

Ecological site R008XY546WA

Sand South Aspect Columbia Hills

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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): 008X–Columbia Plateau

MLRA 8 encompasses about 50,100 square kilometers mainly in Washington and Oregon, with a small area in Idaho. This MLRA is characterized by loess hills, surrounding scablands, and alluvial deposits. This MLRA consists mostly of Miocene Columbia River Basalt covered with up to 200 feet of loess and volcanic ash. The dominant soil order in this MLRA is Mollisols. Soils in this MLRA dominantly have a mesic temperature regime, a xeric moisture regime, and mixed minerology.

Classification relationships

Major Land Resource Area (MLRA): 8 – Columbia Plateau

LRU – Common Resource Areas (CRA):

8.5 - Moist Yakima Folds

Ecological site concept

Diagnostics:

Sand, south aspect, Columbia Hills is an upland grassland site occurring on the south side of the Columbia Hills in Klickitat county. Soils are moderately deep to deep, coarse textured and well drained. The most common textures are sand and loamy fine sand.

Note: due to historic farming and grazing the south side of the Columbia Hills has been heavily disturbed. No pristine remnant is known, so the reference state has been

reconstructed based on experience in MLRA 8.

The south side of the Columbia Hills is a grassland steppe area and has not had sagebrush for more than 50 years and is not expected to have sagebrush. This area does not have sagebrush, nor bitterbrush, and no rabbitbrush except for one small area near the Columbia River.

Needle and thread and Indian ricegrass would be the dominate species in the reference state. Onespoke oatgrass, Eriogonum species and balsamroot would also be common.

Principle Vegetative Drivers:

The coarse-textured soils and south aspect drive the vegetative expression of this site. The soil would favor sand-loving species such as needle and thread and Indian ricegrass.

Associated Sites:

Sand, south aspect s is associated with other ecological sites in the Columbia Hills grassland steppe areas of MLRA 8, including Shallow Stony and loamy. Very Shallow may also be nearby.

Similar Sites:

The MLRA 7 Columbia Basin Sands is a needle and thread and Indian ricegrass ecological site, but with sagebrush and rabbitbrush as well.

Associated sites

| | |
|-------------|---|
| R008XY435WA | Loamy 14-20 PZ Goldendale Prairie |
| R008XY455WA | Loamy North Aspect 14-20 PZ Goldendale Prairie |
| R008XY516WA | Shallow Stony South Aspect Columbia Hills |

Similar sites

| | |
|-------------|--------------|
| R007XY140WA | Sands |
|-------------|--------------|

Table 1. Dominant plant species

| | |
|------------|---|
| Tree | Not specified |
| Shrub | Not specified |
| Herbaceous | (1) <i>Hesperostipa comata</i> (2) <i>Achnatherum hymenoides</i> |

Physiographic features

The landscape is part of the Columbia basalt plateau. Sand, south aspect, Columbia Hills is commonly found on terraces, terrace escarpments, benches and plateaus of the Columbia Hills in Klickitat County.

Physiographic Division: Intermontane Plateau

Physiographic Province: Columbia Plateau

Physiographic Sections: Walla Walla Plateau Section

Landscapes: Hills and plateaus

Landform: Terraces, terraces escarpments, hillslopes, dunes

Aspect: Dominantly southern aspects, but can occur on all aspects

Table 2. Representative physiographic features

| | |
|--------------------|--|
| Landforms | (1) Hills (2) Plateau (3) Terrace (4) Escarpment (5) Hillslope (6) Dune |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 91–457 m |
| Slope | 10–50% |
| Water table depth | 152 cm |
| 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 | 46–518 m |
| Slope | 0–65% |
| Water table depth | Not specified |

Climatic features

Grasslands do not have shrubs because they receive more spring precipitation especially in March (Daubenmire). The climate is characterized by moderately cold, wet winters, and

hot, dry summers, with limited precipitation due to the rain shadow effect of the Cascades. Winter fog is variable and often quite localized, as the fog settles on some areas but not others. Compared to the rest of MLRA 8, the south side of the Columbia Hills is dry and hot. Taxonomic soil climate is xeric moisture regime with a mesic temperature regime.

Table 4. Representative climatic features

| | |
|--|--------------|
| Frost-free period (characteristic range) | 120-150 days |
| Freeze-free period (characteristic range) | |
| Precipitation total (characteristic range) | 254-356 mm |
| Frost-free period (actual range) | 110-180 days |
| Freeze-free period (actual range) | |
| Precipitation total (actual range) | |

Influencing water features

A plant's ability to grow on a site and overall plant production is determined by soil-water-plant relationships

1. Whether rain and melting snow runs off-site or infiltrates into the soil
2. Whether soil condition remain aerobic or become saturated and become anaerobic
3. Water drainage and how quickly the soil reaches wilting point

Sand, south aspect, Columbia Hills ecological sites are well drained and dry down quicker than adjacent Loamy ecological sites.

Soil features

This ecological site components are dominantly Typic and Xeric taxonomic subgroups of Haploxerolls and Xeropsammets great groups of the Mollisols and Entisols taxonomic orders. Soils are dominantly very deep. Average available water capacity of about 3.0 inches (7.6 cm) in the 0 to 40 inches (0-100 cm) depth range.

Soil parent material is dominantly mixed eolian deposits with colluvium and residuum.

The associated soils are Dallesport, Ewall, Haploxerolls and similar soils.

Dominate soil surface is sand to very cobbly fine sandy loam.

Dominant particle-size class is loamy to sandy-skeletal.

Table 5. Representative soil features

| | |
|---|---|
| Parent material | (1) Eolian deposits (2) Residuum |
| Surface texture | (1) Sand (2) Very cobbly fine sandy loam |
| Family particle size | (1) Loamy (2) Sandy-skeletal |
| Drainage class | Well drained to excessively drained |
| Depth to restrictive layer | 152 cm |
| Soil depth | 152 cm |
| Surface fragment cover ≤3" | 10% |
| Surface fragment cover >3" | 10% |
| Available water capacity (0-101.6cm) | 7.62 cm |
| Calcium carbonate equivalent (Depth not specified) | 0–10% |
| Electrical conductivity (Depth not specified) | 0 mmhos/cm |
| Sodium adsorption ratio (Depth not specified) | 0 |
| Soil reaction (1:1 water) (0-25.4cm) | 6.1–8.4 |
| Subsurface fragment volume ≤3" (Depth not specified) | 20% |
| Subsurface fragment volume >3" (Depth not specified) | 10% |

Table 6. Representative soil features (actual values)

| | |
|---|---------------|
| Drainage class | Not specified |
| Depth to restrictive layer | Not specified |
| Soil depth | Not specified |
| Surface fragment cover ≤3" | 0–25% |
| Surface fragment cover >3" | 0–25% |
| Available water capacity (0-101.6cm) | 3.3–11.68 cm |
| Calcium carbonate equivalent (Depth not specified) | Not specified |

| | |
|---|---------------|
| Electrical conductivity (Depth not specified) | Not specified |
| Sodium adsorption ratio (Depth not specified) | Not specified |
| Soil reaction (1:1 water) (0-25.4cm) | Not specified |
| Subsurface fragment volume ≤3" (Depth not specified) | 0–50% |
| Subsurface fragment volume >3" (Depth not specified) | 0–25% |

Ecological dynamics

Sand, south aspect, Columbia Hills produces about 450-750 pounds/acre of biomass annually.

The line between sagebrush steppe and true grasslands has been discussed and debated for many years. Daubenmire states that the line has nothing to do with pre-settlement as native ungulates played no significant role in the evolution of ecotypes. He also says that there is no evidence that the distribution of vegetative types is related to fire. And he also says there is no useful correlation between soil classification and the line between grasslands and sagebrush steppe.

The ecotones between Daubenmire's vegetation types can be defined on the basis of consistent differences in climate and consistent differences in vegetation. Higher spring precipitation, especially in March, favors grasses over sagebrush. The grassland area of southeastern Adams and eastern Franklin counties have more precipitation in March. The same for the grasslands in Walla Walla, Asotin and Garfield counties. The Goldendale Prairie and the high elevation grassland above Coulee Dam in Douglas county also have higher spring precipitation. So, the grassland areas of MLRA 8 are consistent with Daubenmire's findings.

Needle and thread and Indian ricegrass would be dominant in the reference state and warrants a degree of understanding. Needle and thread is a very drought tolerant perennial bunchgrass. It prefers excessively drained sandy and coarse textured gravelly loam soils. Needle and thread produces erect, unbranched stems about three feet in height. The seeds have a 4 to 5-inch long twisted awn. With wetting and drying the seed drills itself into the ground. Thus, needle and thread is one of the best seeders in the reference community. With grazing pressure needle and thread initially increases.

Indian ricegrass is a winter hardy, cool-season bunchgrass. It has tightly rolled, slender leaves. Indian ricegrass is known for its ability to reseed and stabilize shifting sand.

The stability and resiliency of the reference communities is directly linked to the health and

vigor of needle and thread and Indian ricegrass Research has found that the community remains resistant to medusahead if the site maintains at least 0.8 mid-sized bunchgrass plants per square foot (K. Davies, 2008). These two grasses help hold the system together. If we lose either grass the ecosystem begins to unravel.

The natural disturbance regime for grassland communities is periodic lightning-caused fires. The fire return intervals (FRI) listed in research for sagebrush steppe communities is quite variable. Ponderosa pine communities have the shortest FRI of about 10-20 years (Miller). The FRI increases as one moves to wetter forested sites or to drier shrub steppe communities. Given the uncertainties and opinions of reviewers, a mean of 75 years was chosen for Wyoming sagebrush communities (Rapid Assessment Model). This would place the historic FRI for grassland steppe around 30 to 50 years.

The effect of fire on the community depends upon the severity of the burn. With a light to moderate fire there can be a mosaic of burned and unburned patches. Bunchgrasses thrive as the fire does not get into the crown. With adequate soil moisture the bunchgrasses can make tremendous growth the year after the fire. Largely, the community is not affected by lower intensity fire. Needle and thread and Indian ricegrass are native species that can increase via new seedlings following a fire.

A severe fire puts stress on the entire community. Spots and areas that were completely sterilized are especially vulnerable to exotic invasive species. Sterilized spots must be seeded to prevent invasive species (annual grasses, tumble mustard) from totally occupying the site. Needle and thread and Indian ricegrass may have weak vigor for a few years but generally survive.

Grazing is another common disturbance that occurs in this ecological site. Grazing pressure can be defined as heavy grazing intensity, or frequent grazing during reproductive growth, or season-long grazing (the same plants grazed more than once). As grazing pressure increases the plant community unravels in stages:

1. Indian ricegrass declines while needle and thread increase
2. Needle and thread declines as invasive species such as cheatgrass and knapweed colonize the site
3. With further decline the site can become a cheatgrass community

Managing grasslands to improve the vigor and health of needle and thread and Indian ricegrass begins with an understanding their needs. New growth each year begins from basal buds. Both grasses reproduce via seed and need to produce viable seed on a regular basis. During seed formation, the growing points of Indian ricegrass become elevated and are vulnerable to damage or removal??

Repeated critical period grazing (boot stage through seed formation) is especially damaging. Over several years each native bunchgrass pasture should be rested during the critical period two out of every three years (approximately April 15 to July 15). And each pasture should be rested the entire growing season every third year (approximately

March 1 to July 15).

In the spring each year it is important to monitor and maintain an adequate top growth: (1) so plants have enough energy to replace basal buds annually, (2) to optimize regrowth following spring grazing, and (3) to protect the elevated growing points of bluebunch wheatgrass.

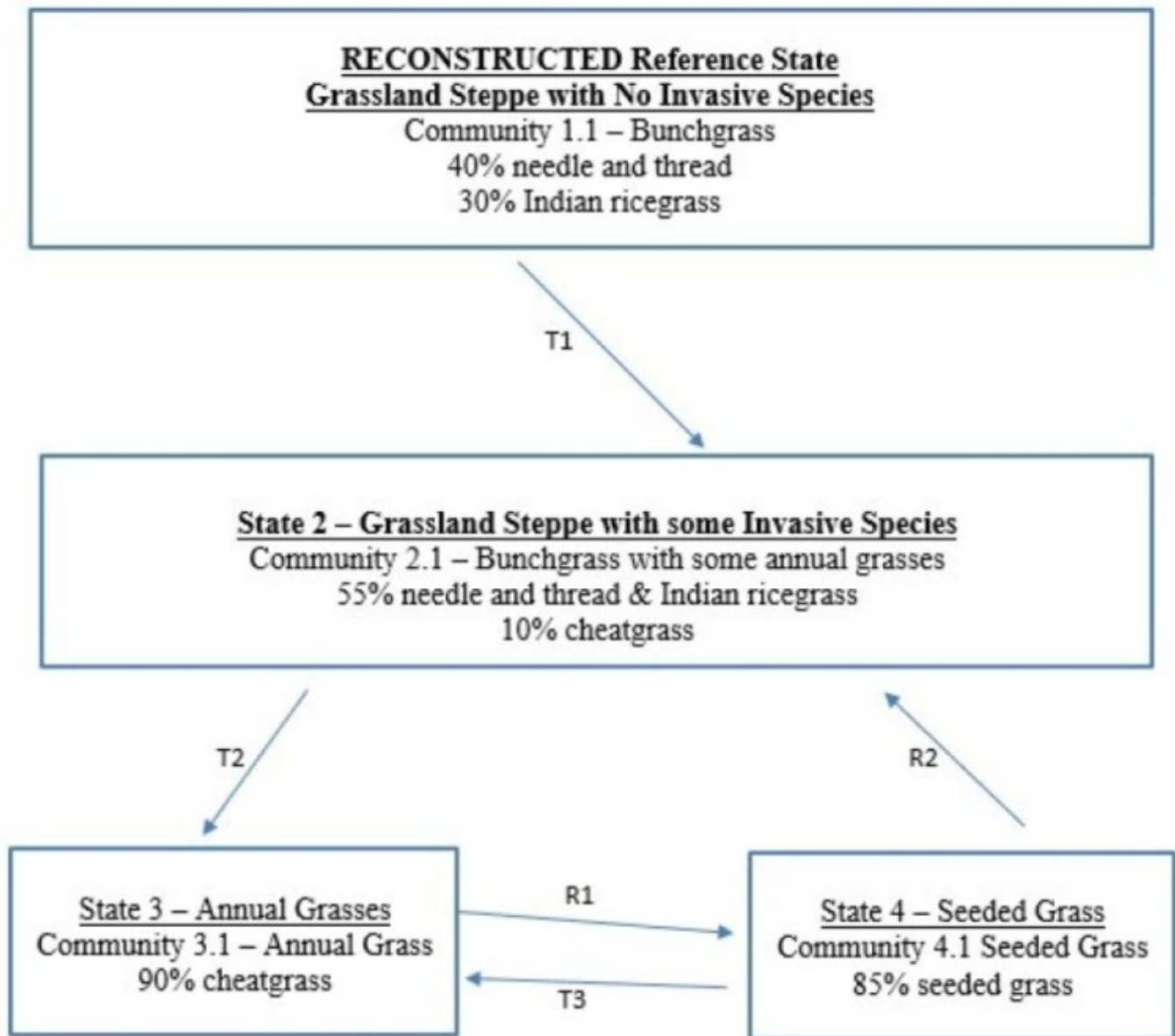
Needle and thread and Indian ricegrass remains competitive if:

- (1) Basal buds are replaced annually,
- (2) Enough top-growth is maintained for growth and protection of growing points, and
- (3) The timing of grazing and non-grazing is managed over a several-year period. Careful management of late spring grazing is especially critical

For more grazing management information refer to Range Technical Notes found in Section I Reference Lists of NRCS Field Office Technical Guide for Washington State.

In Washington, needle and thread and Indian ricegrass communities provide habitat for a variety of upland wildlife species.

State and transition model



State 1

Historic Reference - Grassland Steppe with No Invasive Species

Note: most Sand sites on the south side of the Columbia Hills have already crossed the threshold into State 3

State 1 Narrative: State 1 represents grassland steppe with no invasive or exotic weed species. All the functional, structural groups are represented by one or more native species. The south side of the Columbia Hills has no sagebrush or bitterbrush, and except for a spot along the Columbia River, the south side of the Columbia Hills also has no rabbitbrush. The Reference Community 1.1 would be dominated by needle and thread and Indian ricegrass. Native forbs are also present.

Reference State Community Phases: 1.1 Reference Needle and thread – Indian ricegrass

Dominant Reference State Species: would be needle and thread, Indian ricegrass

At-risk Communities:

- Any community in the reference state is at risk of moving to State 2. The seed source of cheatgrass is nearby and blowing onto most sites annually.

Community 1.1

Needle and Thread and Indian Ricegrass

40% needle and thread 30% Indian ricegrass

State 2

Current Potential - Grassland Steppe with Some Invasive Species

Note: most Sand sites on the south side of the Columbia Hills have already crossed the threshold into State 3 State 2 Narrative: State 2 represents native grassland with the inclusion of a few invasive annual grasses such as cheatgrass. All the native functional, structural groups would be represented by one or more species. Once a community has been invaded by cheatgrass the chance of going back to State 1 is small. The Reference Community 2.1 would be dominated by needle and thread and Indian ricegrass. Native forbs would also be present. Community Phases for State 2: 2.1 Bunchgrass Needle and thread – Indian ricegrass Dominate State 2 Species: Needle and thread, Indian ricegrass

Community 2.1

Needle and Thread, Indian Ricegrass, and Cheatgrass

55% needle and thread & Indian ricegrass 10% cheatgrass

State 3

Annual Grasses

State 3: Annual Grasses Note: most Sand sites on the south side of the Columbia Hills have already crossed the threshold into State 3 State 3 Narrative: State 3 represents sites dominated by invasive annual species and has crossed a biological threshold. As State 1 or State 2 begins to unravel the dominant bunchgrasses decline while invasive grasses become more and more prominent. Virtually all the native functional, structural groups are missing in State 3. Community Phases for State 3: 3.2 Annual Grass Cheatgrass Dominate State 3 Species: Annual grasses such as cheatgrass. The main species can include other annual bromes, medusahead, ventenata, mustard, prickly lettuce and diffuse knapweed.

Community 3.1

Annual Grass

90% cheatgrass

State 4

Seeded Grass

State 4 Narrative: State 4 represents a site that has been seeded to desirable grasses

such as needle and thread, Indian ricegrass, Secar Snake River wheatgrass, Sherman big bluegrass, or Siberian wheatgrass. State 4 is stable if 0.8 plant per sq. ft. or greater of the desired bunchgrasses is maintained. Dominate Species for State 4: Desirable seeded grass species with or without legumes Community Phases for State 4: 4.1 Seeded Grass

Community 4.1 Seeded Grass

85% seeded grass

Transition T1A State 1 to 2

Result: transition from Reference State to State 2 (grassland steppe w/ a few annuals). The Reference State would not have invasive species. State 2 is the same as Reference State but with minor addition of invasive annual grasses such as cheatgrass. Primary Trigger: soil disturbances (rodents, badgers) create openings or opportunities in the community or a high moisture year causes a micro-burst of cheatgrass and is the principle means of colonization. Ecological process. Annually cheatgrass seed blows onto most Reference State sites. With seed-soil contact this seed germinates and competes with the native species for space, light and moisture. The loss of soil biological crusts also contributes to the invasion. Even pristine communities in the Reference State are susceptible to colonization by invasive annual grasses. Indicators: The occurrence of annual grasses on sites where they had been absent.

Transition T2A State 2 to 3

Result: shift from State 2 with a few annuals to State 3 which is dominated by annual grasses. This transition occurs once the cover of needleandthread & Indian ricegrass declines to less than 10% and invasive species cover is greater than 40%. Primary trigger: Grazing pressure causes low vigor and reduces cover of Indian ricegrass and needleandthread. Initially both needleandthread and the annual grasses increase. As the grazing pressure continues, needleandthread will decrease allowing the annual grasses to become dominate. Grazing pressure is defined as heavy grazing, season long grazing or frequent late spring grazing. Secondary Trigger: Repeated fire does the same thing. In Washington, chronic season-long grazing caused more acres of State 2 than repeated fire. Repeated fire is a much more common event in south Central Washington than elsewhere in MLRA 8. Ecological process: the unraveling of the native plant community begins with consistent defoliation pressures to bluebunch wheatgrass. This causes poor vigor, shrinking crowns and plant mortality. With more and more of the soil surface and upper soil rooting surfaces open, opportunistic weeds that take advantage of the available niche space and expand. The invasive annual grasses in State 2 communities make a dramatic increase to dominate the community. Indicators: Decreasing cover of needleandthread and Indian ricegrass and increasing cover of invasive annual species.

Increasing distance between perennial species. Decreasing soil organic matter, soil water retention, limited water infiltration and percolation in the soil profile.

Restoration pathway R3A State 3 to 2

Result: Shift from State 3 back to State 2. This restoration transition does not occur without a significant commitment of time & resource inputs to restore ecological processes, native bunchgrasses, bitterbrush and native forb species. Attention needs to be paid to each step of the process: weed control, seedbed preparation, seeding and planting operations and post-seeding management. Shifting from State 3 to State 4: If the goal is to restore back to a native plant community, State 3 must first be shifted to State 4. It will take two years or longer to kill annual species and to exhaust the seedbank of invasive species. Site will then need to be seeded to perennial species such as crested wheatgrass to restore soil properties before native species can survive and thrive on site. The seeded species rebuild some of the basic soil properties including increased soil organic matter, increased soil moisture, and likely would also require the soil's pore spaces, bulk density and soil microorganisms to return before the native species that used to survive in this ecological site can return. The site would also need several years with no significant fires and proper grazing management as well. See narrative for R1 transition above. Shifting from State 4 to State 2: This assumes that the shift from State 3 to State 4 has been successful and that seeds of native species are available and affordable. State 4 stand must be killed before proceeding. The seeding of native species should occur in two steps: (1) a seeding of native bunchgrasses so that broadleaf weeds may be controlled, (2) a re-introduction of native forbs. The site would also need several years of no significant fires and proper grazing management as well to ensure plant establishment and vigor.

Restoration pathway R3B State 3 to 4

Result: shift from State 3 dominated by annual grasses to State 4 desirable seeded grasses. This restoration transition does not occur without significant time and inputs to control weeds, prepare a seedbed, seed desirable species, and post-seeding weed control and management. This requires a commitment of two years or more for weed control. Care must be taken to maintain soil structure so that the seedbed has many safe-sites for the seed. Seed placement must be managed to achieve seed-soil contact at very shallow depth (about 1/8 inch is desired). Proper grazing management is essential to maintain the stand post-seeding. Needleandthread, Indian ricegrass, Secar Snake River wheatgrass, thickspike wheatgrass, Sherman big bluegrass, Sandberg bluegrass, and intermediate wheatgrass are typical species seeded on Loamy ecological site. The actual transition occurs when the seeded species have successfully established and are outcompeting the annual species for cover and dominance of resources.

Transition T4A State 4 to 3

Result: Transition from State 4 seeded grass to State 3 annual grasses. This transition occurs when the desirable seeded grasses become minor to the dominant annual grasses. Primary trigger: chronic grazing pressure on the seeded grasses reduce the vigor and density of key bunchgrass species. Ecological process: the unraveling of the seeded grass community begins with consistent defoliation pressures to seeded grasses. This causes poor vigor, shrinking crowns and plant mortality. With more and more of the soil surface and upper soil rooting surfaces open, invasive annual grasses become more and more common with the loss of each bunchgrass. The invasive annual grasses in State 2 communities make a dramatic increase to dominate the community. Indicators: shrinking crowns and mortality of desirable species, increasing caps gaps between perennial species, increasing cover by annual grasses.

Additional community tables

Table 7. Community 1.1 plant community composition

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|------------------------|--|--------|---------------------------------|--------------------------------|------------------|
| Grass/Grasslike | | | | | |
| 1 | Dominant Mid-Size Bunchgrasses | | | 588– | |
| | needle and thread | HECO26 | <i>Hesperostipa comata</i> | 336– | – |
| | Indian ricegrass | ACHY | <i>Achnatherum hymenoides</i> | 252– | – |
| 2 | Other Mid-Size Bunchgrasses - Minor | | | 129– | |
| | sand dropseed | SPCR | <i>Sporobolus cryptandrus</i> | – | – |
| | bluebunch wheatgrass | PSSP6 | <i>Pseudoroegneria spicata</i> | – | – |
| | squirreltail | ELEL5 | <i>Elymus elymoides</i> | – | – |
| | Thurber's needlegrass | ACTH7 | <i>Achnatherum thurberianum</i> | – | – |
| 3 | Short Grass - Minor | | | 28– | |
| | Sandberg bluegrass | POSE | <i>Poa secunda</i> | – | – |
| | sixweeks fescue | VUOC | <i>Vulpia octoflora</i> | – | – |
| Forb | | | | | |
| 4 | Native Forbs - Minor | | | 168– | |
| | arrowleaf balsamorhiza | BASA3 | <i>Balsamorhiza hirtella</i> | – | – |

| | daisymoot | | sagittata | | |
|--|-----------------------|--------|------------------------------|---|---|
| | lupine | LUPIN | <i>Lupinus</i> | – | – |
| | hawksbeard | CREPI | <i>Crepis</i> | – | – |
| | fleabane | ERIGE2 | <i>Erigeron</i> | – | – |
| | buckwheat | ERIOG | <i>Eriogonum</i> | – | – |
| | Indian paintbrush | CASTI2 | <i>Castilleja</i> | – | – |
| | spiny phlox | PHHO | <i>Phlox hoodii</i> | – | – |
| | granite prickly phlox | LIPU11 | <i>Linanthus pungens</i> | – | – |
| | trumpet | COLLO | <i>Collomia</i> | – | – |
| | woolly plantain | PLPA2 | <i>Plantago patagonica</i> | – | – |
| | yellow fritillary | FRPU2 | <i>Fritillaria pudica</i> | – | – |
| | silverpuffs | MICRO6 | <i>Microseris</i> | – | – |
| | mariposa lily | CALOC | <i>Calochortus</i> | – | – |
| | longleaf phlox | PHLO2 | <i>Phlox longifolia</i> | – | – |
| | desertparsley | LOMAT | <i>Lomatium</i> | – | – |
| | milkvetch | ASTRA | <i>Astragalus</i> | – | – |
| | low pussytoes | ANDI2 | <i>Antennaria dimorpha</i> | – | – |
| | Douglas' dustymaiden | CHDO | <i>Chaenactis douglasii</i> | – | – |
| | snow buckwheat | ERNI2 | <i>Eriogonum niveum</i> | – | – |
| | larkspur | DELPH | <i>Delphinium</i> | – | – |
| | western stoneseed | LIRU4 | <i>Lithospermum ruderale</i> | – | – |
| | common yarrow | ACMI2 | <i>Achillea millefolium</i> | – | – |

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Acknowledgments

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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 | 05/08/2025 |
| 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:**
-