USDA Natural Resources Conservation Service

Ecological site R010XB086OR
JD Shrubby Mountain Shallow 12-16 PZ

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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): 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

Landfire Biophysical Setting:
711260 - Inter-Mountain Basins Montane Sagebrush Steppe

US National Vegetation Classification System:
(Reference State)
Group: G302- Intermountain Mesic Tall Sagebrush Steppe & Shrubland
Alliance: A3179- *Purshia tridentata* - *Artemisia tridentata* Mesic Steppe & Shrubland Alliance
Association: CEGL002674- *Purshia tridentata* / *Festuca idahoensis* Shrub Grassland

(Juniper Invaded State)
Group: G248- Columbia Plateau Western Juniper Open Woodland
Alliance: A3500- *Juniperus occidentalis* Grassy Open Woodland Alliance
Association: CEGL002622- *Juniperus occidentalis* / *Purshia tridentata* / *Festuca idahoensis* - *Pseudoroegneria spicata* Wooded Grassland

Bunchgrass Plant Communities of the Blue and Ochoco Mountains: A Guide for Managers
SD2911: ARTRV/FEID-AGSP
SD3111: *Purshia tridentata*/*Festuca idahoensis*-Agropyron spicatum

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*). Abiotically, this site is typified by gentle slope aspects and shallow soils. The climate of the site is typified by 12 to 16 inches of annual precipitation, a frigid soil temperature regime and a xeric 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

R010XB082OR	**JD Shrubby Claypan 12-16 PZ** Occurring on soils with a claypan restrictive layer within the upper 10 inches

Similar sites

R010XB028OR	**JD Shrubby Mountain 12-16 PZ** Generally deeper soils, yet XB028 is currently correlated to many shallow soils
R010XC037OR	**SR Mountain Shallow 12-16 PZ** Less composition of PUTR, mapping is somewhat more concentrated to the east of XB086
R010XB083OR	**JD Shrubby Shallow 12-16 PZ** Generally lower elevation, more common on north aspects

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Purshia tridentata* (2) *Artemisia tridentata ssp. vaseyana*
Herbaceous	(1) *Festuca idahoensis* (2) *Pseudoroegneria spicata*

Physiographic features

This site occurs primarily on mesas, plateaus and broad ridgetops composed of residuum and colluvium with a basalt source. Slopes typically range from 2 to 15 percent but may be as steep as 20 percent. Elevation typically varies from 3,800 to 5,800 feet (1,150 to 1,775 meters) but may occur from 3,500 to 6,500 feet (1,050 to 1,975 meters). This site occurs on all aspects. No water table is present within the soil profile and the site is not subject to ponding or flooding.

Table 2. Representative physiographic features

Landforms	(1) Foothills > Mesa (2) Foothills > Plateau (3) Foothills > Ridge
Flooding frequency	None
Ponding frequency	None
Elevation	3,800–5,800 ft
Slope	2–15%
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	3,500–6,500 ft
Slope	2–20%

Climatic features

Annual precipitation is 12 to 16 inches (300 to 400 millimeters), primarily in the form of rain and snow from November through April. This Mediterranean climate pattern results in a xeric soil moisture regime. This site experiences a frigid soil temperature regime, with a frost free period of 50 to 80 days. Climate graphs are based on the nearest available climate stations to representative site locations and are provided to indicate general climate patterns.

Table 4. Representative climatic features

Frost-free period (characteristic range)	50-80 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	12-16 in
Frost-free period (average)	60 days
Freeze-free period (average)	
Precipitation total (average)	14 in

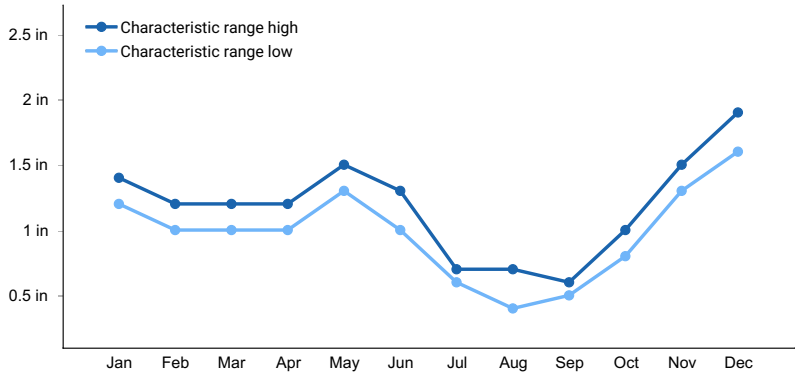


Figure 1. Monthly precipitation range

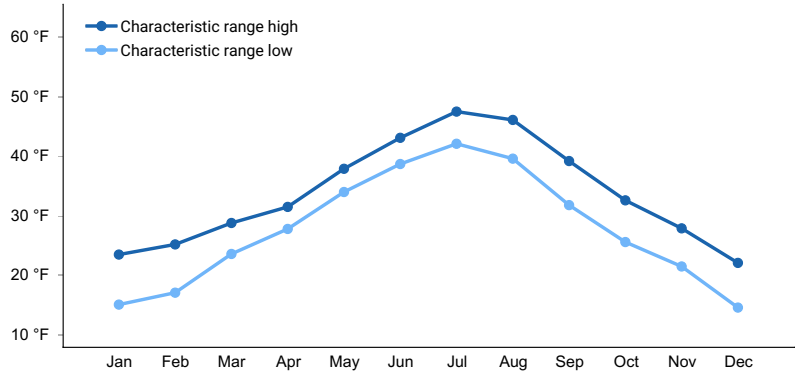


Figure 2. Monthly minimum temperature range

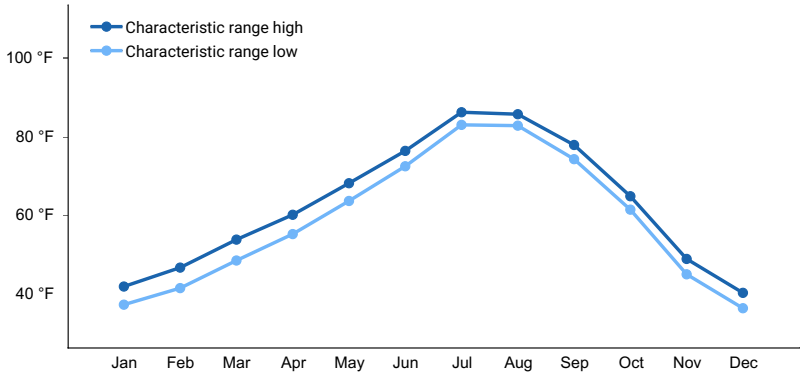


Figure 3. Monthly maximum temperature range

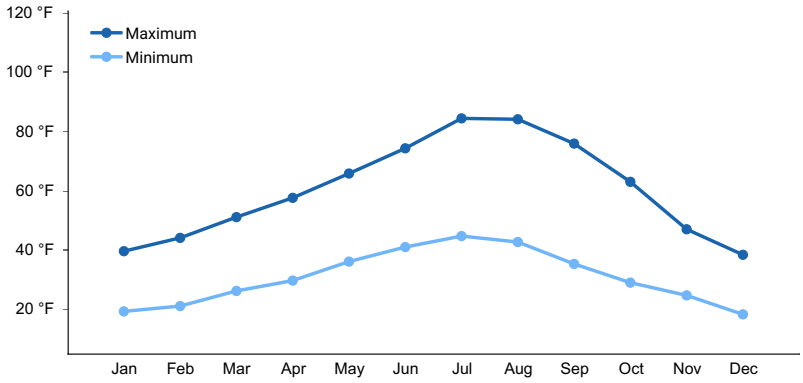


Figure 4. Monthly average minimum and maximum temperature

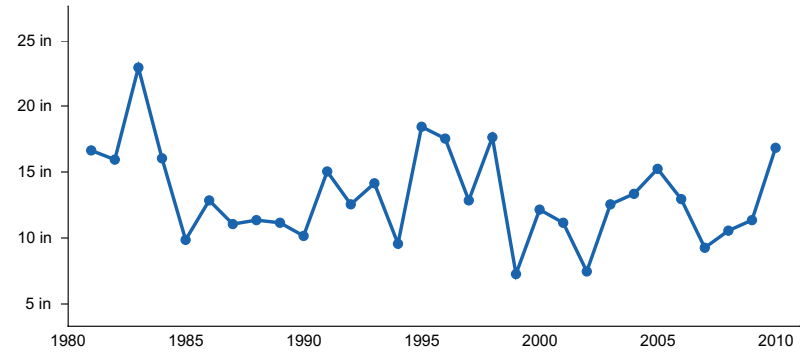


Figure 5. Annual precipitation pattern

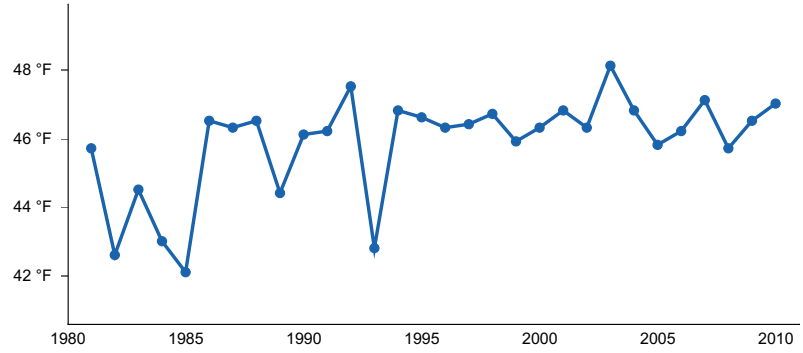


Figure 6. Annual average temperature pattern

Climate stations used

- (1) BARNES STN [USC00350501], Prineville, OR
- (2) PRINEVILLE [USC00356883], Prineville, OR
- (3) SENECA [USC00357675], Seneca, OR

Influencing water features

This site is not influenced by nearby water features.

Wetland description

Not applicable

Soil features

Soils on this site are typified by shallow loam to clay loam textures throughout the profile. Family particle size is loamy. These soils formed in tuff and tuffaceous sandstone and are underlain by weathered tuff. Surface horizons may include volcanic ash. Soils are typically well drained with moderate permeability. See Choptie for a typical soil series associated with this site concept.

Table 5. Representative soil features

Parent material	(1) Colluvium–tuff (2) Residuum–sedimentary rock
Surface texture	(1) Loam (2) Ashy loam (3) Clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	10–20 in
Soil depth	10–20 in
Surface fragment cover <=3"	0–45%
Surface fragment cover >3"	0–45%
Available water capacity (0-20in)	2.7–3.5 in
Soil reaction (1:1 water) (0-20in)	6.1–7.3
Subsurface fragment volume <=3" (0-20in)	0–12%
Subsurface fragment volume >3" (0-20in)	0–5%

Ecological dynamics

The Reference Plant Community is dominated by Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Pseudoroegneria spicata*), and antelope bitterbrush (*Purshia tridentata*). Sandberg bluegrass (*Poa secunda*) and Mountain big sagebrush (*Artemisia tridentata* ssp. vaseyana) are common along with multiple buckwheat species (Eriogonum spp.). Western juniper (*Juniperus occidentalis*) may be present in trace amounts, but under normal a disturbance regime is controlled by periodic fire.

Ecological dynamics of this site are primarily driven by interactions between climatic patterns and disturbance regimes. Frequent low intensity fires were the historical disturbance that maintained the reference state and drove plant community shifts within the state. Intensity and frequency of these fires was strongly influence by drought cycles and insect or disease attacks on the plant community. Introduction of exotic annual grasses compromises the resistance and resiliency of the site, putting it at higher risk of crossing a threshold into another state.

Periodic drought regularly influences sagebrush ecosystems and drought duration and severity has increased throughout the 20th century in much of the Intermountain West. Major shifts away from historical precipitation

patterns have the greatest potential to alter ecosystem function and productivity. Species composition and productivity can be altered by the timing of precipitation and water availability with the soil profile (Bates et al. 2006). Plant communities within this MLRA have high spatial and temporal variability in precipitation both among years and within growing seasons.

Bluebunch wheatgrass is considered to be a highly fire-adapted grass species with low buds often protected from fire (Zlatnik 1999). 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 should be avoided. Idaho fescue is also adapted to regenerate following light severity fires by resprouting from root crowns and increased tillering (Zouhar 2000). However, high severity fires, especially if they occur during the growing season, may kill the plants. As a highly palatable grass species, Idaho fescue is often preferred by livestock and is highly sensitive to heavy grazing.

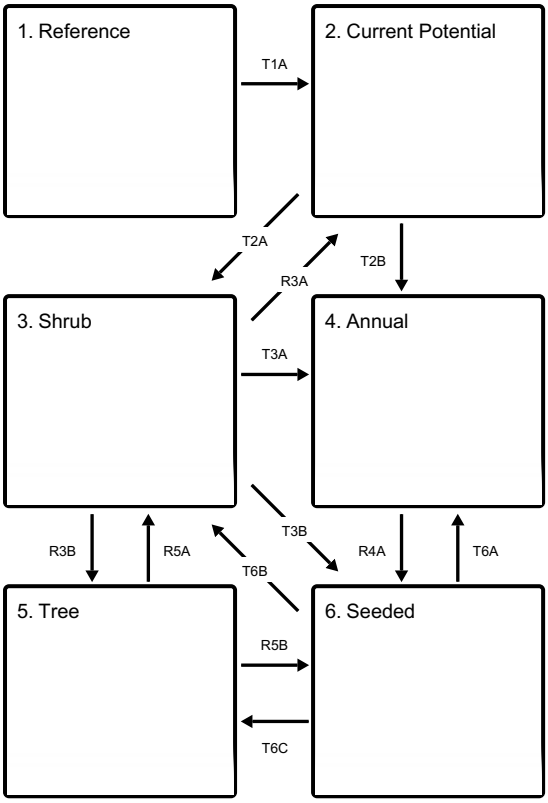
Grazing disturbance outside the natural range of variability may cause a decrease in deep-rooted perennial bunchgrass, primarily Idaho fescue and bluebunch wheatgrass. Woody species such as bitterbrush and juniper may increase and the percentage of bottlebrush squirreltail (*Elymus elymoides*) and Sandberg bluegrass may also increase. Further disturbance will often decrease cover of these species as well. As grass cover declines the potential for weed invasion and expansion of juniper increases.

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 (Miller et al. 2008). This is likely due to a combination of factors, principally: 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. Historically, fire return intervals of approximately 20 years would have minimized encroachment of western juniper into this site (Landfire 2007). As juniper trees mature and bark thickens, however, they become resistant to low severity fire rendering the site more resistant to community change following light severity fire. An increase in juniper crown density causes a decrease in understory perennial vegetation and an increase in bare ground. This allows for the invasion of non-native annual species such as cheatgrass (*Bromus tectorum*) and medusahead (*Taeniatherum caput-medusae*). At high levels of invasion, exotic annual grasses may increase the 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 prone to fire following years of above average precipitation during which invasive annual grass production can increase dramatically (Pilliod et al. 2017). With frequent wildfires these plant communities can convert to annual species with a sprouting shrub and juvenile tree overstory. While advanced disturbance may greatly decrease the cover of understory plant species and increase susceptibility to wind and water erosion, the low slope of this site makes a transition to an eroded state unlikely.

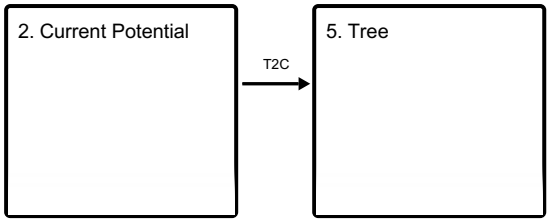
An understanding of the site specific ecological dynamics for this site are incomplete. Thresholds between states and phases have yet to be quantified and restoration pathways and outcomes are poorly understood. Current and anticipated effects of climate change are not included in this model, yet this site may experience significant impacts as climate continues to change. The description above and model below draws from the ecological dynamics described in disturbance response group 2B of Stringham et al. 2017, with modifications.

State and transition model

Ecosystem states



States 2 and 5 (additional transitions)



T1A - Introduction of non-native plant species

T2A - Chronic, inappropriate grazing management, fire or brush treatment/tree thinning

T2B - Catastrophic fire, failed rehabilitation attempt or combination, inappropriate grazing management in the presence of non-native annuals

T2C - Time and lack of disturbance, may be combined with inappropriate grazing management.

R3A - Shrub and tree reduction treatments and seeding of desired native species

T3A - Catastrophic fire, failed rehabilitation attempt or combination, inappropriate grazing management in the presence of non-native annuals

R3B - Shrub and tree reduction treatments and seeding of desired native species

T3B - Time and lack of disturbance, may be combined with inappropriate grazing management.

R4A - Herbicide of annual species and seeding of desired species; may be coupled with brush management

R5A - Juniper stand thinning or removal

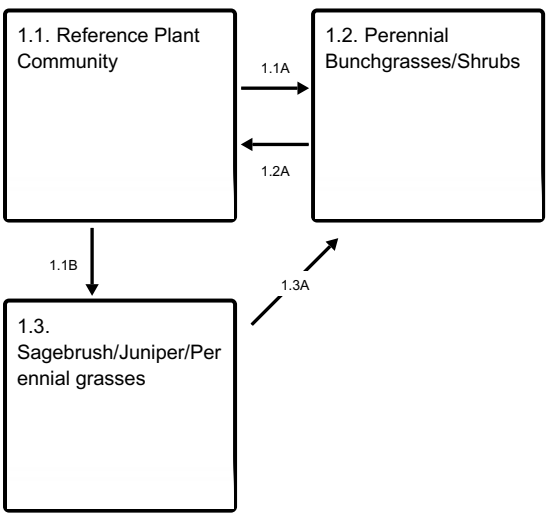
R5B - Juniper stand removal and seeding of desired cultivated species: herbicide may be necessary

T6B - Chronic, heavy growing season grazing will decrease bunchgrasses, increase Sandberg bluegrass and shrubs. Severe fire.

T6A - Catastrophic fire. Inappropriate grazing facilitates decrease in bunchgrasses and increase in non-native annual grasses.

T6C - Time without disturbance allows for maturation of tree community

State 1 submodel, plant communities



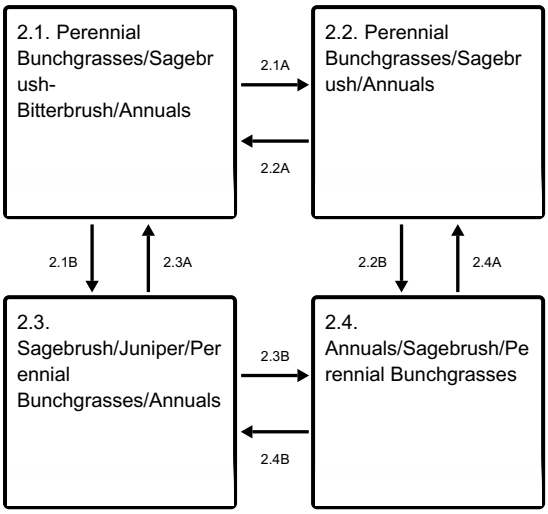
1.1A - Low severity fire (ground fire)

1.1B - Time and lack of disturbance such as fire, drought, herbivory, or combinations

1.2A - Time and lack of disturbance such as fire, drought, herbivory, or combinations

1.3A - Low severity fire

State 2 submodel, plant communities



2.1A - Low severity fire, brush treatments and tree thinning; high severity fire

2.1B - Time and lack of disturbance such as fire; may be coupled with drought or inappropriate grazing management.

2.2A - Time and lack of disturbance such as fire

2.2B - higher than normal spring precipitation, tree and shrub removal, prescribed or wildfire

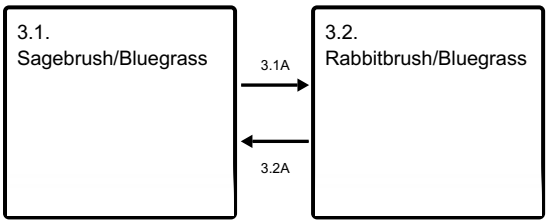
2.3A - Low severity fire, brush treatments and tree thinning; high severity fire

2.3B - higher than normal spring precipitation, tree and shrub removal, or prescribed or wildland fire

2.4A - less than normal spring with higher than normal early summer rainfall

2.4B - less than normal spring with higher than normal early summer rainfall

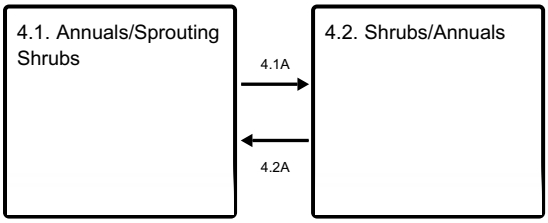
State 3 submodel, plant communities



3.1A - Fire (ground fires) or brush and tree removal treatments.

3.2A - Time and lack of disturbance

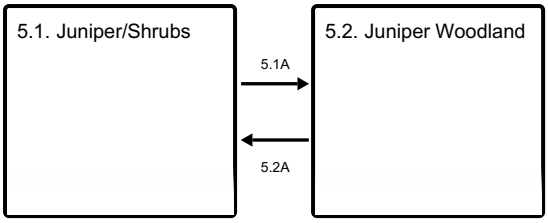
State 4 submodel, plant communities



4.1A - Time and lack of disturbance

4.2A - Fire

State 5 submodel, plant communities



5.1A - Time and lack of disturbance

5.2A - Tree stand thinning treatments

State 6 submodel, plant communities

6.1A - Time and lack of disturbance, grazing management

6.2A - Fire or shrub management practices.

6.2B - Time and lack of disturbance, grazing management

6.3A - Fire or other shrub reduction treatments.

6.3B - Shrub management, low severity fire, or Aroga moth damage

State 1
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.

Community 1.1
Reference Plant Community

The reference plant community is dominated by Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Pseudoroegneria spicata*), mountain big sagebrush (*Artemisia tridentata* subsp. vaseyana) and antelope bitterbrush (*Purshia tridentata*). Sandberg bluegrass (*Poa secunda*) is common along with multiple buckwheat species (Erioganum spp.). Western juniper (*Juniperus occidentalis*) may be present in trace amounts, but under normal a disturbance regime is controlled by periodic fire. Understory ground cover for this reference community is approximately 70 to 80 percent (50 to 60 percent herbaceous cover, 10 percent litter, 30 percent cryptograms, 1 percent bare ground, 5 percent stones, and 4 percent gravel).

Dominant plant species

- antelope bitterbrush (*Purshia tridentata*), shrub
- Idaho fescue (*Festuca idahoensis*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata ssp. spicata*), grass

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	440	590	735
Shrub/Vine	80	110	135
Forb	70	85	110
Tree	10	15	20
Total	**600**	**800**	**1000**

Community 1.2
Perennial Bunchgrasses/Shrubs

Idaho fescue, bluebunch wheatgrass and other perennial grasses increase. Big sagebrush and juniper decrease. Antelope bitterbrush may be sprouting.

Community 1.3
Sagebrush/Juniper/Perennial grasses

Mountain big sagebrush increases. Young juniper may increase. Idaho fescue, bluebunch wheatgrass, and other perennial grasses decrease.

Pathway 1.1A
Community 1.1 to 1.2

Low severity fire (ground fire) resulting in a mosaic pattern.

Pathway 1.1B
Community 1.1 to 1.3

Time and lack of disturbance such as fire. Drought, herbivory, or combinations would also reduce the perennial understory.

Pathway 1.2A
Community 1.2 to 1.1

Time and lack of disturbance such as fire. Drought, herbivory, or combinations would also reduce the perennial understory.

Pathway 1.3A
Community 1.3 to 1.2

Low severity fire resulting in a mosaic pattern.

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 bluegrass), unpalatable forbs and shrubs.

Community 2.1
Perennial Bunchgrasses/Sagebrush-Bitterbrush/Annuals

Idaho fescue, bluebunch wheatgrass, mountain big sagebrush and antelope bitterbrush are dominant. Few young juniper are present. Annual non-native species are present.

Community 2.2
Perennial Bunchgrasses/Sagebrush/Annuals

Idaho fescue, bluebunch wheatgrass, and other perennial grasses increase. Big sagebrush and juniper decrease. Antelope bitterbrush may be sprouting, and annual non-native species are present.

Community 2.3
Sagebrush/Juniper/Perennial Bunchgrasses/Annuals

Big sagebrush increases. Young juniper increases. Idaho fescue, bluebunch wheatgrass, and other perennial grasses decrease. Annual non-native species are present.

Community 2.4
Annuals/Sagebrush/Perennial Bunchgrasses

Annual non-native species increase; may be codominant. Mountain big sagebrush may be dominant. Idaho fescue, bluebunch wheatgrass, and other perennial grasses may decrease. Juniper may be present.

Pathway 2.1A
Community 2.1 to 2.2

Low severity 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 bitterbrush cover and leads to a community dominated by grasses and forbs.

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 or 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 community.

Pathway 2.2B
Community 2.2 to 2.4

Rainfall pattern favoring annual species reproduction (higher than normal spring precipitation); tree and shrub

removal, or prescribed or wildfire coupled with higher than normal spring precipitation.

Pathway 2.3A
Community 2.3 to 2.1

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

Pathway 2.3B
Community 2.3 to 2.4

Rainfall pattern favoring annual non-native grass production (higher than normal spring precipitation); tree and shrub removal, or prescribed or wildland fire coupled with higher than normal spring precipitation.

Pathway 2.4A
Community 2.4 to 2.2

Rainfall pattern favoring perennial bunchgrass production and reduced non-native annual grass production (less than normal spring with higher than normal early summer rainfall).

Pathway 2.4B
Community 2.4 to 2.3

Rainfall pattern favoring perennial bunchgrass production and reduced non-native annual grass production (less than normal spring with higher than normal early summer rainfall).

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 and squirreltail increasing. Antelope bitterbrush and mountain big sagebrush dominate the shrub overstory, with rabbitbrush an important component in some instances. 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. In both community phases, 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.

Community 3.1
Sagebrush/Bluegrass

Mountain big sagebrush and other shrubs are dominant with Sandberg bluegrass increasing in the understory. Perennial bunchgrasses are a minor component. Juniper may be present. Young juniper may be increasing. Non-native annual species are present to increasing.

Community 3.2
Rabbitbrush/Bluegrass

Rabbitbrush is dominant and Sandberg bluegrass may be codominant. Perennial bunchgrasses are a minor component. Juniper may be present. Non-native annual species are present to increasing.

Pathway 3.1A
Community 3.1 to 3.2

Fire (ground fires) or brush and tree removal treatments.

Pathway 3.2A
Community 3.2 to 3.1

Time and lack of disturbance allows for sagebrush and bitterbrush to recover. Western juniper may increase.

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 possibly invasive annual and perennial forbs. Sagebrush, 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 slope site during extreme weather events.

Community 4.1
Annuals/Sprouting Shrubs

Non-native annual species are dominant with increasing rabbitbrush. Big sagebrush and bitterbrush are missing or reduced. Juniper may be present. Perennial bunchgrasses are a minor component or missing.

Community 4.2
Shrubs/Annuals

Sagebrush and rabbitbrush or other sprouting shrubs are dominant in the overstory with annual non-native species dominant in the understory. Sandberg bluegrass may be present. Understory may be sparse and young juniper may increase.

Pathway 4.1A
Community 4.1 to 4.2

Time and lack of disturbance allows for sagebrush, bitterbrush, or sprouting shrubs to increase. Western juniper may increase.

Pathway 4.2A
Community 4.2 to 4.1

Fire

State 5
Tree

This state is characterized by a dominance of young juniper (<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 slope site during extreme weather events.

Community 5.1
Juniper/Shrubs

Western juniper is dominant with mountain big sagebrush and bitterbrush decreasing. Perennial bunchgrasses are

a minor component. Sandberg bluegrass and six-weeks fescue may increase. Annual non-native species are present and bare ground is increasing.

Community 5.2
Juniper Woodland

Western juniper is dominant on the site. Big sagebrush and bitterbrush are minor components. Perennial bunchgrassess are a minor component. Annual non-native species are present to increasing. Bare ground areas are large and connected. Soil redistribution may be apparent.

Pathway 5.1A
Community 5.1 to 5.2

Time and lack of disturbance allows for maturation of the tree community.

Pathway 5.2A
Community 5.2 to 5.1

Tree stand thinning treatments for fuels management or other resource values.

State 6
Seeded

Within this state, site resources are primarily controlled by introduced range grasses such as crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (Agropyron 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.

Community 6.1
Seeded Species

Seeded species are dominant. Annual non-native species may be present. Juniper may be present.

Community 6.2
Seeded species/Shrubs

Seeded species are codominant with rabbitbrush or sagebrush. Annual non-native species and Sandberg bluegrass may be present.

Community 6.3
Shrubs/Seeded Species

Big sagebrush and rabbitbrush is dominant. Seeded species are reduced while annual non-native species are increasing. Juniper is present to increasing.

Pathway 6.1A
Community 6.1 to 6.2

Time and lack of disturbance allows for shrubs to reestablish, may be coupled with grazing management facilitating shrubs.

Pathway 6.2A
Community 6.2 to 6.1

Fire or shrub management practices.

Pathway 6.2B
Community 6.2 to 6.3

Time and lack of disturbance allows for maturation of shrub community, may be coupled with grazing management facilitating shrub establishment.

Pathway 6.3A
Community 6.3 to 6.1

Fire or other shrub reduction treatments.

Pathway 6.3B
Community 6.3 to 6.2

Shrub management, low severity fire, or Aroga moth damage would decrease the shrub community.

Transition T1A
State 1 to 2

Introduction of non-native plant species

Transition T2A
State 2 to 3

Chronic, inappropriate grazing management reduces perennial grasses and allows for an increase in shrub/tree species. 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 or combination, inappropriate grazing management in the presence of non-native annuals or competitive increase in medusahead 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 or failed rehabilitation treatment or combination of both. Inappropriate grazing management in the presence of annual non-native species or competitive increase in medusahead through lack of active management.

Restoration pathway R3B
State 3 to 5

Shrub and tree reduction treatments and seeding of desired native species

Transition T3B
State 3 to 6

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

Restoration pathway R4A
State 4 to 6

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

Restoration pathway R5A
State 5 to 3

Juniper stand thinning or removal

Restoration pathway R5B
State 5 to 6

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

Transition T6B
State 6 to 3

Chronic, heavy growing season grazing will decrease bunchgrasses, increase Sandberg bluegrass and shrubs. Severe fire.

Transition T6A
State 6 to 4

Catastrophic fire. Inappropriate grazing facilitates decrease in bunchgrasses and increase in non-native annual grasses.

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**			640–800	
	Idaho fescue	FEID	*Festuca idahoensis*	400–480	–
	bluebunch wheatgrass	PSSPS	*Pseudoroegneria spicata ssp. spicata*	240–320	–
2	**Other Perennial Grasses**			32	
	Sandberg bluegrass	POSE	*Poa secunda*	16	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	8	–
	squirreltail	ELEL5	*Elymus elymoides*	8	–
Forb					
4	**Forbs**			88–136	
	slender buckwheat	ERMI4	*Eriogonum microthecum*	80–120	–
	buckwheat	ERIOG	*Eriogonum*	8–16	–
	snow buckwheat	ERNI2	*Eriogonum niveum*	0	–
Shrub/Vine					
7	**Shrubs**			96–184	
	antelope bitterbrush	PUTR2	*Purshia tridentata*	80–120	–
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	16–64	–
8	**Other Shrubs**			0	
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0	–
	desert gooseberry	RIVE	*Ribes velutinum*	0	–
	wax currant	RICE	*Ribes cereum*	0	–
	little sagebrush	ARAR8	*Artemisia arbuscula*	0	–
Tree					
6	**Trees**			8–24	
	western juniper	JUOC	*Juniperus occidentalis*	8–24	–

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Approval

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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:**

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

   ---

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

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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:**