# Ecological site R052XC209MT
# Saline Overflow (SOv)
# 10-14" p.z.

Last updated: 4/14/2025
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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): 052X–Brown Glaciated Plains

The Brown Glaciated Plains, MLRA 52, is an expansive and agriculturally and ecologically significant area. It consists of approximately 14.5 million acres and stretches across 350 miles from east to west, encompassing portions of 15 counties in north-central Montana. This region represents the southwestern limit of the Laurentide Ice Sheet and is considered to be the driest and westernmost area within the vast network of glacially derived prairie pothole landforms of the northern Great Plains. Elevation ranges from 2,000 feet (610 meters) to 4,600 feet (1,400 meters). Soils are primarily Mollisols, but Entisols, Inceptisols, Alfisols, and Vertisols are also common. Till from continental glaciation is the predominant parent material, but alluvium and bedrock are also common. Till deposits are typically less than 50 feet thick, and in some areas glacially deformed bedrock occurs at or near the soil surface (Soller, 2001). Underlying the till is sedimentary bedrock largely consisting of Cretaceous shale, sandstone, and mudstone (Vuke et al., 2007). The bedrock is commonly exposed on hillslopes, particularly along drainageways. Significant alluvial deposits occur along glacial outwash channels and major drainages, including portions of the Missouri, Teton, Marias, Milk, and Frenchman Rivers. Large glacial lakes, particularly in the western half of the MLRA, deposited clayey and silty lacustrine sediments (Fullerton et al., 2013). Much of the western portion of this MLRA was glaciated towards the end of the Wisconsin age, and the maximum glacial extent occurred approximately 20,000 years ago (Fullerton et al., 2004). The result is a geologically young landscape that is predominantly a level till plain interspersed with lake plains and dominated by soils in the Mollisol and Vertisol orders. These soils are very productive and generally are well suited to dryland farming. Much of this area is aridic-ustic. Crop-fallow dryland wheat farming is the predominant land use. Areas of rangeland typically are on steep hillslopes along drainages. The rangeland, much of which is native mixed-grass prairie, increases in abundance in the eastern half of the MLRA. The Wisconsin-age till in the north-central part of this area typically formed large disintegration moraines with steep slopes and numerous poorly drained potholes. A large portion of Wisconsin-age till occurring on the type of level terrain that would typically be optimal for farming has large amounts of less-suitable sodium-affected Natrustalfs. Significant portions of Blaine, Phillips, and Valley Counties were glaciated approximately 150,000 years ago during the Illinoisan age. Due to erosion and dissection of the landscape, many of these areas have steeper slopes and more exposed bedrock than areas glaciated during the Wisconsin age (Fullerton and Colton, 1986). While much of the rangeland in the aridic-ustic portion of MLRA 52 is classified as belonging to the “dry grassland” climatic zone, sites in portions of southern MLRA 52 may belong to the “dry shrubland” climatic zone. The Dry Shrubland climatic zone represents the northernmost extent of the big sagebrush (Artemisia tridentata) steppe on the Great Plains. Because similar soils occur in both southern and northern portions of the MLRA, it is currently hypothesized that climate is the primary driving factor affecting big sagebrush distribution in this area. However, the precise factors are not fully understood at this time. Sizeable tracts of largely unbroken rangeland in the eastern half of the MLRA and adjacent southern Saskatchewan are home to the Northern Montana population of greater sage-grouse (Centrocercus urophasianus), and large portions of this area are considered to be a Priority Area for Conservation (PAC) by the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service, 2013). This population is unique among sage grouse populations because many individuals overwinter in the big sagebrush steppe (dry shrubland) in the southern portion of the MLRA and then migrate to the northern portion of the MLRA, which lacks big sagebrush (dry grassland), to live the rest of the year (Smith, 2013). Areas of the till plain near the Bearpaw and Highwood Mountains as well as the Sweetgrass Hills and Rocky Mountain foothills are at higher elevations, receive higher amounts of precipitation, and have a typic-ustic moisture regime. These areas have significantly more rangeland production than the drier aridic-ustic portions of the MLRA and have enough moisture to produce crops annually rather than just bi-annually, as in the drier areas. Ecological sites in this higher precipitation area are classified as the Moist Grassland climatic zone.

## Classification relationships

NRCS Soil Geography Hierarchy • Land Resource Region: Northern Great Plains • Major Land Resource Area (MLRA): 052 Brown Glaciated Plains • Climate Zone: N/A National Hierarchical Framework of Ecological Units (Cleland et al., 1997; McNab et al., 2007) • Domain: Dry • Division: Temperate Steppe • Province: Great Plains-Palouse Dry Steppe Province 331 • Section: Northwestern Glaciated Plains 331D • Subsection: Montana Glaciated Plains 331Dh • Landtype association/Landtype phase: N/A National Vegetation Classification Standard (Federal Geographic Data Committee, 2008) • Class: Mesomorphic Shrub and Herb Vegetation Class (2) •

Subclass: Shrub and Herb Wetland Subclass (2.C) • Formation: Salt Marsh Formation (2.C.5) • Division: Distichlis spicata - Hordeum jubatum Great Plains Saline Marsh Division (2.C.5.Na) • Macrogroup: Great Plains Saline Wet Meadow and Marsh Macrogroup (2.C.5.Na.1) • Group: Western Great Plains Saline Wet Meadow Group (2.C.5.Na.1.b) • Alliance: Sarcobatus vermiculatus Great Plains Wet Shrubland Alliance • Association: Sarcobatus vermiculatus / Pascopyrum smithii - (Elymus lanceolatus) Shrub Wet Meadow EPA Ecoregions • Level 1: Great Plains (9) • Level 2: West-Central Semi-Arid Prairies (9.3) • Level 3: Northwestern Glaciated Plains (42) • Level 4: North Central Brown Glaciated Plains (42o) and Glaciated Northern Grasslands (42j)

## Ecological site concept

Saline Overflow is a moderately extensive ecological site, it occurs on floodplains, alluvial fans, and stream terraces where seasonal flooding occurs and salts have accumulated. Sometimes, but not always, a seasonal water table is present at a depth of more than 42 inches below the soil surface, especially during peak runoff periods. The distinguishing characteristics of this site are that it receives additional moisture from surface water and that saline, sodic, or saline-sodic conditions are evident in the upper 20 inches of soil. Soils for this ecological site are typically very deep (more than 60 inches) and derived from clayey alluvium. Soil textures in the upper 4 inches are typically clay or silty clay. Characteristic vegetation is mostly western wheatgrass (Pascopyrum smithii). The principal shrub is greasewood (Sarcobatus vermiculatus). Other shrubs that may occur are silver sagebrush (Artemisia cana) and Gardner's saltbush (Atriplex gardneri). Total shrub cover is approximately 5 percent.

## Associated sites

| | |
|---|---|
| **R052XC217MT** | **Silty (Si) 10-14" p.z.**<br>soils >20 inches in depth, and slopes < 15%, no salt tolerant plants. |
| **R052XC210MT** | **Saline Upland (SU) 10-14" p.z.**<br>soils with saline-sodic conditions limiting moisture for plant growth |
| **R052XC215MT** | **Shallow Clay (SwC) 10-14" p.z.**<br>soils are clayey over clayey shale, different vegetation |

## Similar sites

| | |
|---|---|
| **R052XN171MT** | **Saline Overflow (SOv) 10-14" p.z.**<br>R052XN171MT Saline Overflow 10-14" p.z. (formerly "Saline Lowland 10-14" p.z.) R053AE072MT |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | (1) *Sarcobatus vermiculatus*<br>(2) *Atriplex nuttallii* |
| Herbaceous | (1) *Sporobolus airoides*<br>(2) *Pascopyrum smithii* |

## Physiographic features

This site occurs on overflow lands (topography that receives run-in moisture from upland areas) where salt and/or alkali accumulations are apparent. The site is found in small bands and patches associated with alkali basins, and at isolated alkali seeps. It is also found at the base of badlands erosional sideslopes (such as along the floodplain of the Missouri River—just southeast of the Fred Robinson bridge).

The site has a seasonal water table that is within 42” of the surface. Slopes usually vary from 0 to 2 percent. Elevations normally vary from 2000 to 3500 feet.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Terrace<br>(2) Fan<br>(3) Swale |
| Runoff class | Medium |
| Flooding frequency | None to rare |
| Ponding frequency | None |
| Elevation | 580 – 1,370 m |
| Slope | 0 – 10 % |
| Water table depth | 110 – 180 cm |
| Aspect | Aspect is not a significant factor |

### Climatic features

**Table 3 Representative climatic features**

| | |
|---|---|
| Frost-free period (characteristic range) | 90-120 days |
| Freeze-free period (characteristic range) | 120-140 days |
| Precipitation total (characteristic range) | 250-360 mm |
| Frost-free period (average) | 90 days |
| Freeze-free period (average) | 130 days |
| Precipitation total (average) | 310 mm |

- (1) CHESTER [USC00241692], Chester, MT
- (2) GLASGOW [USW00094008], Glasgow, MT

- (3) HAVRE CITY CO AP [USW00094012], Havre, MT
- (4) SHELBY [USC00247500], Shelby, MT

### Influencing water features

This site receives additional “run in” moisture from adjacent upland sites during snowmelt or precipitation events. It is not influenced by water from perennial streams.

### Wetland description

It is not influenced by water from wetlands.

### Soil features

The soils on this site are moderately to strongly saline, medium- to fine-textured, moderately deep to deep, but poorly developed. This site has a seasonal high water table that is deeper than 48 inches. Soils tend to be saline or sodic. Soluble salt accumulations are often apparent at or near the surface. Most herbaceous roots extend less than 20 inches below the soil surface. Surface textures are mainly silty clay, silt loam, silty clay loam, clay loam and loam. Permeability varies with surface texture and the amount of salt and/or sodium present. Soil ph varies from 7.9 – 9.0.

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Alluvium – sedimentary rock |
| Surface texture | (1) Clay loam<br>(2) Loam<br>(3) Silty clay loam |
| Family particle size | (1) Fine-loamy<br>(2) Fine |
| Drainage class | Moderately well drained to well drained |
| Permeability class | Slow |
| Soil depth | 50 – 200 cm |
| Surface fragment cover <=3" | Not specified |
| Surface fragment cover >3" | Not specified |
| Available water capacity<br>(Depth not specified) | 7.62 – 15.24 cm |

| | |
|---|---|
| Calcium carbonate equivalent<br>(Depth not specified) | 0 – 20 % |
| Electrical conductivity<br>(Depth not specified) | 0 – 30 mmhos/cm |
| Sodium adsorption ratio<br>(Depth not specified) | 10 – 30 |
| Soil reaction (1:1 water)<br>(Depth not specified) | 7.4 – 10 |
| Subsurface fragment volume <=3"<br>(Depth not specified) | Not specified |
| Subsurface fragment volume >3"<br>(Depth not specified) | Not specified |

## Ecological dynamics

This site developed through time under the influence of climate, herbivory, geological materials, fire, plants and animals. The plant communities associated with the site tend to have low species diversity.

The historic climax plant community (HCPC) is the basis for plant community interpretations. The HCPC has been determined by evaluating rangeland relic areas, and other areas protected from excessive disturbance.

Departures from the HCPC generally result from management actions, drought, and/or a change in the natural fire regime, or from hydrological changes. Because the site is influenced by the receipt of “overflow” (run-in) moisture and by saline or sodic conditions, the plant communities in State #1 are not highly resistant to disturbance. The site is considered fragile in the sense that vegetative vigor and composition will rapidly decline with continued adverse impacts. Once regression to a lower state occurs, salts and/or sodium are more likely to accumulate on the soil surface. This makes it unlikely that the use of prescribed grazing and/or favorable precipitation will induce and facilitate succession to the HCPC (State #1). In comparison to the other ecological sites that encompass large acreages in the Glaciated Plains, this Saline Overflow 10-14” p.z. site occupies rather small portions of the landscape. The limited acreage may explain why very little research has been published on the site.

State and Transition Diagram

Successional pathways of the Saline Overflow 10-14” p.z. ecological site cannot be satisfactorily described using traditional theories of plant succession leading to a single climax community (Stringham et al. 2003). A threshold, lying somewhere between the mid and early seral stages is crossed as the HCPC regresses toward the early seral stage. The plant communities occurring below this threshold are in a steady state. Succession back to the HCPC does not occur within a reasonable length of time, and/or without a large input of energy.

Two common plant communities within the reference state (State #1) with associated successional pathways, and transitions from State #1 to States #2 and #3 are illustrated below for this ecological site. Ecological processes are discussed further in the plant community descriptions following the diagram.

## 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 Grasses** | | | 1401-3082 | |
| | Nuttall's alkaligrass | PUNU2 | *Puccinellia nuttalliana* | 560-1121 | – |
| | alkali sacaton | SPAI | *Sporobolus airoides* | 560-1121 | – |
| | alkali cordgrass | SPGR | *Spartina gracilis* | 280-560 | – |
| 2 | **Rhizomatous Wheatgrasses** | | | 280-560 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 140-280 | – |
| | tufted wheatgrass | ELMA7 | *Elymus macrourus* | 140-280 | – |
| 3 | **Miscellaneous Grasses** | | | 140-841 | |
| | saltgrass | DISP | *Distichlis spicata* | 140-280 | – |
| | slimstem reedgrass | CAST36 | *Calamagrostis stricta* | 140-280 | – |
| | Grass, native | 2GN | *Grass, native* | 140-280 | – |
| 4 | **Miscellaneous Grasslikes** | | | 140-841 | |
| | spikerush | ELEOC | *Eleocharis* | 140-280 | – |
| | bulrush | SCIRP | *Scirpus* | 140-280 | – |
| | sedge | CAREX | *Carex* | 140-280 | – |
| **Forb** | | | | | |
| 5 | | | | 28-168 | |
| | knotweed | POLYG4 | *Polygonum* | 28-140 | – |
| | common yarrow | ACMI2 | *Achillea millefolium* | 28-140 | – |
| | pussytoes | ANTEN | *Antennaria* | 28-140 | – |
| | povertyweed | IVAX | *Iva axillaris* | 28-140 | – |
| | white prairie aster | SYFA | *Symphyotrichum falcatum* | 28-140 | – |
| | slimleaf goosefoot | CHPA5 | *Chenopodium pallescens* | 28-140 | – |
| | seaside arrowgrass | TRMA20 | *Triglochin maritima* | 28-140 | – |
| | Forb, native | 2FN | *Forb, native* | 28-140 | – |
| | herbaceous seepweed | SUMA | *Suaeda maritima* | 28-140 | – |
| **Shrub/Vine** | | | | | |
| 6 | | | | 28-168 | |
| | Nuttall's saltbush | ATNU2 | *Atriplex nuttallii* | 28-140 | – |
| | silver buffaloberry | SHAR | *Shepherdia argentea* | 28-140 | – |
| | greasewood | SAVE4 | *Sarcobatus vermiculatus* | 28-140 | – |
| | rubber rabbitbrush | ERNA10 | *Ericameria nauseosa* | 28-140 | – |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 28-140 | – |

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

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

**Table 7. Community 2.1 plant community composition**

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

**Table 8. Community 3.1 plant community composition**

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

## Animal community

Livestock Management The Saline Overflow 10-14” p.z. ecological site is suited for livestock grazing. The HCPC (or reference state) is highly productive and has a high carrying capacity. Livestock are often attracted to the site because of the level terrain and the high potential for livestock water developments within the adjacent areas. Species composition and soils are susceptible to heavy stocking and season long grazing. Therefore, prescribed grazing is needed to maintain the high seral state and/or to prevent further deterioration. This site may also be attractive to livestock and wildlife because of the increase salt accumulations in the plants. It is important to understand site limitations. A site in an early seral state is not likely to successionally respond solely to the implementation of a prescribed grazing management system. Furthermore, seeding and/or mechanical treatment are usually not recommended on the Saline Overflow 10-14” p.z. ecological site. Landowners may have to learn to live with a site that is in an early seral state. Wildlife Interpretations The HCPC associated with the Saline Overflow 10-14” p.z. ecological site provides diverse and valuable wildlife habitat. This site often occurs as a minor component of a large, dry landscape. The uniqueness of the site makes it extremely critical habit for many species of wildlife. This ecological site becomes less valuable for wildlife when plant diversity is loss. For example, the disappearance of either the tall warm season grasses or cool season grasses reduces the amount of cover available for wildlife.

## Hydrological functions

Soils characterizing this ecological site have a moderately high runoff potential, with hydrologic runoff curves of 74 to 86. These soils fall into Hydrologic Group C. Field investigations are needed to adjust the runoff curves when plant communities deteriorate from the HCPC. Areas where ground cover is less than 50% have the greatest potential to have reduced infiltration and higher runoff.

## Recreational uses

This site is aesthetically appealing for its natural beauty. Recreational potential is somewhat limited by the relatively small areas.

## Wood products

This site has no significant value for wood products.

## Other information

The Saline Overflow 10-14” p.z. ecological site is not highly resistant to disturbances in State #1. Species diversity is adversely affected by season long continuous grazing and by heavy stocking. Mid and tall cool season perennial grasses are replaced by short warm season perennial grasses, or by a shrub-dominated community in more extreme cases. The number of structural/ functional groups is reduced with retrogression, which adversely affects the amount of solar energy that is captured and converted to carbohydrates for plant growth. A reduction in total vegetative growth results in less potential vegetation that can be transformed into litter. Less soil water use by plants combined with reduced ground cover may cause salinity or alkalinity to increase.

## Inventory data references

Data Source Number of Records Sample Period State County SCS-Range-417 ECS-1 Modified Double Sampling 34 2001-2004 MT Blaine, Phillips, Valley, Roosevelt, Daniels, Sheridan USDA-SCS-MT 1981 Technical Range Site Description (for saline lowland)

## Other references

Stringham, Tamzen K., William C. Krueger, and Patrick L. Shaver. (2003). State and transition modeling: an ecological process approach. J. Range Manage. 56:2(106-113).

## Contributors

Kirt Walstad

## Approval

Kirt Walstad, 4/14/2025

## Acknowledgments

Site Revisions This site was formerly called Saline Lowland 10-14” p.z. It was split into two sites, Saline Subirrigated 10-14” p.z., and Saline Overflow 10-14” p.z. in 2004. The 2005 Saline Overflow 10-14” p.z. ecological site description replaces earlier dated versions of Saline Lowland 10-14” p.z. descriptions in Rangeland Resource Unit 52XC. This 2005 revision incorporates the State and Transition Model theory, additional data on site productivity, and an improved understanding of many rangeland health indicators. Site Description Approval This ecological site description is approved with the understanding that it is no more than another step in our continual effort to

update the NRCS technical guide. In order to facilitate the process, NRCS field personnel are encouraged to forward existing information and/or new data that can be used to improve the utility of this site description. Please forward the information and data to the State Rangeland Management Specialist. Authors Date Approval Date Dr. John Lacey 02/28/2005 Loretta J. Metz 03/19/2005 Maxine Rasmussen, Area RMS, Glasgow, MT Jon Siddoway, Area RMS, Great Falls, MT Rick Bandy, Area RSS, Great Falls, MT Greg Snell, Area RSS, Glasgow, MT

### 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) | Loretta Metz, Maxine Rasmussen, Jon Siddoway |
| Contact for lead author | Area Rangeland Management Specialist, Glasgow Area Office, MT Reference site used? No |
| Date | 05/04/2005 |
| Approved by | |
| Approval date | |
| Composition (Indicators 10 and 12) based on | Annual Production |

### Indicators

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

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2. **Presence of water flow patterns: None.**

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3. **Number and height of erosional pedestals or terracettes: None.**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground): Bare ground is essentially nonexistent in HCPC. Bare ground patches should be less than 2” in diameter. If in plant community A, less than 5% of the soil surface can be exposed.**

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

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

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7. **Amount of litter movement (describe size and distance expected to travel):** None.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class anticipated to be 5 or 6 under plant canopy and 2-3 in plant interspaces.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The surface layer is 0.1” to 7” thick. The color ranges from light brownish gray to gray. Surface textures include loam, silt loam, clay loam, silty clay loam or silty clay. Soil organic matter ranges from 1-5%.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** In HCPC, 90-95% plant canopy and 80-85% basal cover with small gaps between plants should reduce raindrop impact and slow overland flow, providing increased time for infiltration to occur. Healthy, deep rooted native grasses enhance infiltration and reduce runoff. Infiltration rate is moderate to very slow. If in plant community A, 90-95% plant canopy and 70-80% basal cover with small gaps between plants will still reduce raindrop impact and decrease overland flow.

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

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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: HCPC: Tall, warm season bunch grasses = mid-stature, cool season bunch grasses> mid-stature cool season rhizomatous grasses > sedges and rushes > short, warm season rhizomatous grasses >forbs =shrubs. Plant community A: Short, warm season rhizomatous grasses > mid-stature, cool season rhizomatous grasses> sedges and rushes > mid-stature cool season bunch grasses > shrubs > forbs.**

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Plant mortality and decadence very low in HCPC and Plant community A. In periods of drought, shrubs would exhibit decadence in the state 1 reference communities.

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14. **Average percent litter cover (%) and depth ( in):** Litter cover is in contact with soil surface. Litter decreases in Plant community A to 40-50% and depth is reduced to 0.5 inch.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1700 - 2800 #/acre from Plant community A to HCPC in the State 1 reference community.

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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:** Foxtail barley, inland saltgrass, knotweeds, poverty weed, curly cup gumweed, and greasewood.

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17. **Perennial plant reproductive capability:** All species are capable of reproducing in HCPC. In Plant community A, plant seedlings will be weighed in favor of marginal and undesirable species. Replacement of desirable species will be very few.

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