USDA Natural Resources Conservation Service

# Ecological site R010XB085OR
# JD Mountain North 12-16 PZ

Last updated: 12/13/2023
Accessed: 05/21/2024

## General information

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

## 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.

## Ecological site concept

In reference condition, this ecological site supports a plant community dominated by Idaho fescue (Festuca idahoensis) and bluebunch wheatgrass (Pseudoroegneria spicata) with a shrub component of mountain big sagebrush (Artemisia tridentata ssp. vaseyana). Abiotically, this site is characterized by north aspects, moderately deep to deep soils and a frigid/xeric soil climate. Historically, plant community dynamics were driven primarily by disturbances such as periodic fire and drought. Presently, reference conditions are less common and current dynamics are influenced by the spread of invasive species, proliferation of western juniper (Juniperus occidentalis), livestock grazing pressures and fire suppression.

## Associated sites

| | |
|---|---|
| R010XB033OR | **JD Shallow North 12-16 PZ**<br>Adjacent shallow north slopes |
| R010XB028OR | **JD Shrubby Mountain 12-16 PZ**<br>Adjacent non-aspect positions with greater antelope bitterbrush cover |
| R010XB081OR | **JD Claypan North 12-16 PZ**<br>Adjacent north aspects with root restricting claypan layers |

## Similar sites

| | |
|---|---|
| R010XB033OR | **JD Shallow North 12-16 PZ**<br>Shallow rather than moderately deep to deep soil |

| | |
|---|---|
| R010XB070OR | **JD North 12-16 PZ**<br>JD sediments LRU, Mesic soil temperature regime, lower elevation range |
| R010XB071OR | **JD Shrubby Mountain North 12-16 PZ**<br>Higher cover of antelope bitterbrush |
| R010XB081OR | **JD Claypan North 12-16 PZ**<br>North aspects with root restricting claypan layers |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | (1) *Artemisia tridentata ssp. vaseyana* |
| Herbaceous | (1) *Festuca idahoensis*<br>(2) *Pseudoroegneria spicata ssp. spicata* |

## Physiographic features

This site occurs on northerly exposures composed of residuum and colluvium derived from hard igneous extrusive geologies (basalt, andesite, rhyolite, tuff, etc.) with an influence of volcanic ash in the surface. Slopes range from 12 to 60 percent. Elevation varies from 3,000 to 5,600 feet (900 to 1,700 meters). This site is not subject to ponding or flooding and no water table is present.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Upland > Hill<br>(2) Upland > Mountain slope |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 3,000–5,600 ft |
| Slope | 12–60% |
| Aspect | W, NW, N, NE |

## Climatic features

The annual precipitation is 12 to 16 inches (300 to 400 mm), most of which occurs in the form of snow during the months of November through March. Localized, occasionally severe, convectional storms occur during the summer. Frost free days are approximately 50 to 80. The soil temperature regime is frigid. The graphs below are populated from the closest available weather station to representative site locations and are provided to indicate general climate patterns.

**Table 3. 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) | 65 days |
| Freeze-free period (average) | |
| Precipitation total (average) | 14 in |

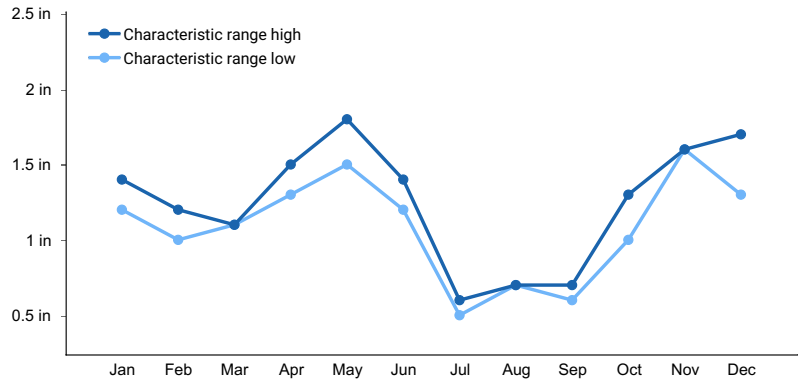



**Figure 1. Monthly precipitation range**

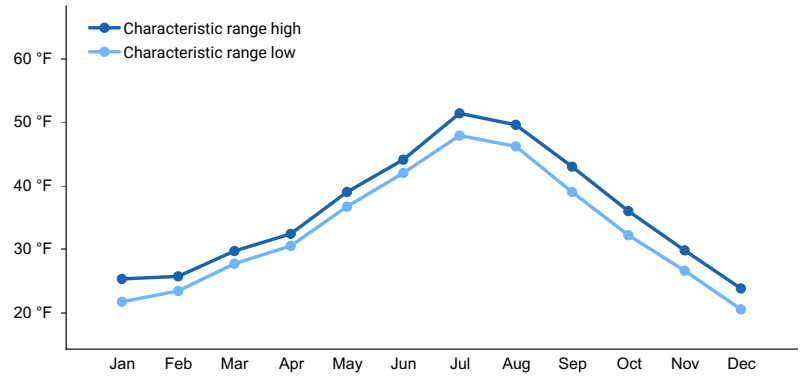



**Figure 2. Monthly minimum temperature range**

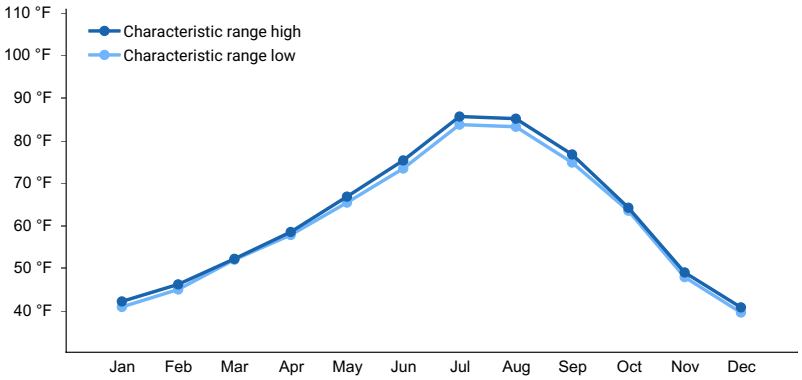



**Figure 3. Monthly maximum temperature range**

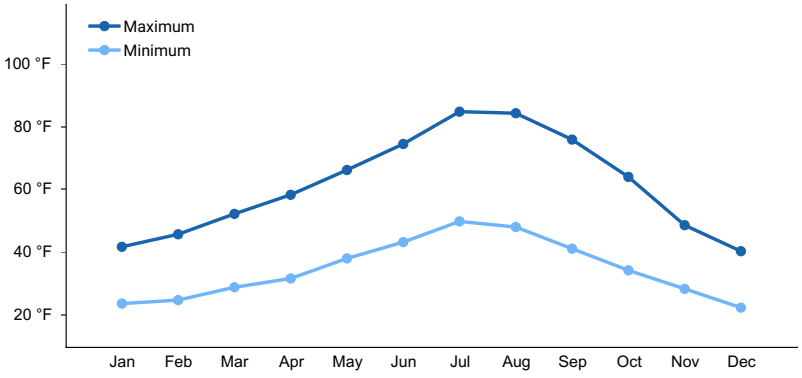



**Figure 4. Monthly average minimum and maximum temperature**

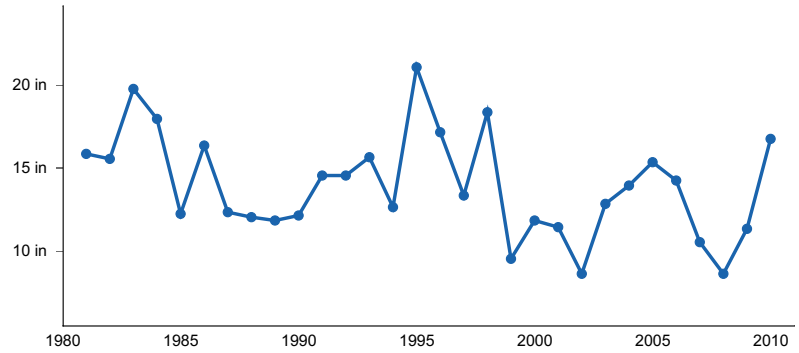



**Figure 5. Annual precipitation pattern**

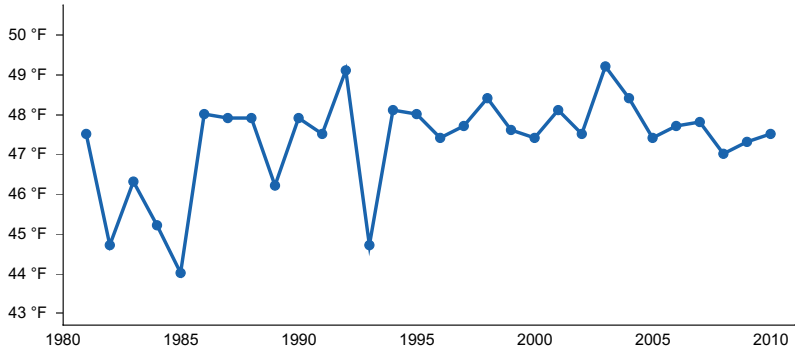



**Figure 6. Annual average temperature pattern**

## Climate stations used

- (1) BARNES STN [USC00350501], Prineville, OR
- (2) MITCHELL 2 E [USC00355638], Mitchell, OR

## Influencing water features

This site is not influenced by water from a wetland or stream.

## Wetland description

Not applicable

## Soil features

The soils of this site are formed from residuum and colluvium derived from hard igneous extrusive geologies (basalt, andesite, rhyolite, tuff, etc.) with an influence of volcanic ash in the surface. They are moderately deep to deep. Typically the surface layer is an ashy loam or ashy loamy sand over a very gravelly loam or clay loam subsoil. Depth to bedrock is typically 20 to greater than 60 inches. Soil permeability is moderate. The available water holding capacity (AWC) is 2 to 6 inches.

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Colluvium–basalt<br>(2) Residuum–tuff<br>(3) Volcanic ash |
| Surface texture | (1) Ashy loam<br>(2) Ashy loamy sand<br>(3) Cobbly loam |

| | |
|---|---|
| Family particle size | (1) Ashy<br>(2) Clayey-skeletal<br>(3) Loamy-skeletal |
| Drainage class | Moderately well drained to well drained |
| Permeability class | Moderate to slow |
| Depth to restrictive layer | 20–60 in |
| Soil depth | 20–60 in |
| Surface fragment cover <=3" | 5–20% |
| Surface fragment cover >3" | 15–30% |
| Available water capacity (0-40in) | 2–6 in |
| Calcium carbonate equivalent (0-40in) | 0% |
| Electrical conductivity (0-40in) | 0–2 mmhos/cm |
| Sodium adsorption ratio (0-40in) | 0 |
| Soil reaction (1:1 water) (0-40in) | 6.6–7.3 |
| Subsurface fragment volume <=3" (4-40in) | 15–50% |
| Subsurface fragment volume >3" (4-40in) | 10–40% |

## Ecological dynamics

The reference plant community is dominated by Idaho fescue and bluebunch wheatgrass in the understory and mountain big sagebrush in the overstory. Sandberg bluegrass, prairie junegrass, squirreltail and a variety of forbs are also present.

Ecological Dynamics and Disturbance Response:
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 is 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).

The Great Basin sagebrush communities have high spatial and temporal variability in precipitation both among years and within growing seasons. Nutrient availability is typically low but increases with elevation and closely follows moisture availability. The invasibility of plant communities is often linked to resource availability. Disturbance can decrease resource uptake due to damage or mortality of the native species and depressed competition or can increase resource pools by the decomposition of dead plant material following disturbance. The invasion of sagebrush communities by cheatgrass (*Bromus tectorum*) has been linked to disturbances (fire, abusive grazing) that have resulted in fluctuations in resources (Chambers et al. 2007).

The range and density of western juniper has increased since the middle of the nineteenth century (Tausch 1999, Miller and Tausch 2000). Causes for expansion of western juniper into sagebrush ecosystems include wildfire suppression, historic livestock grazing, and climate change (Bunting 1994). Mean fire return intervals prior to

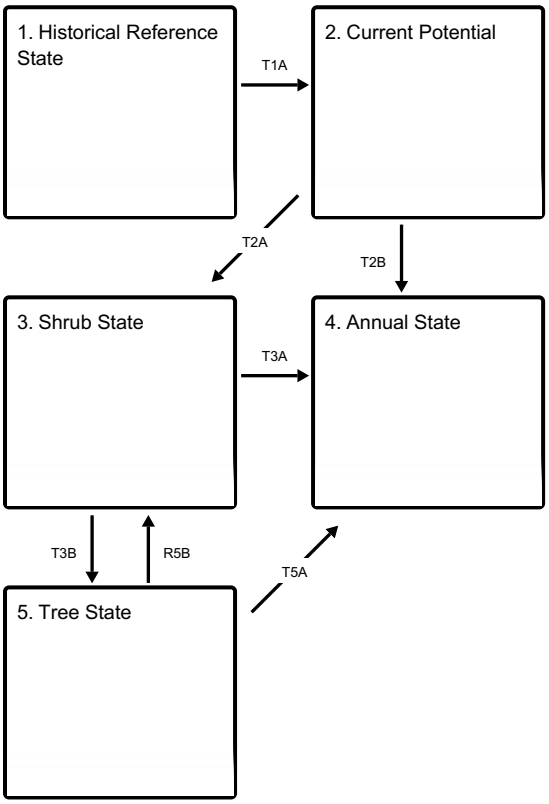
European settlement in mountain big sagebrush ecosystems were 15 to 25 years (Burkhardt and Tisdale 1976, Young and Evans 1981), frequent enough to inhibit the encroachment of western juniper into these big sagebrush cover types (Miller and Tausch 2000). With the increased suppression of wildfire and livestock grazing, which reduces ground fuels and understory competition, regeneration and establishment of western juniper have expanded into suitable sites previously dominated by big sagebrush (Burns and Honkala 1990). An increase in 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*). With annual species in the understory wildfire can become more frequent and increase in intensity. With frequent wildfires these plant communities can convert to annual species with a sprouting shrub and juvenile tree overstory.

Treatment Response:
North facing aspects respond positively to juniper removal if soil erosion is not significant. Seeding may be necessary if there is less than one to two bunchgrass plants per meter square in the understory. Sagebrush and forbs may also need to be seeded if adult plants are no longer present in the understory.

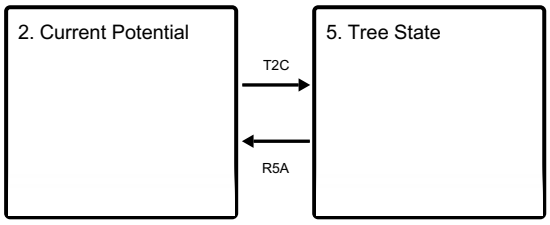
Adapted from: Stringham, et al. 2017

## State and transition model

**Ecosystem states**




**States 2 and 5 (additional transitions)**




**T1A** - Introduction of non-native species

**T2A** - Less frequent fire or extended drought reduces perennial bunchgrasses and allows for an increase in shrub and tree species

**T2B** - Catastrophic fire, often coupled with soil disturbing activities or extended drought.

**T2C** - Time and lack of disturbance allows for maturation of the tree community

**T3A** - Catastrophic fire, multiple fires, or soil disturbing treatments or activities.

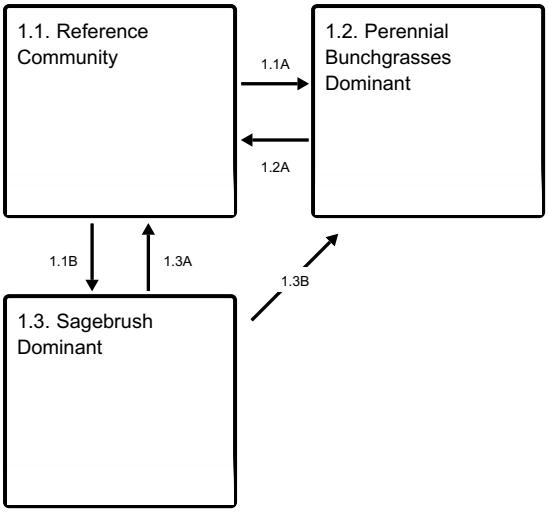
**T3B** - Time and lack of disturbance allows for maturation of the tree community.

**R5A** - Mechanical treatment of trees coupled with seeding of desired species.

**R5B** - Mechanical treatment of trees

**T5A** - Catastrophic fire

**State 1 submodel, plant communities**




**1.1A** - Low and high severity fire

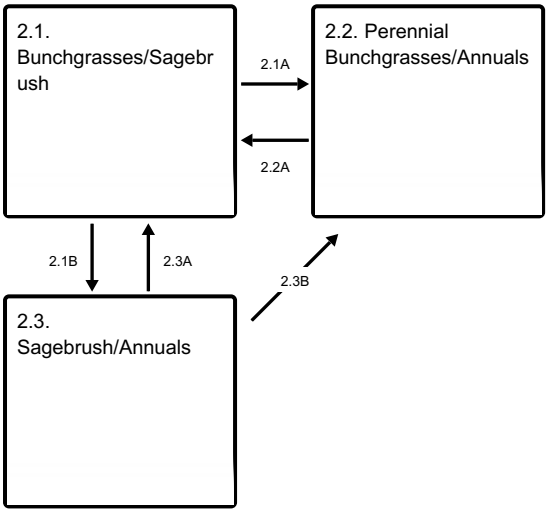
**1.1B** - Time and lack of disturbance

**1.2A** - Time and lack of disturbance

**1.3A** - High severity fire

**1.3B** - Low severity fire

**State 2 submodel, plant communities**




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

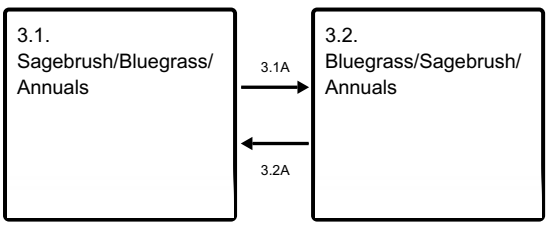
**2.1B** - Time and lack of disturbance

**2.2A** - Time and lack of disturbance

**2.3A** - Moderate to high severity fire, brush treatments and tree thinning

**2.3B** - Low severity fire, brush treatments and tree thinning

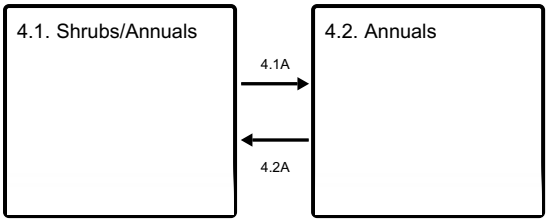
**State 3 submodel, plant communities**




**3.1A** - Fire or brush treatments with minimal soil disturbance.

**3.2A** - Time and lack of disturbance

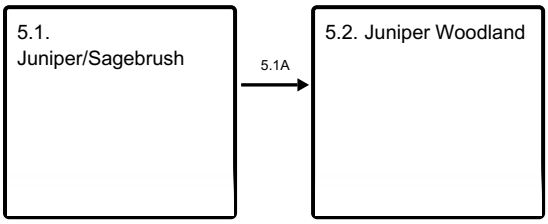
**State 4 submodel, plant communities**




**4.1A** - Fire

**4.2A** - Time and lack of disturbance

**State 5 submodel, plant communities**




**5.1A** - Time and lack of disturbance

## State 1
## Historical Reference State

The Reference State 1.0 is a representation of the natural range of variability under pristine conditions. The reference state has 3 general community phases; a shrub-grass dominant phase, a perennial grass dominant phase and a shrub dominant phase. 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 include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. Plant community phase changes are primarily driven by fire, periodic drought and/or insect or disease attack. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These feedbacks include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients.

### Dominant plant species

- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- Idaho fescue (*Festuca idahoensis*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata ssp. spicata*), grass

## Community 1.1

## Reference Community

Mountain Big Sagebrush - Idaho Fescue Deep-rooted perennial bunchgrasses and sagebrush are dominant, with a diverse forb component present. Annual non-native species present.

### Dominant plant species

- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- Idaho fescue (*Festuca idahoensis*), grass

**Table 5. Annual production by plant type**

| Plant Type | Low (Lb/Acre) | Representative Value (Lb/Acre) | High (Lb/Acre) |
|---|---|---|---|
| Grass/Grasslike | 740 | 905 | 1150 |
| Shrub/Vine | 95 | 115 | 145 |
| Forb | 50 | 60 | 80 |
| Tree | 15 | 20 | 25 |
| **Total** | **900** | **1100** | **1400** |

**Table 6. Ground cover**

| | |
|---|---|
| Tree foliar cover | 0-1% |
| Shrub/vine/liana foliar cover | 5-10% |
| Grass/grasslike foliar cover | 50-60% |
| Forb foliar cover | 0-5% |
| Non-vascular plants | 25-35% |
| Biological crusts | 0% |
| Litter | 5-10% |
| Surface fragments >0.25" and <=3" | 3-5% |
| Surface fragments >3" | 4-6% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 0-2% |

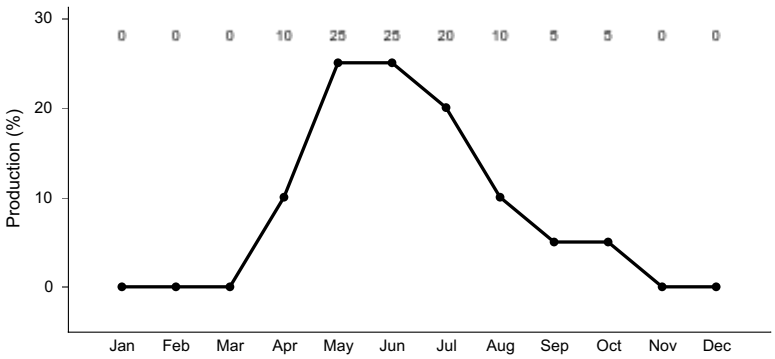



**Figure 8. Plant community growth curve (percent production by month). OR4181, B10 JD higher elev. RPC. B10XB JD higher elev. 12-16 PZ RPC.**

## Community 1.2
## Perennial Bunchgrasses Dominant

Deep-rooted perennial bunchgrasses are dominant and forbs may increase.

### Community 1.3
### Sagebrush Dominant

Sagebrush increases while the deep-rooted perennial bunchgrasses decrease and young juniper increase.

### Pathway 1.1A
### Community 1.1 to 1.2

Low severity fire creates a grass and sagebrush mosaic; high severity fire significantly reduces sagebrush cover and leads to a community dominated by grasses and forbs.

### Pathway 1.1B
### Community 1.1 to 1.3

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

### Pathway 1.2A
### Community 1.2 to 1.1

Time and lack of disturbance allows for shrub regeneration.

### Pathway 1.3A
### Community 1.3 to 1.1

High severity fire significantly reduces sagebrush and juniper cover and leads to a community dominated by grasses and forbs.

### Pathway 1.3B
### Community 1.3 to 1.2

Low severity fire reduces sagebrush and juniper cover and creates a sagebrush and grass mosaic.

## State 2
## Current Potential

This state is similar to the Reference State 1.0 with three similar community phases. Ecological function has not changed, however the resiliency of the state has been reduced by the presence of invasive weeds. Non-natives may increase in abundance but will not become dominant within this State. These non-natives 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 feedbacks include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. Positive feedbacks decrease ecosystem resilience and stability of the state. These include the non-natives' high seed output, persistent seed bank, rapid growth rate, residual dry matter accumulation, and adaptations for seed dispersal.

**Dominant plant species**

- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- Idaho fescue (*Festuca idahoensis*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata ssp. spicata*), grass

### Community 2.1
### Bunchgrasses/Sagebrush

Deep-rooted perennial bunchgrasses and sagebrush are dominant, with a diverse forb component present. Annual non-native species are present.

### Community 2.2

### Perennial Bunchgrasses/Annuals

Deep-rooted perennial bunchgrasses are dominant with annual non-native species present to increase. Forbs may increase.

### Community 2.3
### Sagebrush/Annuals

Sagebrush increases while the deep-rooted perennial bunchgrasses decrease. The young juniper are increasing and the non-native annual species are present and increasing.

### Pathway 2.1A
### Community 2.1 to 2.2

Low severity fire creates a grass and sagebrush mosaic; high severity fire significantly reduces sagebrush cover and leads to a community dominated by grasses and forbs. Brush treatments and tree thinning would also reduce the overstory allowing the perennial understory to increase.

### Pathway 2.1B
### Community 2.1 to 2.3

Time and lack of disturbance such as fire facilitates an increase in the shrub overstory; may be coupled with drought.

### Pathway 2.2A
### Community 2.2 to 2.1

Time and lack of disturbance allows for shrub regeneration.

### Pathway 2.3A
### Community 2.3 to 2.1

Moderate to high severity fire reduces sagebrush and juniper cover and leaves a community dominated by grasses and forbs. Brush treatments and tree thinning would also reduce the overstory allowing the perennial understory to increase.

### Pathway 2.3B
### Community 2.3 to 2.2

Low severity fire creates a sagebrush and grass mosaic. Brush treatments and tree thinning would also reduce the overstory allowing the perennial understory to increase.

### State 3
### Shrub State

This state is a product of many years of heavy grazing during time periods harmful to perennial bunchgrasses, changes in the historic fire regime or long-term drought favoring shrub establishment. Grazing tolerant Sandberg bluegrass will increase with a reduction in deep rooted perennial bunchgrass competition and become the dominant grass. Sagebrush dominates the overstory and rabbitbrush may be a significant component. Sagebrush cover exceeds site concept and may be decadent, reflecting stand maturity and lack of seedling establishment due to competition with mature plants. The shrub overstory and Sandberg bluegrass understory dominate site resources such that soil water, nutrient capture, nutrient cycling and soil organic matter are temporally and spatially redistributed (3.1). 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.

**Dominant plant species**

- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- antelope bitterbrush (*Purshia tridentata*), shrub
- rabbitbrush (*Chrysothamnus*), shrub
- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- Sandberg bluegrass (*Poa secunda*), grass

### Community 3.1
### Sagebrush/Bluegrass/Annuals

Sagebrush is dominant and Sandberg bluegrass is increasing. The deep-rooted perennial bunchgrasses are a minor component or are missing. Non-native annual species are present and increasing. Western juniper is present to increasing.

### Community 3.2
### Bluegrass/Sagebrush/Annuals

Sandberg bluegrass is dominant with sagebrush decreasing. Deep-rooted perennial grasses are a minor component or missing. Non-native annual species are present to increasing. Western juniper is present to increasing.

### Pathway 3.1A
### Community 3.1 to 3.2

Fire or brush treatments with minimal soil disturbance.

### Pathway 3.2A
### Community 3.2 to 3.1

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

### State 4
### Annual State

This community is characterized by the dominance of annual non-native species such as cheatgrass, medusahead, and tansy mustard in the understory. Sagebrush and rabbitbrush may dominate the overstory.

**Dominant plant species**

- cheatgrass (*Bromus tectorum*), grass
- medusahead (*Taeniatherum caput-medusae*), grass
- North Africa grass (*Ventenata dubia*), grass

### Community 4.1

### Shrubs/Annuals

Sagebrush and rabbitbrush is dominant in the community with annual non-native species dominant in the understory. Mat forming forbs increase and Western juniper present to increasing.

### Community 4.2
### Annuals

Annual non-native species are dominant once the perennial grasses decrease. Western juniper may be present. Rabbitbrush and other sprouting shrubs may increase.

### Pathway 4.1A
### Community 4.1 to 4.2

Fire

### Pathway 4.2A
### Community 4.2 to 4.1

Time and lack of disturbance allows for sagebrush and sprouting shrubs to increase. Western juniper may be present.

## State 5
## Tree State

This state is characterized by a dominance of western juniper in the overstory. 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.

#### Dominant plant species

- western juniper (*Juniperus occidentalis*), tree

### Community 5.1
### Juniper/Sagebrush

Western juniper becomes dominant as sagebrush decreases. Deep-rooted perennial grasses decrease and Sandberg bluegrass may increase. Non-native annual species increase.

### Community 5.2
### Juniper Woodland

Western juniper is dominant with only a minor component of sagebrush. Deep-rooted perennial grasses are also a minor component or may be missing. Non-native annual species increase and the bare ground may be increasing.

### Pathway 5.1A
### Community 5.1 to 5.2

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

### Transition T1A
### State 1 to 2

Introduction of non-native species

### Transition T2A
### State 2 to 3

Less frequent fire or extended drought reduces perennial bunchgrasses and allows for an increase in shrub and tree species

### Transition T2B
### State 2 to 4

Catastrophic fire, often coupled with soil disturbing activities or extended drought.

### Transition T2C
### State 2 to 5

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

### Transition T3A
### State 3 to 4

Catastrophic fire, multiple fires, or soil disturbing treatments or activities.

### Transition T3B
### State 3 to 5

**Shrub State** **Tree State**

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

### Restoration pathway R5A
### State 5 to 2

Mechanical treatment of trees coupled with seeding of desired species.

### Restoration pathway R5B
### State 5 to 3

**Tree State** **Shrub State**

Mechanical treatment of trees

## Transition T5A
## State 5 to 4

Catastrophic fire

## 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 | **Dominant Mid Bunch Grass** | | | 450–680 | |
| | Idaho fescue | FEID | *Festuca idahoensis* | 550–660 | – |
| 2 | **Subdominant Mid Bunchgrass** | | | 230–440 | |
| | bluebunch wheatgrass | PSSP6 | *Pseudoroegneria spicata* | 330–440 | – |
| 3 | **Short bunchgrass** | | | 20–25 | |
| | Sandberg bluegrass | POSE | *Poa secunda* | 20–25 | – |
| 4 | **Other Grasses** | | | 11–33 | |
| | squirreltail | ELEL5 | *Elymus elymoides* | 0–11 | – |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 0–11 | – |
| **Shrub/Vine** | | | | | |
| 5 | **Shrubs** | | | 55–187 | |
| | mountain big sagebrush | ARTRV | *Artemisia tridentata ssp. vaseyana* | 55–165 | – |
| | antelope bitterbrush | PUTR2 | *Purshia tridentata* | 0–22 | – |
| 8 | **Other Shrubs** | | | 0–33 | |
| | yellow rabbitbrush | CHVI8 | *Chrysothamnus viscidiflorus* | 0–11 | – |
| | rubber rabbitbrush | ERNA10 | *Ericameria nauseosa* | 0–11 | – |
| | tetraclea | TETRA | *Tetraclea* | 0–11 | – |
| | wax currant | RICE | *Ribes cereum* | 0–11 | – |
| | desert gooseberry | RIVE | *Ribes velutinum* | 0–11 | – |
| **Forb** | | | | | |
| 7 | **Dominant perennial forbs** | | | 22–66 | |
| | buckwheat | ERIOG | *Eriogonum* | 11–33 | – |
| | lupine | LUPIN | *Lupinus* | 11–33 | – |
| 9 | **Other perennial forbs** | | | 0–55 | |
| | erigenia | ERIGE | *Erigenia* | 0–11 | – |
| | desertparsley | LOMAT | *Lomatium* | 0–11 | – |
| | common yarrow | ACMI2 | *Achillea millefolium* | 0–11 | – |
| | castilla | CASTI | *Castilla* | 0–11 | – |
| | pussytoes | ANTEN | *Antennaria* | 0–11 | – |
| | ragwort | SENEC | *Senecio* | 0–11 | – |
| | milkvetch | ASTRA | *Astragalus* | 0–11 | – |
| | sagebrush mariposa lily | CAMA5 | *Calochortus macrocarpus* | 0–11 | – |
| **Tree** | | | | | |
| 17 | **Juniper** | | | 11–33 | |
| | western juniper | JUOC | *Juniperus occidentalis* | 11–33 | – |

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## Contributors

Jenni Moffitt, general updates 2020
Stringham et al. 2017, ecological dynamics/S&T Model
Cici Brooks
Bob Gillaspy
Ed Petersen
JPR
Andrew Neary - table population and edits 2021

## Approval

Kirt Walstad, 12/13/2023

## 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 | 05/21/2024 |
| 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:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth ( in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**

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