USDA Natural Resources Conservation Service

Ecological site R018XE102CA
Steep Clayey Shallow

Last updated: 4/24/2024
Accessed: 11/23/2024

General information

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

MLRA notes

Major Land Resource Area (MLRA): 018X–Sierra Nevada Foothills

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Major Land Resource Area (MLRA) 18, Sierra Nevada Foothills is located entirely in California and runs north to south adjacent to and down-slope of the west side of the Sierra Nevada Mountains (MLRA 22A). MLRA 18 includes rolling to steep dissected hills and low mountains, with several very steep river valleys. Climate is distinctively Mediterranean (xeric soil moisture regime) with hot, dry summers, and relatively cool, wet winters. Most of the precipitation comes as rain; average annual precipitation ranges from 15 to 55 inches in most of the area (precipitation generally increases with elevation and from south to north). Soil temperature regime is thermic; mean annual air temperature generally ranges between 52 and 64 degrees F. Geology is rather complex in this region; there were several volcanic flow and ashfall events, as well as tectonic uplift, during the past 25 million years that contributed to the current landscape.

LRU notes

LRU 18XE is located on moderate to steep mountains and hills in the Tehachapi Foothills east of Bakersfield. This LRU covers the lower slopes around the southern end of the Greenhorn Mountains, the western sides of Breckenridge Mountain and the Tehachapi Mountains. The elevation ranges from 500 to 6500 feet above sea level and the geology of the region is predominately granitoid (both unaltered and metamorphosed). Similar to LRU 18XC to the north, vegetation series include blue oak, needlegrass and annual grasslands, as well as chamise, ceanothus, mixed oaks, and foothill pine, although this LRU tends to be more arid than with an annual precipitation range of only 8 to 31 inches per year. The lower precipitation and higher evaporative losses mean that these soils may not be able to completely leach excess salts, leading to a build-up of calcium and/or sodium in the subsoil. The soil temperature regime in this LRU is thermic and the soil moisture regimes are both xeric and aridic.

Classification relationships

CLASSIFICATION RELATIONSHIPS
This site is located within M261F, the Sierra Nevada Foothills Section, (McNab et al., 2007) of the National Hierarchical Framework of Ecological Units (Cleland et al., 1997), M261Fb, the Lower Foothills Metamorphic Belt Subsection.

Level III and Level IV ecoregions systems (Omernik, 1987, and EPA, 2011) are: Level III, Central California Foothills and Coastal Mountains and Level IV, Ecoregion 6ae, Tehachapi Foothills.

Ecological site concept

This site is characterized by moderately deep, fine-textured soils occurring on steep to very steep foothills typically formed on residuum weathered from gabbro. Slopes typically range from 15 to 50%. Precipitation typically ranges from 10 to 17 inches per year, and elevation ranges from 1940 to 4300 feet.

The overriding abiotic factors controlling vegetation expression on this site are high clay content (often 40% or more) and the smectitic mineralogy which leads to shrink-swell properties.These factors, coupled with steep, water shedding positions prevent the establishment of woody vegetation and severely impact the plant productivity. Infiltration of water is limited; roots often can not exploit the entire profile depth due to seasonal cracking during drying cycles. These are also highly erodible landscapes. The main soil component is Cibo (Fine, smectitic, thermic Aridic Haploxerert). Cibo soils are moderately deep, well drained soils.

This vegetation community consists of annual and perennial grasses and forbs. Dominant plants include soft brome (Bromus hordeaceus), desert needle grass (Achnatherum speciosum), fillaree (Erodium spp.), bur clover, (Medicago hispida), squirreltail (Elymus elymoides), fescue (Festuca spp.), rabbit brush (Chrysothamnus spp.) Annual production ranges from 700 to 1200 lbs per acre.

Associated sites

F018XE201CA	**Granitic Hills and Mountains** This site commonly occurs nearby.

Similar sites

R018XE103CA	**Loamy Low Hills** Site relationships being developed.
R018XE104CA	**Thermic Granitic Hills** Site relationships being developed.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Chrysothamnus*
Herbaceous	(1) *Bromus hordeaceus* (2) *Achnatherum speciosum*

Physiographic features

This ecological site occurs on steep hills in the foothills. The slope gradient ranges from 15 to 50 percent.

Table 2. Representative physiographic features

Slope shape across	(1) Convex
Landforms	(1) Foothills > Hillslope (2) Foothills > Hill
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	594–1,311 m
Slope	15–50%
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None

Elevation	15–1,981 m
Slope	2–85%

Climatic features

This ecological site is characterized by hot, dry summers and cool, wet winters, a typical Mediterranean climate. Mean annual precipitation ranges from 13 to 17 inches and usually falls from October to May. Mean annual temperature ranges from 57 to 60 degrees F with 132 to 212 frost free days.

Table 4. Representative climatic features

Frost-free period (characteristic range)	132-212 days
Freeze-free period (characteristic range)	187-365 days
Precipitation total (characteristic range)	330-432 mm
Frost-free period (actual range)	112-216 days
Freeze-free period (actual range)	174-365 days
Precipitation total (actual range)	305-483 mm
Frost-free period (average)	170 days
Freeze-free period (average)	275 days
Precipitation total (average)	381 mm

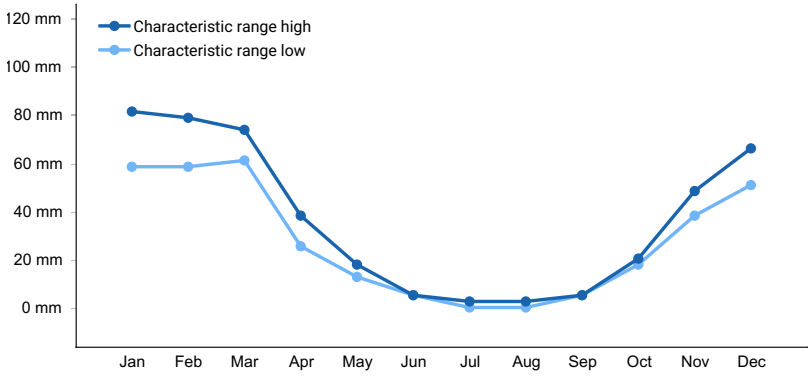

Figure 1. Monthly precipitation range

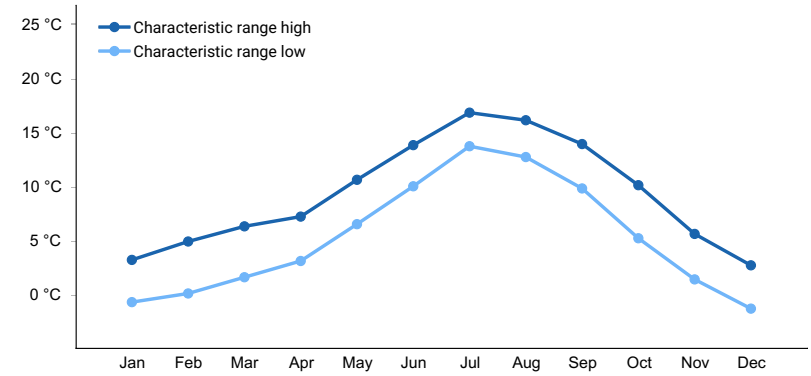

Figure 2. Monthly minimum temperature range

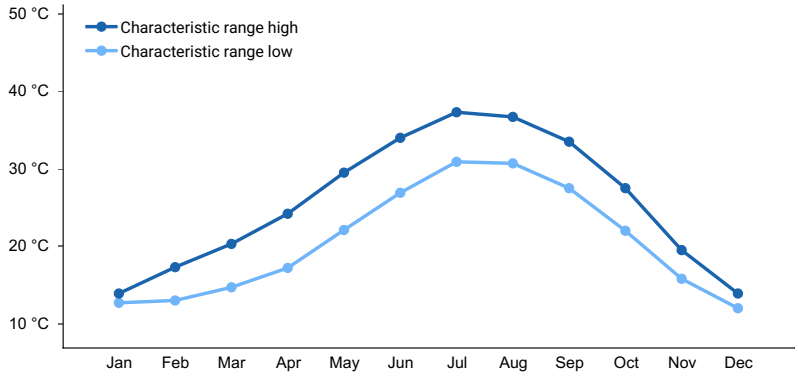

Figure 3. Monthly maximum temperature range

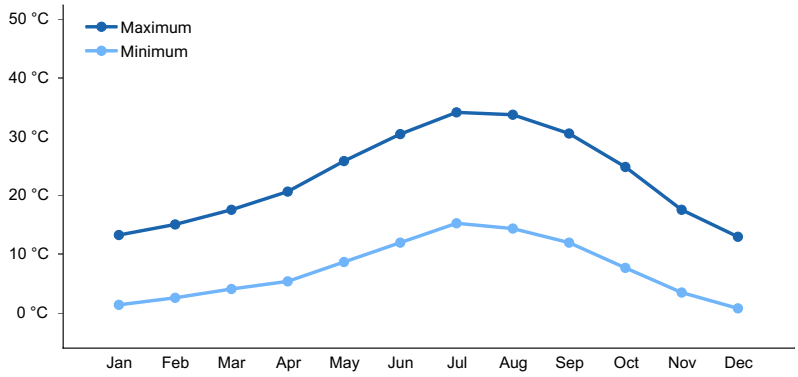

Figure 4. Monthly average minimum and maximum temperature

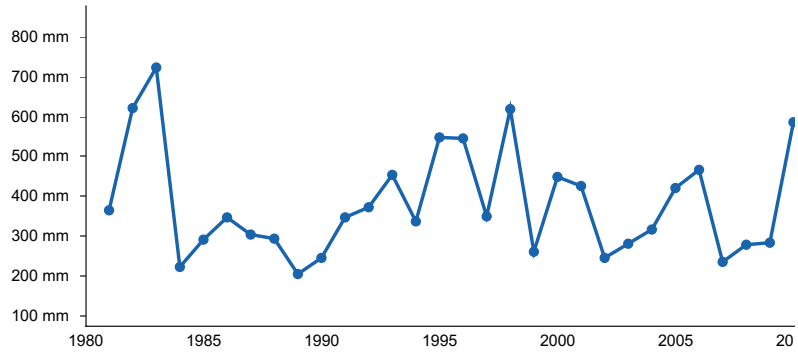

Figure 5. Annual precipitation pattern

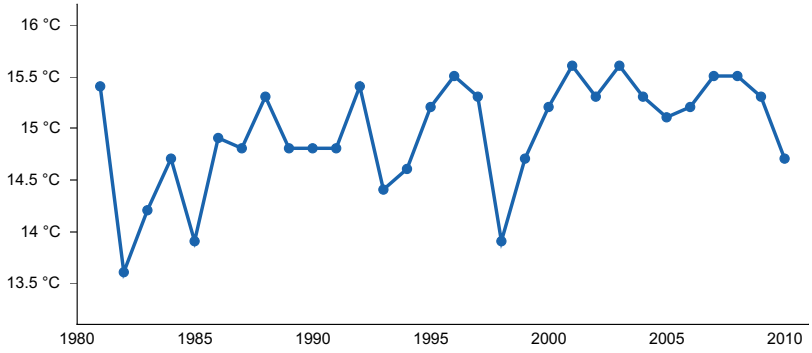

Figure 6. Annual average temperature pattern

Climate stations used

- (1) FRIANT GOVERNMENT CAMP [USC00043261], Friant, CA
- (2) LEMON COVE [USC00044890], Woodlake, CA
- (3) GLENNVILLE [USC00043463], Glennville, CA

- (4) TEHACHAPI [USC00048826], Tehachapi, CA

Influencing water features

Due to the topographic position, this site does not have water features.

Wetland description

N/A

Soil features

The soils in this ecological site are formed in alluvium and residuum from granite and gabbro. The site concept includes soils formed in fine-textured alluvium as well as highly-weathered residuum. These soil depth class ranges from shallow to moderately deep.
The particle size control section is Clayey or Fine and surface textures include sandy loam, gravelly clay loam, clay and cobbly clay. Gravels on the soil surface range from 15 to 30% cover and larger fragments range from 5 to 20% cover. Gravels (<3 inch diameter) range from 1 to 20% by volume throughout the profile, and larger fragments (=3 inch diameter) range from 0 to 15% by volume throughout the profile. . Soils in this ecological site range are moderately deep. Available Water Storage (AWS) in the profile generally ranges from 2 to 6 inches. Surface pH ranges from 7.2 to 7.6 and subsurface pH ranges from 7.1 to 7.7. Common soils correlated to this ecological site include Cibo (Fine, smectitic, thermic Aridic Haploxererts) and Alberti (Clayey, smectitic, thermic, shallow Vertic Rhodoxeralfs).

Table 5. Representative soil features

Parent material	(1) Residuum–granite (2) Residuum–gabbro (3) Residuum–granitoid
Surface texture	(1) Sandy loam (2) Cobbly clay (3) Gravelly clay loam (4) Clay
Family particle size	(1) Clayey (2) Fine
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	51–102 cm
Soil depth	41–97 cm
Surface fragment cover <=3"	15–30%
Surface fragment cover >3"	5–20%
Available water capacity (0-101.6cm)	5.08–15.24 cm
Soil reaction (1:1 water) (0-25.4cm)	7.2–7.6
Subsurface fragment volume <=3" (0-152.4cm)	1–20%
Subsurface fragment volume >3" (0-152.4cm)	0–15%

Table 6. Representative soil features (actual values)

Drainage class	Poorly drained to well drained
Permeability class	Moderately slow to moderate

Depth to restrictive layer	25–127 cm
Soil depth	25–102 cm
Surface fragment cover <=3"	0–35%
Surface fragment cover >3"	0–30%
Available water capacity (0-101.6cm)	4.57–15.49 cm
Soil reaction (1:1 water) (0-25.4cm)	6.1–8.4
Subsurface fragment volume <=3" (0-152.4cm)	0–25%
Subsurface fragment volume >3" (0-152.4cm)	0–20%

Ecological dynamics

State and transition model

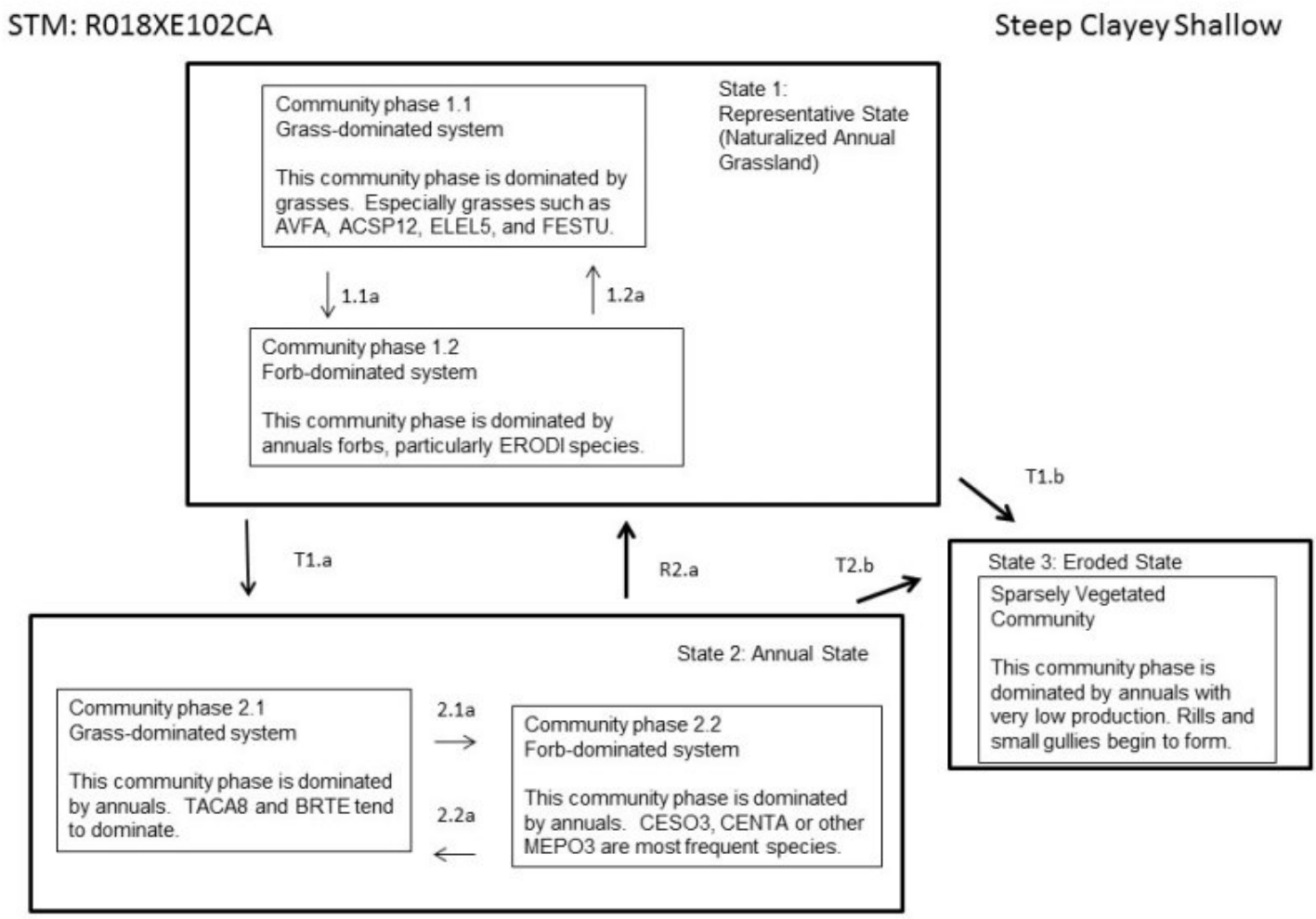

Figure 7. State and Transition Model.

Community pathways and Transitions

T1.a This transition occurs after invasive plants causing negative affects to society become established.

1.1a This community pathway occurs as forbs become more dominant, often following low winter precipitation and reduced litter layers.

1.2a This community pathway occurs as grasses become more dominant, often in response to higher litter levels.

T2.a This transition occurs after removal of vegetation in conjunction with heavy precipitation.

R2.a This restoration pathway occurs with integrated weed management.

2.1a This community pathway occurs as forbs become more dominant, often following low winter precipitation and reduced litter layers.

2.2a This community pathway occurs as grasses become more dominant, often in response to higher litter levels.

T3.a This transition occurs after removal of vegetation in conjunction with heavy precipitation.

Figure 8. Community Pathways and Transitions.

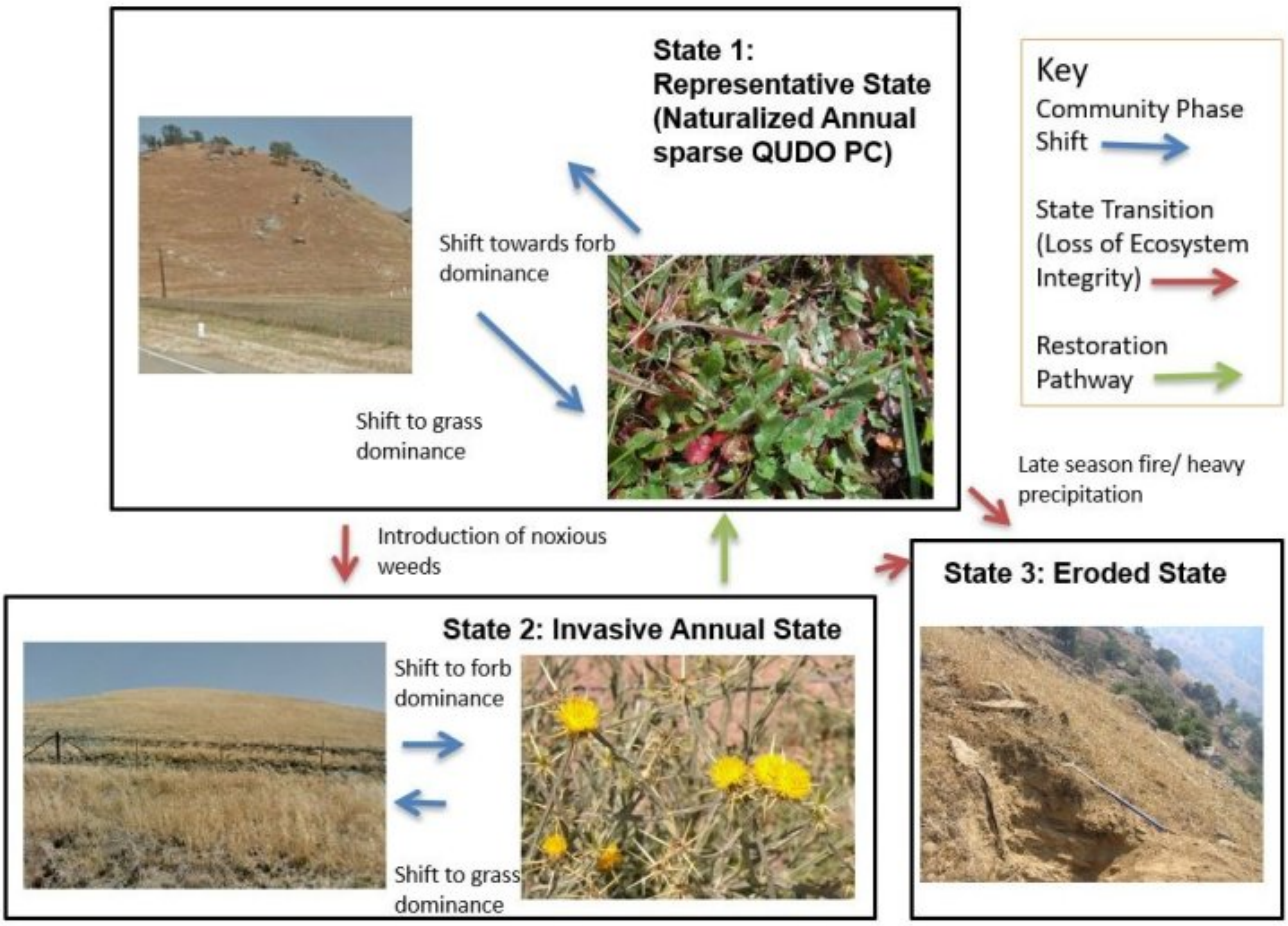

Figure 9. STM Photos

State 1
Representative State (Naturalized Annual Grassland)

Community 1.1
Grass-dominated system

This community phase is dominated by grasses. Especially grasses such as AVFA, ACSP12, ELEL5, and Vulpia spp.

Dominant plant species

- wild oat (*Avena fatua*), grass
- desert needlegrass (*Achnatherum speciosum*), grass
- squirreltail (*Elymus elymoides*), grass
- fescue (*Vulpia*), grass

Community 1.2
Forb-dominated system

This community phase is dominated by annuals forbs, particularly ERODI species

Dominant plant species

- stork's bill (*Erodium*), other herbaceous

Pathway P1.1a
Community 1.1 to 1.2

This community pathway occurs as forbs become more dominant, often following low winter precipitation and reduced litter layers.

Pathway P1.2a
Community 1.2 to 1.1

This community pathway occurs as grasses become more dominant, often in response to higher litter levels.

State 2
Invaded Annual State

Community 2.1
Grass-dominated system

This community phase is dominated by annuals. TACA8 or BRTE tend to dominate.

Dominant plant species

- medusahead (*Taeniatherum caput-medusae*), grass
- cheatgrass (*Bromus tectorum*), grass

Community 2.2
Forb-dominated system

This community phase is dominated by annuals. CESO3, CENTA or other MEPO3 are most frequent species.

Dominant plant species

- yellow star-thistle (*Centaurea solstitialis*), other herbaceous
- knapweed (*Centaurea*), other herbaceous

Pathway P2.1a
Community 2.1 to 2.2

This community pathway occurs as forbs become more dominant, often following low winter precipitation and reduced litter layers.

Pathway P2.2a
Community 2.2 to 2.1

This community pathway occurs as grasses become more dominant, often in response to higher litter levels.

State 3
Eroded State

Community 3.1
Sparsely Vegetated Community

This community phase is dominated by annuals with very low production. Rills and small gullies begin to form.

Transition T1a
State 1 to 2

This transition occurs after invasive plants causing negative affects to society become established.

Transition T3.a

State 1 to 3

This transition occurs after removal of vegetation in conjunction with heavy precipitation.

Restoration pathway R2.a
State 2 to 1

This restoration pathway occurs with integrated weed management.

Transition T2.b
State 2 to 3

This transition occurs after removal of vegetation in conjunction with heavy precipitation.

Restoration pathway R3.a
State 3 to 1

This restoration pathway occurs only when significant time and money inputs that would require constant maintenance and weed management and should be focused on areas that have not been permanently altered by urban developments.

Additional community tables

Inventory data references

Inventory data to be collected using future projects based on priorities.

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Contributors

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Approval

Kendra Moseley, 4/24/2024

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.

Author(s)/participant(s)	
Contact for lead author	
Date	11/23/2024
Approved by	Kendra Moseley
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:**

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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:**
