# Ecological site R025XY018OR SHALLOW CLAYPAN 13-16 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): 025X–Owyhee High Plateau

The Owyhee High Plateau, MLRA 25, lies within the Intermontane Plateaus physiographic province. The southern half is found in the Great Basin while the northern half is located in the Columbia Plateaus. The southern section of the Owyhee High Plateau is characterized by isolated, uplifted fault-block mountain ranges separated by narrow, aggraded desert plains. This geologically older terrain has been dissected by numerous streams draining to the Humboldt River. The northern section forms the southern boundary of the extensive Columbia Plateau basalt flows. Deep, narrow canyons drain to the Snake River across the broad volcanic plain. This MLRA is characteristically cooler and wetter than the neighboring MLRAs of the Great Basin. Elevation ranges from 3,000 to 7,550 feet on rolling plateaus and in gently sloping basins. It is more than 9,840 feet on some steep mountains. The average annual precipitation in most of this area is typically 11 to 22 inches. It increases to as much as 49 inches at the higher elevations. Precipitation occurs mainly as snow in winter. The supply of water from precipitation and streamflow is small and unreliable, except along major rivers. Streamflow depends largely on accumulated snow in the mountains. The dominant soil orders in this MLRA are Aridisols and Mollisols. The soils in the area dominantly have a mesic or frigid temperature regime and an aridic, arid bordering on xeric, or xeric moisture regime. Most of the soils formed in mixed parent material. Volcanic ash and loess mantle the landscape. Surface soil textures are loam and silt loam, and have ashy texture modifiers in some cases. Argillic horizons occur on the more stable landforms.

## Ecological site concept

This ecological site is found on gently sloping foothills and broad tablelands associated with volcanic plateau landscapes. Elevations range from 4,700 to 6,500 feet (1,433 to 1,981 meters). The soils associated with this site have an abrupt boundary in the top 10 inches (25cm) resulting in wet non-satiated conditions. The soil climate is frigid (soil temperature regime) and xeric (soil moisture regime). The reference plant community is characterized by dominance of low sagebrush and Idaho fescue. Bluebunch wheatgrass and Sandburg bluegrass are also common in the understory. (wet non-saturated conditions - Schoeneberger, P.J., 2012, pg 1-15)

## Associated sites

| | |
|---|---|
| R025XY014OR | **LOAMY 13-16 PZ** |
| R025XY063OR | **SKELETAL CLAYPAN 11+ PZ** |
| R025XY064OR | **SHRUBBY SHALLOW CLAYPAN 13-16 PZ** |
| R025XY066OR | **SHRUBBY LOAM 11-13 PZ** |

## Similar sites

| | |
|---|---|
| **R025XY016OR** | **SHALLOW CLAYPAN 11-13 PZ**<br><br>Lower precipitation (aridic); lower production |
| **R025XY064OR** | **SHRUBBY SHALLOW CLAYPAN 13-16 PZ**<br><br>Bedrock is more fractured; possibly different geologies. More likely to occur on paralithic than lithic soils. |

**Table 1. Dominant plant species**

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

## Physiographic features

This site is on tablelands and plateaus. Slopes range from 2 to 12 percent. Elevation varies from 4,700 to 6,600 feet (1,433 to 1,981 meters).

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Plateau<br>(2) Tableland<br>(3) Fold |
| Elevation | 1,430 – 2,010 m |
| Slope | 0 – 10 % |
| Water table depth | 250 cm |
| Aspect | Aspect is not a significant factor |

## Climatic features

The annual precipitation ranges from 13 to 16 inches (33 to 41cm), most of which is in the form of snow during the months of December through March. Localized convection storms occasionally occur during the summer. The soil temperature regime if frigid with a mean annual air temperature of 44 degrees F. Temperature extremes range from 10 to 90 degrees F. The frost free period ranges from less than 50 to 90 days. The optimum growth period for native plants is from April through June.

*The above data is averaged from the Danner climate station, NASIS and, the Western Regional Climate Center.

**Table 3 Representative climatic features**

| | |
|---|---|
| Frost-free period (characteristic range) | 50-90 days |
| Freeze-free period (characteristic range) | 90-120 days |
| Precipitation total (characteristic range) | 280-410 mm |
| Frost-free period (average) | 80 days |
| Freeze-free period (average) | 100 days |
| Precipitation total (average) | 380 mm |

- (1) DANNER [USC00352135], Jordan Valley, OR

### Influencing water features

Site is not influenced by water features.
Site is not connected to a water table.

### Soil features

The soils of this site are moderately deep over fractured bedrock or paralithic material. The surface layer is ashy silt loam to gravelly ashy silt loam. The subsoil is a clay to clay loam. An abrupt boundary occurs at the interface of the surface and subsoil, resulting in wet non-satiated conditions in the spring. Depth to lithic or paralithic contact is 20 to 40 inches (51 to 102cm). Permeability is moderate to moderately slow in the surface layer and slow in the subsoil. The available water holding capacity is about 3 to 5 inches (8 to 13cm) for the profile.

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Volcanic ash<br>(2) Loess<br>(3) Colluvium – volcanic rock<br>(4) Residuum – volcanic rock |
| Surface texture | (1) Ashy silt loam<br>(2) Ashy, gravelly silt loam |
| Family particle size | (1) Fine |
| Drainage class | Moderately well drained to well drained |
| Permeability class | Slow to moderate |

| | |
|---|---|
| Depth to restrictive layer | 50 – 80 cm |
| Soil depth | 50 – 80 cm |
| Surface fragment cover <=3" | 0 – 10 % |
| Surface fragment cover >3" | Not specified |
| Available water capacity (0-76.2cm) | 7.62 – 12.7 cm |
| Soil reaction (1:1 water) (0-76.2cm) | 10 |
| Subsurface fragment volume <=3" (0-76.2cm) | 0 – 10 % |

### Ecological dynamics

The reference plant community is dominated by low sagebrush (little sagebrush) in the overstory and Idaho fescue in the understory. Bluebunch wheatgrass and Sandburg bluegrass are also common The site has moderate resilience to disturbance and moderately low to moderate resistance to invasion (Chambers 2014a). Resilience is a system's capacity to regain its structure, processes, and function following stressors or disturbance (e.g. drought or fire). Resistance is the capacity of the system to retain its structure, processes, and function despite stressors or disturbances (including pressure from invasive species) (Chambers 2014a). Increased resilience increases with elevation, aspect, increased precipitation and increased nutrient availability (Stringham et al. 2015); where greater resource availability and more favorable environmental conditions exist for plant growth and reproduction (Chambers 2014a).

This ecological site's relatively higher effective precipitation (xeric soil moisture regime) makes this site more productive than similar sites in lower precipitation zones. This added productivity results in fewer open spaces where invasive annual grasses can become established. Some of this benefit is counteracted by restrictive soil features that limit site productivity compared to other sites in this precipitation range. While moderately resilient, this site is not immune to annual grass invasion. Timing of precipitation favors invasive annual grasses that are particularly well adapted to cool wet winters and warm dry summers; beginning growth and utilizing resources prior to native species breaking dormancy. The site's cooler soil temperature regime (frigid) does increase resistance compared to warmer sites but is not cold enough to inhibit invasive annual grasses (Chambers 2014b).

This ecological site is dominated by deep-rooted cool season, perennial bunchgrasses and long-lived shrubs (50+ years) with high root to shoot ratios. Community types with low sagebrush as the dominant shrub were found to have soil depths and thus available rooting depths of 71 to 81 centimeters in a study in northeast Nevada (Jensen 1990). Where soil depth is not limiting, tap roots of antelope bitterbrush have been documented from 4.5 to 5.4 m in length (McConnell 1961). These shrubs have a flexible generalized root system with development of both deep taproots and laterals near the surface (Comstock and Ehleringer 1992).

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).

Low sagebrush is fairly drought tolerant but also tolerates periodic wetness during some portion of the growing season. Low sagebrush is also susceptible to the sagebrush defoliator Aroga moth. Aroga moth can partially or entirely kill individual plants or entire stands of big sagebrush (Furniss and Barr 1975), but the research is inconclusive of the damage sustained by low sagebrush populations.

The low 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. It can also 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 perennial bunchgrasses that are dominant on this ecological site are Idaho fescue and bluebunch wheatgrass. These species generally have shallower root systems than the shrubs, but root densities are often as high as or higher than those of shrubs in the upper 0.5 m of the soil profile. General differences in root depth distributions between grasses and shrubs results in resource partitioning in these shrub/grass systems.

Fire Ecology:
Prior to 1897, mean fire return intervals for low sagebrush communities have been estimated to be from 35 to over 100 years. Fire most often occurs during wet years with high forage production.

Low sagebrush is killed by fire and does not sprout (Tisdale and Hironaka 1984). Establishment after fire is from seed, generally blown in and not from the seed bank (Bradley et al. 1992). Fire risk is greatest following a wet, productive year when there is greater production of fine fuels (Beardall and Sylvester 1976). Fire return intervals have been estimated at 100-200 years in black sagebrush-dominated sites (Kitchen and McArthur 2007) and likely is similar in the low sagebrush ecosystem. Historically, however, fires were probably patchy due to the low productivity of these sites. Recovery time of little sagebrush following fire is variable (Young 1983). After fire, if regeneration conditions are favorable, low sagebrush recovers in 2 to 5 years; on harsh sites where cover is low to begin with and/or erosion occurs after fire, recovery may require more than 10 years (Young 1983). Slow regeneration may subsequently worsen erosion (Blaisdell et al. 1982).

The effect of fire on bunchgrasses relates to culm density, culm-leaf morphology, and the size of the plant. The initial condition of bunchgrasses within the site along with seasonality and intensity of the fire all factor into the individual species response. The growing points for most forbs and grasses are located at or below the soil surface, providing relative protection from disturbances which decrease above ground biomass, such as grazing or fire. Thus, fire mortality is more correlated to duration and intensity of heat which is related to culm density, culm-leaf morphology, size of plant and abundance of old growth (Wright 1971, Young 1983). However, season and severity of the fire and post-fire soil moisture availability will influence plant response.

Idaho fescue, the dominant grass within this community, response to fire varies with condition and size of the plant, season and severity of fire, and ecological conditions. Mature Idaho fescue plants are commonly reported to be severely damaged by fire in all seasons (Wright et al. 1979). Initial mortality may be high (in excess of 75%) on severe burns, but usually varies from 20 to 50% (Barrington et al 1988). Rapid burns have been found to leave little damage to root crowns, and new tillers are produced with onset of fall moisture (Johnson et al. 1994). However, Wright and others (1979) found the dense, fine leaves of Idaho fescue provided enough fuel to burn for hours after a fire had passed, thereby killing or seriously injuring the plant regardless of the intensity of the fire (Wright et al. 1979). Idaho fescue is commonly reported to be more sensitive to fire than the other prominent grass on this site, bluebunch wheatgrass (Conrad and Poulton 1966). However Robberecht and Defosse (1995) suggested the latter was more sensitive. They observed culm and biomass reduction with moderate fire severity in bluebunch wheatgrass, whereas a high fire severity was required for this reduction in Idaho fescue. Also, given the same fire severity treatment, post-fire culm production was initiated earlier and more rapidly in Idaho fescue (Robberecht and Defosse 1995).

Bluebunch wheatgrass has coarse stems with little leafy material, the aboveground biomass burns rapidly and little heat is transferred downward into the crowns (Young 1983). Bluebunch wheatgrass was described as fairly tolerant of burning, other than in May in eastern Oregon (Britton et al. 1990). Uresk et al. (1976) reported burning increased vegetative and reproductive vigor of bluebunch wheatgrass, thus it experiences slight damage to fire but is more susceptible in drought years (Young 1983).

Sandberg bluegrass has been found to increase following fire, likely due to its low stature and productivity (Daubenmire 1975) and may retard reestablishment of deeper rooted bunchgrasses.

Adapted from: Stringham, T.K., P. Novak-Echenique, P. Blackburn, D. Snyder, and A. Wartgow. 2015. Final Report for USDA Ecological Site Description State-and-Transition Models by Disturbance Response Groups, Major Land Resource Area 25 Nevada. University of Nevada Reno, Nevada Agricultural Experiment Station Research Report 2015-02. p. 569

## State and transition model

## Additional community tables

**Table 5. Community 1.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Dominant, perennial, deep rooted grasses** | | | 807-1076 | |
| | Idaho fescue | FEID | *Festuca idahoensis* | 807-1076 | – |
| 2 | **Sub-dominant, perennial, deep rooted grasses** | | | 135-269 | |
| | bluebunch wheatgrass | PSSPS | *Pseudoroegneria spicata ssp. spicata* | 135-269 | – |
| 3 | **Sub-dominant, perennial, shallow rooted grasses** | | | 27-67 | |
| | Sandberg bluegrass | POSE | *Poa secunda* | 27-67 | – |
| 4 | **All other perennial grasses** | | | 27-81 | |
| | Thurber's needlegrass | ACTH7 | *Achnatherum thurberianum* | 9-27 | – |
| | squirreltail | ELEL5 | *Elymus elymoides* | 9-27 | – |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 9-27 | – |
| **Forb** | | | | | |
| 5 | **Dominant, perennial forbs** | | | 47-94 | |
| | balsamroot | BALSA | *Balsamorhiza* | 20-40 | – |
| | buckwheat | ERIOG | *Eriogonum* | 13-27 | – |
| | lupine | LUPIN | *Lupinus* | 13-27 | – |
| 6 | **All other perennial forbs** | | | 27-81 | |
| | common yarrow | ACMI2 | *Achillea millefolium* | 4-13 | – |
| | tapertip hawksbeard | CRAC2 | *Crepis acuminata* | 4-13 | – |
| | fleabane | ERIGE2 | *Erigeron* | 4-13 | – |
| | desertparsley | LOMAT | *Lomatium* | 4-13 | – |
| | phlox | PHLOX | *Phlox* | 3-9 | – |
| | stoneseed | LITHO3 | *Lithospermum* | 2-7 | – |
| | onion | ALLIU | *Allium* | 2-7 | – |
| | deathcamas | ZIGAD | *Zigadenus* | 1-4 | – |
| **Shrub/Vine** | | | | | |
| 7 | **Dominant, evergreen shrubs** | | | 40-108 | |
| | little sagebrush | ARAR8 | *Artemisia arbuscula* | 40-108 | – |
| 8 | **Other shrubs** | | | 0-40 | |
| | antelope bitterbrush | PUTR2 | *Purshia tridentata* | 0-40 | – |

**Table 6. Community 1.2 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

**Table 7. Community 1.3 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

**Table 8. Community 2.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

**Table 9. Community 2.2 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

**Table 10. Community 2.3 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

**Table 11. Community 2.4 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

Table 12. Community 3.1 plant community composition

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

Table 13. Community 3.2 plant community composition

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

Table 14. Community 4.1 plant community composition

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

## Animal community

Livestock Grazing Interpretations: This site is suitable for livestock grazing. Grazing management considerations include timing, intensity and duration of grazing. Domestic sheep and, to a much lesser degree, cattle consume low sagebrush, particularly during the spring, fall, and winter (Sheehy and Winward 1981). Heavy dormant season grazing by sheep will reduce sagebrush cover and increase grass production (Laycock 1967). Severe trampling damage to supersaturated soils could occur if sites are used in early spring when there is abundant snowmelt. Trampling damage, particularly from cattle or horses, in low sagebrush habitat types is greatest when high clay content soils are wet. Bunchgrasses, in general, best tolerate light grazing after seed formation. Britton et al. (1990) observed the effects of clipping date on basal area of 5 bunchgrasses in eastern Oregon and found grazing from August to October (after seed set) has the least impact. Heavy grazing during the growing season will reduce perennial bunchgrasses and increase sagebrush (Laycock 1967). Abusive grazing by cattle or horses will likely increase low sagebrush, rabbitbrush and some forbs such as arrowleaf balsamroot. Annual non-native weedy species such as cheatgrass and mustards, and potentially medusahead, may invade. Idaho fescue tolerates light to moderate grazing (Ganskopp and Bedell 1980) and is moderately resistant to trampling (Cole 1987). Heavy grazing may lead to replacement of Idaho fescue with non-native species such as cheatgrass (Mueggler 1984). Bluebunch wheatgrass is moderately grazing tolerant and is very sensitive to defoliation during the active growth period (Blaisdell and Pechanec 1949, Laycock 1967, Anderson and Scherzinger 1975, Britton et al. 1990). Herbage and flower stalk production was reduced with clipping at all times during the growing season; however, clipping was most harmful during the boot stage (Blaisdell and Pechanec 1949). Tiller production and growth of bluebunch was greatly reduced when clipping was coupled with drought (Busso and Richards 1995). Mueggler (1975) estimated that low vigor bluebunch wheatgrass may need up to 8 years rest to recover. Although an important forage species, it is not always the preferred species by livestock and wildlife. Reduced bunchgrass vigor or density provides an opportunity for Sandberg bluegrass expansion and/or cheatgrass and other invasive species to occupy interspaces. Sandberg bluegrass increases under grazing pressure (Tisdale and Hironaka 1981) and is capable of co-existing with cheatgrass or other weedy species. Excessive sheep grazing favors Sandberg bluegrass; however, where cattle are the dominant grazers, cheatgrass often dominates (Daubenmire 1970). Thus, depending on the season of use, the grazer and site conditions, either Sandberg bluegrass or cheatgrass may become the dominant understory with inappropriate grazing management. (Adapted from Stringham, T.K. et al., 2015)

## Other products

This site is suited to use by cattle, sheep and horses in late spring, summer and fall under a planned grazing system. Use should be postponed until the soils are firm enough to prevent trampling damage and soil compaction.

## Inventory data references

Vale District BLM Ecological Site Inventory NASIS component and pedon data Range Site Descriptions Field knowledge of range-trained personnel

## Other references

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## Approval

Kendra Moseley, 4/25/2024

## 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.

| | |
|---|---|
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| Approval date | |
| Composition (Indicators 10 and 12) based on | Annual Production |

## Indicators

1. **Number and extent of rills:** None to some.

2. **Presence of water flow patterns:** Water flow patterns are none to rare. In areas subject to summer convection storms and rapid snowmelt, short (<1m) and stable flow patterns can be expected. Flow paths are not connected.

3. **Number and height of erosional pedestals or terracettes:** Pedestals are none to some on this site. As clay content in soil increases slight pedestalling can occur.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground 20-30% depending on amount of surface gravels.

5. **Number of gullies and erosion associated with gullies:** None.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None; slight wind erosion hazard.

7. **Amount of litter movement (describe size and distance expected to travel):** Fine litter (foliage from grasses and annual & perennial forbs) – limited movement; expected to move no more than the distance of slope length during intense summer convection storms or rapid snowmelt events. Persistent litter (large woody material) will remain in place except during large rainfall events.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Low to moderate resistance to erosion. Aggregate stability values should be 1 to 3 on most soil textures found on this site.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Surface texture is typically stony ashy silty clay loam. Soil surface color is typically grayish brown (10YR 5/2) (dry). Surface structure is weak fine and medium granular structure (A--0-10 cm) and weak thin platy (AB—10-36 cm)(Drice). Soil surface is partly covered by 20 percent stones . *Draft Soil Survey-subject to change.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Typical vegetation composition is 85 percent grasses, 5 percent forbs, and 10 percent shrubs. Perennial herbaceous plants (i.e. Idaho fescue & bluebunch wheatgrass) slow runoff and increase infiltration. Shrub canopy and associated litter break raindrop impact and provide opportunity for snow catch and accumulation on site.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** Compacted layers are none.

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: Deep-rooted, cool season, perennial bunchgrasses(Idaho fescue >> bluebunch wheatgrass)

    Sub-dominant: Low sagebrush

**Other: Other perennial grasses > forbs**

**Additional:**

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** **Normal decadence and mortality for this site is expected to be low <2%. As composition of sagebrush increases decadence and mortality will also increase.**

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

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** **Favorable – 1400 lbs/ac, Average -- 1200 lbs/ac, Unfavorable – 1000 lbs/ac. Spring moisture significantly affects total 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:** **Potential invaders include cheatgrass, medusahead, annual mustards in response to disturbance.**

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17. **Perennial plant reproductive capability:** **All functional groups should reproduce in average (or normal) and above average growing season years. Reduced growth and reproduction occur during extreme or extended drought conditions.**

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