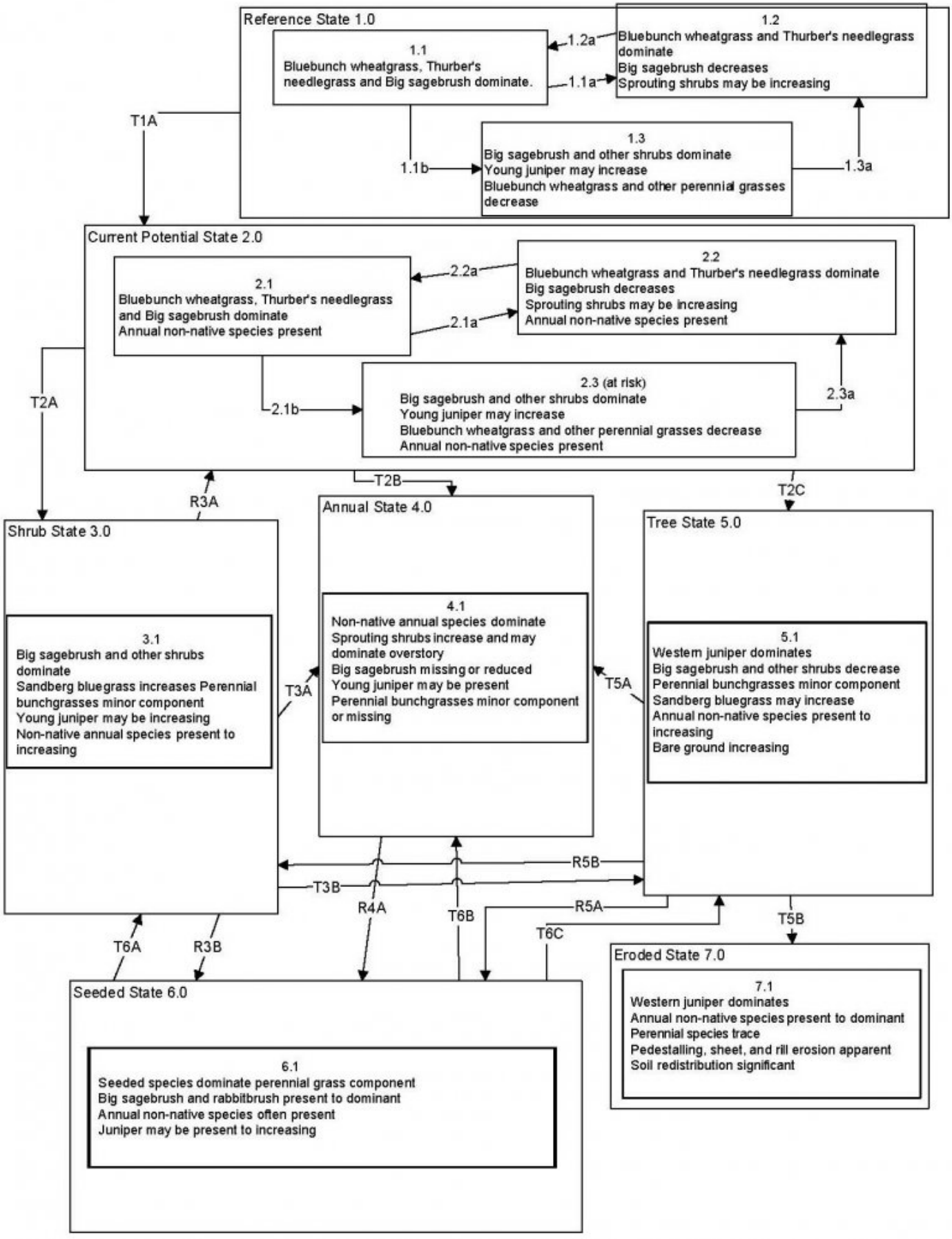

R010XC057OR

Reference State 1.0 Community Phase Pathways
1.1a: Low severity fire resulting in a mosaic pattern; high severity fire leads to early/mid-seral community dominated by grasses and forbs, lacking sagebrush.
1.1b: Time and lack of disturbance such as fire facilitates an increase in the shrub overstory.
1.2a: Time and lack of disturbance such as fire allows for regeneration of the shrub and tree overstory.
1.3a: Low severity fire resulting in a mosaic pattern: high severity fire significantly reduces shrub cover and leads to community dominated by grasses and forbs.

Transition T1A: Introduction of non-native plants.

Current Potential State 2.0 Community Phase Pathways
2.1a: Low severity fire (ground fire) resulting in a mosaic pattern, brush treatments/tree thinning would also reduce the overstory allowing the perennial understory to increase; high severity fire significantly reduces sagebrush, and young juniper facilitating perennial bunchgrass understory.
2.1b: Time and lack of disturbance such as fire leads to increased shrub and or juniper overstory and decreased perennial grass understory; may be coupled with drought and / or inappropriate grazing management.
2.2a: Time and lack of disturbance such as fire allows for regeneration of the shrub overstory.
2.3a: Low severity fire (ground fire) resulting in a mosaic pattern, brush treatments/tree thinning would also reduce the overstory; high severity fire significantly reduces sagebrush cover and leads to early/mid-seral community dominated by grasses and forbs.

State 2 Transitions/Restoration Pathways
Transition T2A: Chronic, inappropriate grazing management reduces perennial grasses and allows for an increase in shrub/tree specie. Fire or brush treatment/tree thinning; may be coupled with inappropriate grazing management. With fire suppression western juniper trees will increase.
Transition T2B: Catastrophic fire, failed rehabilitation attempt or combination, inappropriate grazing management in the presence of non-native annuals or competitive increase in annual grasses through lack of active management.).
Transition T2C: Time and lack of disturbance allows for maturation of the tree community. May be combined with inappropriate grazing management.

State 3 Transitions/Restoration Pathways:
Transition T3A: Catastrophic fire and/ or failed rehabilitation treatment or combination of both. Inappropriate grazing management in the presence of annual non-native species and / or competitive increase in annual grasses through lack of active management.
Transition T3B: Time and lack of disturbance allows for maturation of the tree community. May be combined with inappropriate grazing management.
Restoration R3A: Shrub and tree reduction treatments and seeding of desired native species.
Restoration R3B: Shrub removal treatments and seeding of desired cultivated species. Herbicide may be necessary.

State 4 Transitions/Restoration Pathways:
Restoration R4A: Herbicide of annual species and seeding of desired species; may be coupled with brush management.

State 5 Transitions/Restoration Pathways:
Transition T5A: Catastrophic fire, multiple fires, failed rehabilitation attempt or inappropriate tree removal treatment.
Restoration R5A: Juniper stand thinning or removal.
Transition T5B: Time without disturbance allows for trees to oucompete understory; bare ground allows for excess soil movement.
Restoration R5B: Juniper stand removal and seeding of desired cultivated species: herbicide may be necessary.

State 6 Transitions/Restoration Pathways:
Transition T6A: Catastrophic fire, especially following high shrub and tree fuel accumulation. Inappropriate grazing facilitates decrease in bunchgrasses and increase in non-native annual grasses likely.
Transition T6B: Chronic, heavy growing season grazing will decrease bunchgrasses, increase Sandberg bluegrass and shrubs. Severe fire likely following shrub and tree fuel accumulation.
Transition T6C: Time without disturbance allows for maturation of tree community.

State 1
Historic Reference

The Reference State is representative of the natural range of variability for the site under pristine conditions. The Reference State is a bunchgrass shrubland. State dynamics are maintained by interactions between climatic patterns and disturbance regimes. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These are maintained by ecosystem processes and structural elements such as the presence of all structural and functional plant groups, the retention of organic matter and the maintenance of plant community cover. Plant community phase changes are primarily driven by infrequent fire and periodic drought.

Dominant plant species

- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- wild crab apple (*Peraphyllum ramosissimum*), shrub
- bluebunch wheatgrass (*Pseudoroegneria spicata ssp. spicata*), grass
- Thurber's needlegrass (*Achnatherum thurberianum*), grass

Community 1.1

Reference Community

The potential native plant community is dominated by bluebunch wheatgrass, Thurber's needlegrass, wild crab apple and Wyoming big sagebrush. Antelope bitterbrush is also present in the stand. Vegetative composition is about 70 percent grasses, 5 percent forbs and 25 percent shrubs.

Dominant plant species

- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- bluebunch wheatgrass (*Pseudoroegneria spicata ssp. spicata*), grass
- Thurber's needlegrass (*Achnatherum thurberianum*), grass

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	70	219	290
Shrub/Vine	20	55	73
Forb	10	25	35
Tree	0	1	2
Total	**100**	**300**	**400**

Community 1.2
Perennial Bunchgrasses/Shrubs

Bluebunch wheatgrass and Thurber's needlegrass are dominant. Big sagebrush decreases. Sprouting shrubs may be increasing.

Community 1.3
Shrubs/Juniper

Big sagebrush and other shrubs are dominant. Young juniper may increase. Bluebunch wheatgrass and other perennial grasses decrease.

Pathway 1.1A
Community 1.1 to 1.2

Low severity fire resulting in a mosaic pattern; high severity fire leads to an early- and mid-seral community dominated by grasses and forbs, lacking sagebrush.

Pathway 1.1B
Community 1.1 to 1.3

Time and lack of disturbance such as fire facilitates and increase in the shrub overstory.

Pathway 1.2A
Community 1.2 to 1.1

Time and lack of disturbance such as fire allows for regeneration of the shrub and tree overstory.

Pathway 1.3A
Community 1.3 to 1.2

Low severity fire resulting in a mosaic pattern; high severity fire significantly reduces shrub cover and leads to a community dominated by grasses and forbs.

State 2
Current Potential

This state is similar to the Reference State. Ecological function has not changed fundamentally, however the resiliency of the site has been reduced by the presence of invasive plants. Additionally, livestock herbivory may be present as a disturbance process and changes in climate may be altering ecological dynamics. Non-native plant species may increase in abundance but will not become dominant or control ecological processes within this state. These species can be highly flammable and can promote fire where historically fire had been infrequent. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These are maintained by ecosystem processes and structural elements such as the presence of all structural and functional groups, and retention of organic matter and nutrients. Positive feedbacks driven by plant community invasion decrease ecosystem resilience and stability of the state. These include exotic plant species' high seed output, persistent seed bank, rapid growth rate, ability to cross pollinate, and adaptations for seed dispersal. Plant community phase changes are primarily driven by infrequent fire, periodic drought, and ungulate herbivory. Current potential plant communities mirror those of the above Historical Reference (State 1) yet with the addition of a low level of invasive exotic plant invasion and influences of livestock herbivory. Livestock herbivory may result in decreases in deep rooted perennial grasses, and related increases in shallow-rooted perennial grasses (such as Sandberg's bluegrass), unpalatable forbs and shrubs.

Dominant plant species

- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- wild crab apple (*Peraphyllum ramosissimum*), shrub
- bluebunch wheatgrass (*Pseudoroegneria spicata ssp. spicata*), grass
- Thurber's needlegrass (*Achnatherum thurberianum*), grass

Community 2.1
Perennial Bunchgrasses/Sagebrush/Annuals

Bluebunch wheatgrass, Thurber's needlegrass, and big sagebrush are dominant. Annual non-native species are present.

Community 2.2
Perennial Bunchgrasses/Shrubs/Annuals

Bluebunch wheatgrass and Thurber's needlegrass are dominant. Big sagebrush decreases. Sprouting shrubs may be increasing. Annual non-native species are present.

Community 2.3
Shrubs/Juniper/Annuals

Big sagebrush and other shrubs are dominant. Young juniper may increase. Bluebunch wheatgrass and other perennial grasses decrease. Annual non-native species are present.

Pathway 2.1A
Community 2.1 to 2.2

Low severity fire (ground fire) resulting in a mosaic pattern, brush treatments and tree thinning would also reduce the overstory allowing the perennial understory to increase; high severity fire significantly reduces sagebrush, and young juniper facilitating perennial bunchgrass understory.

Pathway 2.1B
Community 2.1 to 2.3

Time and lack of disturbance such as fire leads to increased shrub and juniper overstory and decreased perennial grass understory; may be coupled with drought and inappropriate grazing management.

Pathway 2.2A
Community 2.2 to 2.1

Time and lack of disturbance such as fire allows for regeneration of the shrub overstory.

Pathway 2.3A
Community 2.3 to 2.2

Low severity fire (ground fire) resulting in a mosaic pattern, brush treatments and tree thinning would also reduce the overstory; high severity fire significantly reduces sagebrush cover and leads to early- and mid-seral community dominated by grasses and forbs.

State 3
Shrub

Within this state, site resources are primarily controlled by shrub species. Native deep-rooted perennial grass composition has been reduced considerably, with shallow-rooted and disturbance adapted grasses such as Sandberg bluegrass increasing. Wyoming big sagebrush dominates the shrub overstory, with rabbitbrush, wild crab apple and antelope bitterbrush sometimes common. Exotic herbaceous species such as cheatgrass and medusahead are likely. Sagebrush cover has increased beyond the natural range of variability for the site and may be decadent, reflecting stand maturity and lack of seedling establishment due to competition with mature plants. The dominance of site resources by the shrub overstory and Sandberg bluegrass understory leads to a temporal redistribution of soil water, nutrient capture, nutrient cycling and soil organic matter. Bare ground may be significant with soil redistribution occurring between interspace and shrub locations. Western juniper increases and may begin to influence the understory vegetation.

Dominant plant species

- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- wild crab apple (*Peraphyllum ramosissimum*), shrub
- rabbitbrush (*Chrysothamnus*), shrub
- antelope bitterbrush (*Purshia tridentata*), shrub

Community 3.1
Shrubs/Bluegrass

Big sagebrush and other shrubs are dominant. Sandberg bluegrass increases. Perennial bunchgasses are a minor component. Young juniper may be increasing. Non-native annual species are present to increasing.

State 4
Annual

Within this state, site resources are primarily controlled by exotic annual and perennial herbaceous species. Native perennial grass composition has been greatly diminished. Shrub species and western juniper may also be present. Multiple plant communities are possible within this state, all of which are dominated by invasive annual grasses such as cheatgrass and medusahead and potentially invasive annual and perennial forbs. Sagebrush, wild crab apple, bitterbrush and rabbitbrush may be common in the overstory. Overtime, with increasing invasion, soil stabilizing perennial root biomass will be decreased. Bare ground will increase during winter, potentially increasing erosion even on this low to moderate slope site during extreme weather events.

Dominant plant species

- cheatgrass (*Bromus tectorum*), grass
- medusahead (*Taeniatherum caput-medusae*), grass

Community 4.1
Annuals/Sprouting Shrubs

Non-native annual species are dominant. Sprouting shrubs increase and may be dominant in the overstory. Big sagebrush is missing or reduced. Young juniper may be present. Perennial bunchgrasses are a minor component or missing.

State 5
Tree

This state is characterized by a dominance of young juniper (less than 100 years old) in the overstory. Big sagebrush and perennial bunchgrasses may still be present, but they are no longer controlling site resources. Soil moisture, soil nutrients and soil organic matter distribution and cycling have been spatially and temporally altered. Juniper encroachment can decrease cover of perennial grasses and shrubs by reducing light availability and altering site hydrology through increased interception of precipitation, reduced infiltration and increased erosion. Bare ground will increase and erosion may be increased even on this low to moderately sloping site during extreme weather events.

Dominant plant species

- western juniper (*Juniperus occidentalis*), tree

Community 5.1
Juniper Woodland

Western juniper is dominant. Big sagebrush and other shrubs decrease. Perennial bunchgrasses are a minor component. Sandberg bluegrass may increase. Annual non-native species present to increasing. Bare ground is increasing.

State 6
Seeded

Within this state, site resources are primarily controlled by introduced range grasses such as crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*Thinopyrum intermedium*). Multiple community phases may occur within this state and will include different compositions of native and introduced shrub and grass species. Western juniper may be present. Similar to ecological dynamics within other states of this site, shrub species and western juniper will increase with greater time since fire and herbivory pressure. While introduced range grasses may provide some analogous ecological functions to native perennial grasses, they may outcompete native grasses in the long-term.

Dominant plant species

- crested wheatgrass (*Agropyron cristatum*), grass
- intermediate wheatgrass (*Thinopyrum intermedium*), grass

Community 6.1
Seeded Grasses/Shrubs

Seeded species are dominant, perennial grass component. Big sagebrush and rabbitbrush present to dominant. Annual non-native species often present.Juniper may be present to increasing.

State 7
Eroded

This state is characterized by significant soil loss through wind and water erosion. Most herbaceous cover has been lost and soil stabilizing microbiotic soil crusts are degraded. Loss of these components reduces soil stability and renders the soil surface vulnerable to raindrop impacts, runoff and transport of soil by water and entrainment of soil particles by wind. Extensive areas of erosion pavement are common. Rill and gully formation may occur, especially toward the higher slope range of this site. Positive feedbacks develop as low vegetative cover leads to decreased litter and organic matter production, higher soil temperature variability, and decreased nutrient cycling, further destabilizing soil and decreasing potential plant establishment. Grass and forb vegetative cover is low yet invasive

annual plants are likely and juniper cover is likely high. Potential for rehabilitation of this state is unknown but would likely pose significant challenges due to degradation of abiotic function of the site, the susceptibility of soils to erosion and damaging frost heaving, and mechanical limitations due to areas of rock outcrops and slopes.

Dominant plant species

- western juniper (*Juniperus occidentalis*), tree

Community 7.1
Juniper Woodland, Eroded

Western juniper is dominant. Annual non-native species present to dominant. Perennial species trace. Pedestalling, sheet, and rill erosion apparent. Soil redistribution significant.

Transition T1A
State 1 to 2

Introduction of non-native plants

Transition T2A
State 2 to 3

Chronic, inappropriate grazing management reduces perennial grasses and allows for an increase in shrub/tree specie. Fire or brush treatment/tree thinning; may be coupled with inappropriate grazing management. With fire suppression western juniper trees will increase.

Transition T2B
State 2 to 4

Catastrophic fire, failed rehabilitation attempt, inappropriate grazing management in the presence of non-native annuals or competitive increase in annual grasses through lack of active management.

Transition T2C
State 2 to 5

Time and lack of disturbance allows for maturation of the tree community. May be combined with inappropriate grazing management.

Restoration pathway R3A
State 3 to 2

Shrub and tree reduction treatments and seeding of desired native species.

Transition T3A
State 3 to 4

Catastrophic fire and/ or failed rehabilitation treatment or combination of both. Inappropriate grazing management in the presence of annual non-native species and competitive increase in annual grasses through lack of active management.

Transition T3B
State 3 to 5

Time and lack of disturbance allows for maturation of the tree community. May be combined with inappropriate grazing management.

Restoration pathway R3B

State 3 to 6

Shrub removal treatments and seeding of desired cultivated species. Herbicide may be necessary.

Restoration pathway R4A
State 4 to 6

Herbicide of annual species and seeding of desired species; may be coupled with brush management.

Restoration pathway R5B
State 5 to 3

Juniper stand removal and seeding of desired cultivated species: herbicide may be necessary.

Transition T5A
State 5 to 4

Juniper stand thinning or removal.

Restoration pathway R5A
State 5 to 6

Juniper stand thinning or removal.

Transition T5B
State 5 to 7

Time without disturbance allows for trees to outcompete understory; bare ground allows for excess soil movement.

Transition T6A
State 6 to 3

Catastrophic fire, especially following high shrub and tree fuel accumulation. Inappropriate grazing facilitates decrease in bunchgrasses and increase in non-native annual grasses

Transition T6B
State 6 to 4

Chronic, heavy growing season grazing will decrease bunchgrasses, increase Sandberg bluegrass and shrubs. Severe fire likely following shrub and tree fuel accumulation.

Transition T6C
State 6 to 5

Time without disturbance allows for maturation of tree community.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Perennial Grasses**			165–252	
	bluebunch wheatgrass	PSSPS	*Pseudoroegneria spicata ssp. spicata*	90–120	–
	Thurber's needlegrass	ACTH7	*Achnatherum thurberianum*	60–90	–
	basin wildrye	LECI4	*Leymus cinereus*	9–24	–
	Sandberg bluegrass	POSE	*Poa secunda*	3–9	–
	squirreltail	ELEL5	*Elymus elymoides*	3–9	–
2	**Other Perennial Grasses**			0–18	
	needle and thread	HECO26	*Hesperostipa comata*	0–9	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–9	–
3	**Cusick Bluegrass**			0–9	
	Sandberg bluegrass	POSE	*Poa secunda*	0–9	–
Forb					
4	**Forbs**			9–24	
	buckwheat	ERIOG	*Eriogonum*	3–9	–
	phlox	PHLOX	*Phlox*	3–9	–
	milkvetch	ASTRA	*Astragalus*	3–6	–
5	**Other Forbs**			0–15	
	Douglas' dustymaiden	CHDO	*Chaenactis douglasii*	0–3	–
	blepharipappus	BLEPH2	*Blepharipappus*	0–3	–
	mariposa lily	CALOC	*Calochortus*	0–3	–
	ragwort	SENEC	*Senecio*	0–3	–
	blazingstar	MENTZ	*Mentzelia*	0–3	–
	hawksbeard	CREPI	*Crepis*	0–3	–
Shrub/Vine					
7	**Shrubs**			27–78	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	15–30	–
	wild crab apple	PERA4	*Peraphyllum ramosissimum*	6–24	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	6–24	–
8	**Other Shrubs**			0–6	
	spiny hopsage	GRSP	*Grayia spinosa*	0–3	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–3	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–3	–
	horsebrush	TETRA3	*Tetradymia*	0–3	–
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	0–3	–
Tree					
6	**Trees**			0–3	
	western juniper	JUOC	*Juniperus occidentalis*	0–3	–

Animal community

WILDLIFE:

Mule deer, hawks, rodents and songbirds.
This site offers cover and food for mule deer, small mammals, and a variety of birds.

LIVESTOCK GRAZING:
This site is suitable for use by livestock under a planned grazing system. Limitations are low productivity, steep slopes and high susceptibility to erosion..

Hydrological functions

The soils of this site are in hydrologic group C. The site has a moderate to high run-off potential and low to moderate infiltration rates.

Wood products

None

Other information

Low available water holding capacity in the surface layer limits seedling survival. Shallow soils limit rooting depths.

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Contributors

2020/2021 update Andrew Neary

Approval

Kirt Walstad, 3/10/2025

Rangeland health reference sheet

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

Author(s)/participant(s)	
Contact for lead author	
Date	03/10/2025
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:**