Ecological site R023XY600OR
CLAYPAN SOUTH
8-12 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): 023X–Malheur High Plateau

The Malheur High Plateau, MLRA 23, consists primarily of nearly level to moderately steep plateaus, basins, and valleys bordered by long, gently sloping alluvial fans. North-south-trending fault-block mountain ranges separate some basins. Volcanic plateaus rise sharply above the valleys. Drainage patterns have not yet been established on the youngest lava plateaus. The area has no major rivers. It consists mostly of closed basins. Elevation ranges from 3,900 to 6,900 feet (1,190 to 2,105 meters) in most of the MLRA, but it exceeds 9,000 feet (2,745 meters) on some mountains. Precipitation is fairly evenly distributed throughout fall, winter and spring but is low in summer. Snow can occur throughout the area in the winter. Average annual precipitation is 6 to 52 inches (156 to 1,331 millimeters). Surface water is scarce, except in areas at the higher elevations where precipitation is greater. The dominant soil orders in this MLRA are Aridisols and Mollisols. The soils in the area dominantly have a mesic or frigid temperature regime, an aridic bordering on xeric or xeric bordering on aridic moisture regime, and mixed or smectitic mineralogy. The soils on uplands generally are well drained, loamy or clayey, and shallow or moderately deep. The soils in the basins may be poorly drained and/or salt and sodium affected. Locally, large areas have an ashy particle-size class and glassy mineralogy.

LRU notes

N/A

Classification relationships

N/A

Ecological site concept

This ecological site is found on south facing slopes of tablelands and hills. Slopes range from 12 to 40 percent. Elevations range from 4,500 – 6,000 ft. The soils associated with this site are shallow or moderately deep and have an abrupt boundary in the top 10 inches resulting in wet non-satiated conditions (Schoeneberger, 2012). The soil climate is frigid (soil temperature regime) and aridic boarding xeric to xeric (soil moisture regime). Since this site occurs on south aspects, it receives more solar insolation and thus is slightly drier and warmer than its non-aspect counterpart, resulting in reduced resistance and resilience and annual production. The reference plant community is characterized by dominance of low sagebrush and bluebunch wheatgrass. Thurber’s needlegrass is also common in the understory.

Associated sites

R023XY302OR	**SOUTH SLOPES 12-16 PZ**
R023XY312OR	**SHALLOW NORTH 12-16 PZ**

R023XY214OR	**CLAYPAN 10-12 PZ**
R023XY301OR	**DROUGHTY SOUTH SLOPES 11-13 PZ**
R023XY216OR	**CLAYPAN 12-16 PZ**

Similar sites

R023XF081CA	**SHALLOW STONY LOAM 9-12"** Non-Aspect. Sites are similar in terms of soil characteristics, species composition, annual production and physiographic features.
R023XY031NV	**CLAYPAN 10-14 P.Z.** Non-Aspect. Sites are similar in terms of soil characteristics, species composition, annual production and physiographic features.
R023XY214OR	**CLAYPAN 10-12 PZ** Non-aspect; aridic soil moisture regime.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia arbuscula*
Herbaceous	(1) *Pseudoroegneria spicata ssp. spicata* (2) *Achnatherum thurberianum*

Physiographic features

This ecological site occurs on south-facing slopes of tablelands and hills. Elevations range from 4,500-6,000 feet. Slopes range from 12 to 40 percent, but are typically less than 20 percent.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope (2) Hills > Hillslope
Elevation	1,370 – 1,830 m

Slope	10 – 40 %
Water table depth	250 cm
Aspect	SE, S, SW

Climatic features

Climate associated with this ecological site is characterized by dry warm summers and wet cold winters.

Table 3 Representative climatic features

Frost-free period (characteristic range)	
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	200-310 mm

Climate stations used

- (1) THE POPLARS [USC00358420], Silver Lake, OR
- (2) RILEY 10 WSW [USW00004128], Brothers, OR

Influencing water features

Water features are not associated with this ecological site.

Wetland description

N/A

Soil features

The soils of this site are shallow to moderately deep over bedrock. Typically the surface layer is a gravelly loam to ashy loam. The subsoil is a clay to clay loam, and typically skeletal. An abrupt boundary occurs at the interface of the surface and subsoil, resulting in wet non-satiated conditions in the spring. Depth to bedrock or an indurated pan ranges from 15 to 40 inches. Permeability is moderate to moderately slow in the surface and slow in the subsoil. The soil is well drained. The available water holding capacity is about 2 to 4 inches for the profile.

(wet non-saturated conditions - Schoeneberger, P.J., 2012, pg 1-15)

Table 4. Representative soil features

Parent material	(1) Residuum – volcanic rock (2) Colluvium – igneous rock (3) Volcanic ash

Surface texture	(1) Gravelly loam (2) Ashy, gravelly loam (3) Ashy loam (4) Loam
Family particle size	(1) Loamy-skeletal (2) Clayey-skeletal
Drainage class	Well drained
Permeability class	Slow to moderate
Depth to restrictive layer	40 – 100 cm
Soil depth	40 – 100 cm
Surface fragment cover <=3"	10 – 30 %
Surface fragment cover >3"	10 – 20 %
Subsurface fragment volume <=3" (0-101.6cm)	20 – 50 %
Subsurface fragment volume >3" (0-101.6cm)	20 – 40 %

Ecological dynamics

The reference plant community is dominated by low sagebrush (little sagebrush) with an understory of bluebunch wheatagrass. Thurber's needlegrass and Sandberg bluegrass are also common in the stand. The site has low resilience to disturbance and resistance to invasion. 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. 2019); where greater resource availability and more favorable environmental conditions exist for plant growth and reproduction (Chambers 2014a).

This ecological site's lower effective precipitation (southern aspect) and restrictive soil features limit site productivity resulting in more open space for establishment of invasive annual grasses. Timing of precipitation also 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 to) does provide some resistance compared to warmer sites but is not cold enough to inhibit invasive annual grasses (Chambers 2014b). Furthermore, the increased solar insolation received by the site due to its southerly aspect makes this site warmer than its non-aspect counterpart and reduces overall site resistance.

Production and composition are affected by soil depth and texture. Bluebunch wheatgrass and production will increase as the soil depth

increases. Sandberg bluegrass will increase as the surface becomes thinner. Thurber needlegrass will increase as the percent of gravels on the surface increases.

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 (Artemisia arbuscula Nutt.) 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). 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 have 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.

The perennial bunchgrasses that are dominant on this site include bluebunch wheatgrass (Pseudoroegneria spicata (Pursh) Á. Löve) and Thurber's needlegrass (Achnatherum thurberianum (Piper) Barkworth). 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 but taper off more rapidly. Differences in root depth distributions between grasses and shrubs result in resource partitioning in these shrub/grass systems.

Prior to 1897, mean fire return intervals for low sagebrush communities have been estimated to be from 35 to over 100 years. Fire risk is greatest following a wet, productive year when there is greater production of fine fuels (Beardall and Sylvester 1976). Historically, however, fires were probably patchy due to the low productivity of these sites. Fine fuel loads generally average 100 to 400 pounds per acre (110- 450 kg/ha) but are occasionally as high as 600 pounds per acre (680 kg/ha) in low sagebrush habitat types (Bradley et al. 1992).

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). Recovery time of low 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). 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.

Bluebunch wheatgrass has coarse stems with little leafy material, therefore 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 and is thus considered to experience slight damage to fire but is more susceptible in drought years (Young 1983). Most authors classify the plant as undamaged by fire (Kuntz 1982).

Thurber’s needlegrass, a minor component on this site, is very susceptible to fire-caused mortality. Burning has been found to decrease the vegetative and reproductive vigor of Thurber’s needlegrass (Uresk et al. 1976). Fire also reduces basal area and yield of Thurber’s needlegrass (Britton et al. 1990). The fine leaves and densely tufted growth form make this grass susceptible to subsurface charring of the crowns. Although timing of fire highly influences the response and mortality of Thurber’s needlegrass, smaller bunch sizes are less likely to be damaged by fire (Wright and Klemmedson 1965). Thurber’s needlegrass often survives fire, however, and will continue growth when conditions are favorable (Koniak 1985). Thus, the initial condition of the bunchgrasses within the site along with seasonality and intensity of the fire are important factors in individual species’ responses.

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

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 via 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 introduction of annual weedy species, like cheatgrass, may cause an increase in fire frequency and eventually lead to an annual state. Conversely, as fire frequency decreases, sagebrush will increase and with inappropriate grazing management, the perennial bunchgrasses and forbs may be reduced.

Adapted from: Stringham, T.K., D. Snyder, P. Novak-Echenique, A. Wartgow, A. Badertscher, K. O’Neill. 2019. Great Basin Ecological Site Development Project: State-and-Transition Models for Major Land Resource Area 23, Nevada and Portions of California. University of Nevada Reno, Nevada Agricultural Experiment Station Research Report 2019-01. 605 p.

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	**Perennial, Deep-rooted, Bunchgrasses**			291-510	
	bluebunch wheatgrass	PSSPS	*Pseudoroegneria spicata ssp. spicata*	235-392	–
	Thurber's needlegrass	ACTH7	*Achnatherum thurberianum*	39-78	–
	Idaho fescue	FEID	*Festuca idahoensis*	9-39	–
2	**Perennial, Shallow rooted, Bunchgrass**			16-39	
	Sandberg bluegrass	POSE	*Poa secunda*	16-39	–
3	**Other Perennial Grasses**			0-63	
	squirreltail	ELEL5	*Elymus elymoides*	0-16	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0-16	–
	Cusick's bluegrass	POCU3	*Poa cusickii*	0-16	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0-16	–
Forb					
4	**Perennial Forbs**			31-94	
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	8-24	–
	phlox	PHLOX	*Phlox*	8-24	–
	fleabane	ERIGE2	*Erigeron*	8-24	–
	buckwheat	ERIOG	*Eriogonum*	8-24	–
5	**Other Forbs**			0-39	
	lupine	LUPIN	*Lupinus*	0-8	–
	pussytoes	ANTEN	*Antennaria*	0-8	–
	milkvetch	ASTRA	*Astragalus*	0-8	–
	phacelia	PHACE	*Phacelia*	0-8	–
	granite prickly phlox	LIPU11	*Linanthus pungens*	0-8	–
	owl's-clover	ORTHO	*Orthocarpus*	0-8	–
	sego lily	CANU3	*Calochortus nuttallii*	0-8	–
	desertparsley	LOMAT	*Lomatium*	0-8	–
Shrub/Vine					
6	**Shrubs**			39-118	
	little sagebrush	ARAR8	*Artemisia arbuscula*	39-118	–
7	**Other Shrubs**			0-39	
	spiny hopsage	GRSP	*Grayia spinosa*	0-8	–
	spineless horsebrush	TECA2	*Tetradymia canescens*	0-8	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0-8	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0-8	–
Tree					
8	**Evergreen Tree**			0-8	
	western juniper	JUOC	*Juniperus occidentalis*	–	–

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 (%)

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Approval

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	04/20/2026
Approved by	
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):**

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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):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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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):**

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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:

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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:**
