USDA Natural Resources
Conservation Service

Ecological site R018XA102CA
Clayey Thermic Terraces

Last updated: 4/24/2024
Accessed: 05/11/2025

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

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

The Tuscan Flows LRU is the northernmost Land Resource Unit in MLRA 18. It occurs down slope of and is geologically related to the southern Cascades; however, its inclusion in MLRA 18 stems from the ecosystem's close resemblance to other Sierra Nevada Foothill systems. This LRU is situated on a low elevation volcanic plateau at the northeast end of the Sacramento Valley. The geology includes, but not limited to late Pliocene and Quartenary basalt, andesite and andesitic lahars (mudflows). Several cinder cones dot the landscape and active fluvial processes are occurring in the larger canyons. Elevation ranges between 250 and 2000 feet above sea level on the main plateau, but can range as high as 3000 feet on the highest hills. Precipitation is among the highest in MLRA 18, ranging from 30 to 55 inches annually. Mean annual air temperature ranges between 56 and 62 F. Frost free days (generally exhibiting an inverse relationship with elevation) range from 184 to 282 days.

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), M261Fa, the Tuscan Flows 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 6a, Tuscan Flows.

Ecological site concept

This site is characterized by moderately deep, fine-textured soils occurring on strath terraces on low elevation hills,

typically formed on alluvium weathered from sedimentary or metamorphic rock. Slopes typically range from 0 to 30%. Precipitation typically ranges from 30 to 36 inches per year, and elevation ranges from 300 to 700 feet.

The overriding abiotic factors controlling vegetation expression on this site include high clay percent (40% or more) and water-shedding landscape positions, which prevent the establishment of woody vegetation. Infiltration of water is limited; roots may not be able to exploit the entire profile depth due to seasonal cracking during drying cycles or because of a duripan. Common soils correlated to this ecological site are Lucksev (Clayey, mixed, superactive, thermic, shallow Typic Haploxeralfs) and Carhart (Fine, smectitic, thermic Xeric Endoaquerts).

This vegetation community consists of annual grasses and forbs. Dominant plants include soft brome (Bromus hordeaceus), wild oat (Avena fatua), fillaree (Erodium spp.), bur clover, (Medicago hispida), ripgut brome (Bromus diandrus), fescue (Festuca spp.), and needlegrass (Stipa spp.).

Associated sites

F018XA201CA	**Deep Thermic Hillslopes** This site commonly occurs nearby.
F018XI201CA	**Moderately Deep Thermic Foothills** This site commonly occurs nearby.
R018XA103CA	**Shallow Thermic Volcanic Ridges** This site commonly occurs nearby.

Similar sites

R018XA103CA	**Shallow Thermic Volcanic Ridges** Site relationships being developed.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Bromus hordeaceus* (2) *Erodium botrys*

Physiographic features

This ecological site occurs on strath terraces and low hills at elevations typically ranging from 300 to 700 feet. Slopes generally range from 2 to 30%.

Table 2. Representative physiographic features

Hillslope profile	(1) Footslope (2) Backslope
Geomorphic position, hills	(1) Side Slope
Landforms	(1) Foothills > Strath terrace (2) Foothills > Hill (3) Foothills > Hillslope
Runoff class	Very high
Flooding frequency	None
Ponding duration	Long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	300–700 ft
Slope	2–30%

Ponding depth	0–2 in
Water table depth	0 in
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Medium to very high
Flooding frequency	None
Ponding duration	Long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	140–1,385 ft
Slope	0–35%
Ponding depth	0–3 in
Water table depth	0 in

Climatic features

This ecological site is characterized by hot, dry summers and cool, wet winters, a typical Mediterranean climate. Mean annual precipitation ranges from 30 to 36 inches and usually falls from October to April. Mean annual temperature ranges from 60 to 63 degrees F with 222 to 238 frost free days.

Table 4. Representative climatic features

Frost-free period (characteristic range)	222-238 days
Freeze-free period (characteristic range)	365 days
Precipitation total (characteristic range)	32-36 in
Frost-free period (actual range)	218-242 days
Freeze-free period (actual range)	365 days
Precipitation total (actual range)	31-37 in
Frost-free period (average)	230 days
Freeze-free period (average)	365 days
Precipitation total (average)	34 in

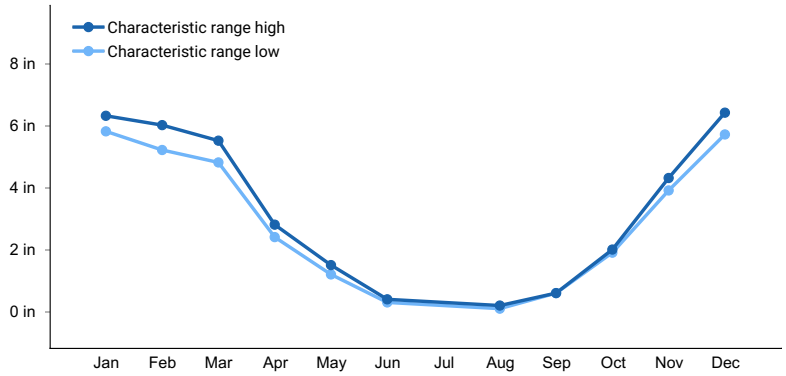


Figure 1. Monthly precipitation range

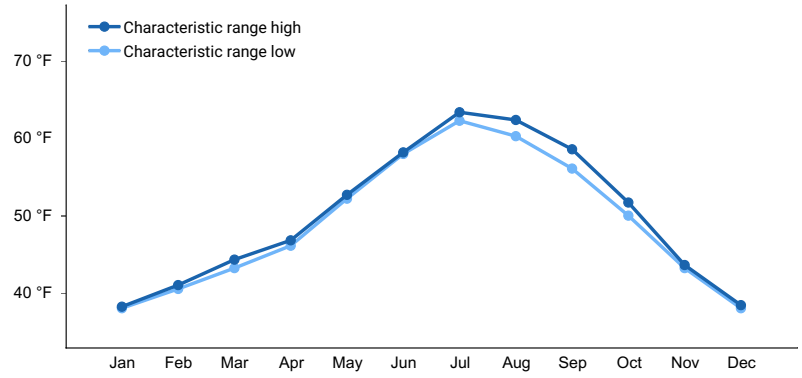


Figure 2. Monthly minimum temperature range

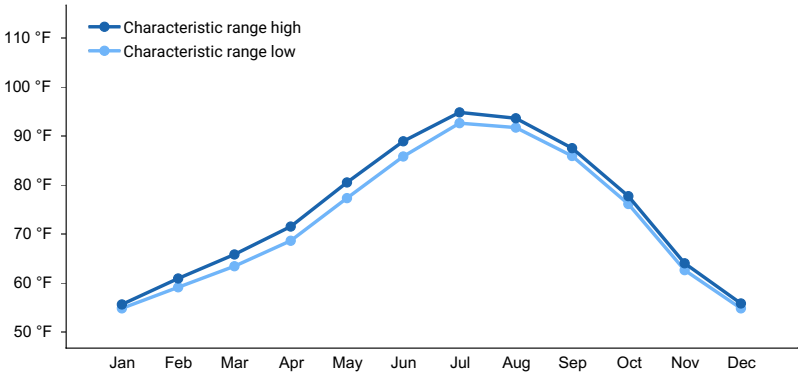


Figure 3. Monthly maximum temperature range

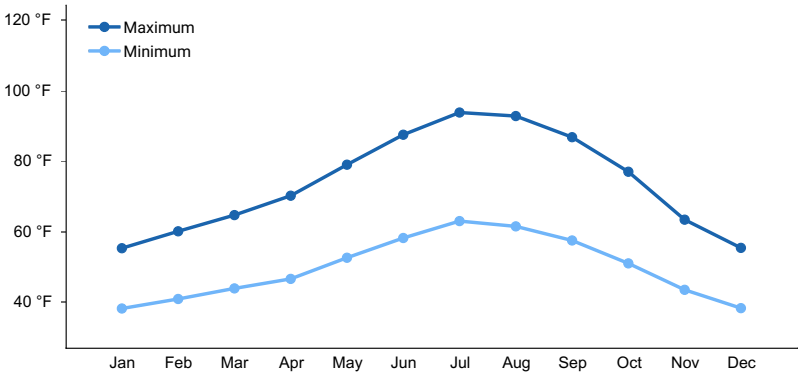


Figure 4. Monthly average minimum and maximum temperature

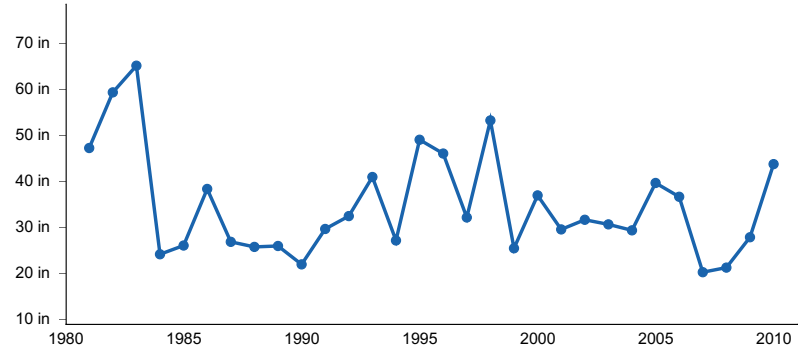


Figure 5. Annual precipitation pattern

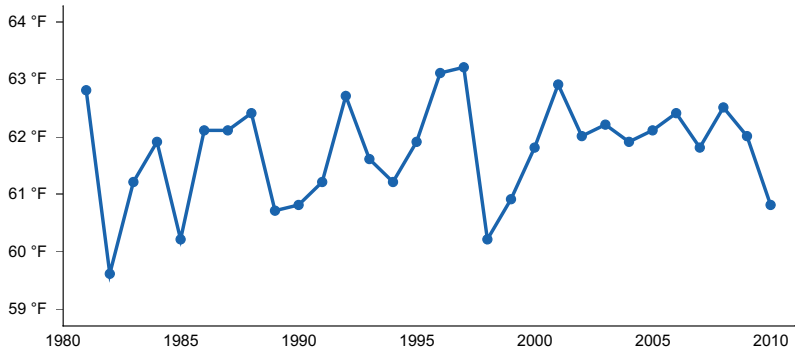


Figure 6. Annual average temperature pattern

Climate stations used

- (1) AUBURN [USC00040383], Auburn, CA
- (2) OROVILLE [USC00046521], Oroville, CA

Influencing water features

The Carhart soils can frequently pond up to 2 inches above the surface for long duration from December through March in concave areas with less than 2 percent slope. A fluctuating water table can occur between the top of the bedrock and the surface of the soil from December through May.

Wetland description

N/A

Soil features

The soils in this ecological site occur on strath terraces and low hills and are formed in colluvium, residuum and alluvium from volcanic rocks. The typical depth range is very shallow to very deep, with soil profiles generally 15 to 75 inches deep. The bedrock (where present in the profile) is restrictive. Deeper soils (40+ inches) occur in deeper alluvial materials or thicker colluvial materials at the base of slopes. The particle size control section is Clayey or Fine. Surface textures include loam, gravelly loam and clay (Carhart soils only). Gravels on the soil surface range from 0 to 1% cover; larger fragments on the soil surface range from 0 to 10% cover. Gravels (<3 inch diameter) range from 0 to 10% by volume throughout the profile; larger fragments (≥3 inch diameter) range from 0 to 5% by volume throughout the profile. Soils in this ecological site are dominantly well and moderately well drained. Carhart soils are poorly drained. Available Water Storage (AWS) in the profile ranges from 2 to 6 inches. Surface pH ranges from 6.4 to 6.9 while subsurface reaction is from 4.7 to 7.2. Common soils correlated to this ecological site are Lucksev (Clayey, mixed, superactive, thermic, shallow Typic Haploxeralfs) and Carhart (Fine, smectitic, thermic Xeric Endoaquerts)

Table 5. Representative soil features

Parent material	(1) Colluvium–volcanic rock (2) Residuum–volcanic rock (3) Alluvium–volcanic rock
Surface texture	(1) Loam (2) Gravelly loam (3) Clay
Family particle size	(1) Clayey (2) Fine
Drainage class	Poorly drained to well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	15–25 in

Soil depth	15–25 in
Surface fragment cover <=3"	0–1%
Surface fragment cover >3"	0–10%
Available water capacity (0-40in)	2–6 in
Soil reaction (1:1 water) (0-10in)	6.4–6.9
Subsurface fragment volume <=3" (0-60in)	0–10%
Subsurface fragment volume >3" (0-60in)	0–5%

Table 6. Representative soil features (actual values)

Drainage class	Poorly drained to well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	10–90 in
Soil depth	10–90 in
Surface fragment cover <=3"	0–20%
Surface fragment cover >3"	0–53%
Available water capacity (0-40in)	0.8–8.4 in
Soil reaction (1:1 water) (0-10in)	4.7–8.3
Subsurface fragment volume <=3" (0-60in)	0–30%
Subsurface fragment volume >3" (0-60in)	0–75%

Ecological dynamics

State and transition model

STM: R018XA102CA

Clayey Thermic Terraces
30-36 " PZ

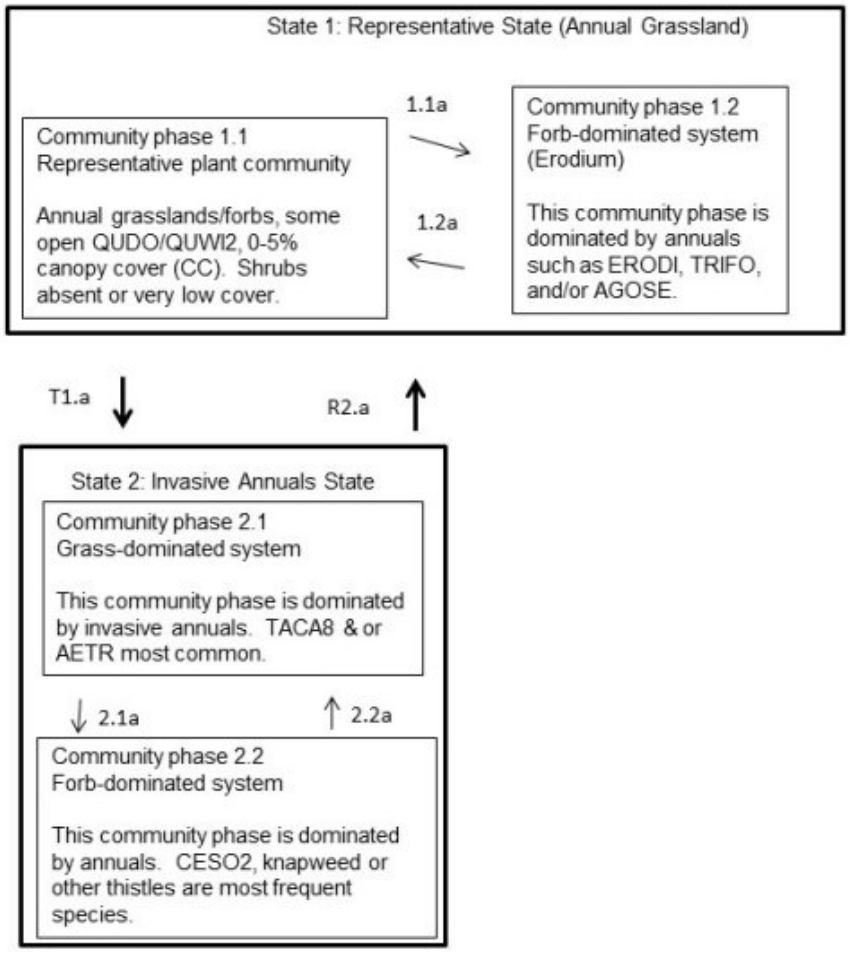


Figure 7. STM: R018XA102CA

Community pathways and Transitions

T1.a This transition occurs after invasive plants posing extreme economic/environmental issues 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.

R2.a This restoration pathway occurs with integrated weed management. May require mowing, herbicides, and/or biological control.

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

2.2a This community pathway occurs as invasive grass species become dominant, often in response to increases in litter following high winter precipitation years.

Figure 8. Community Pathways and Transitions: R018XA102CA

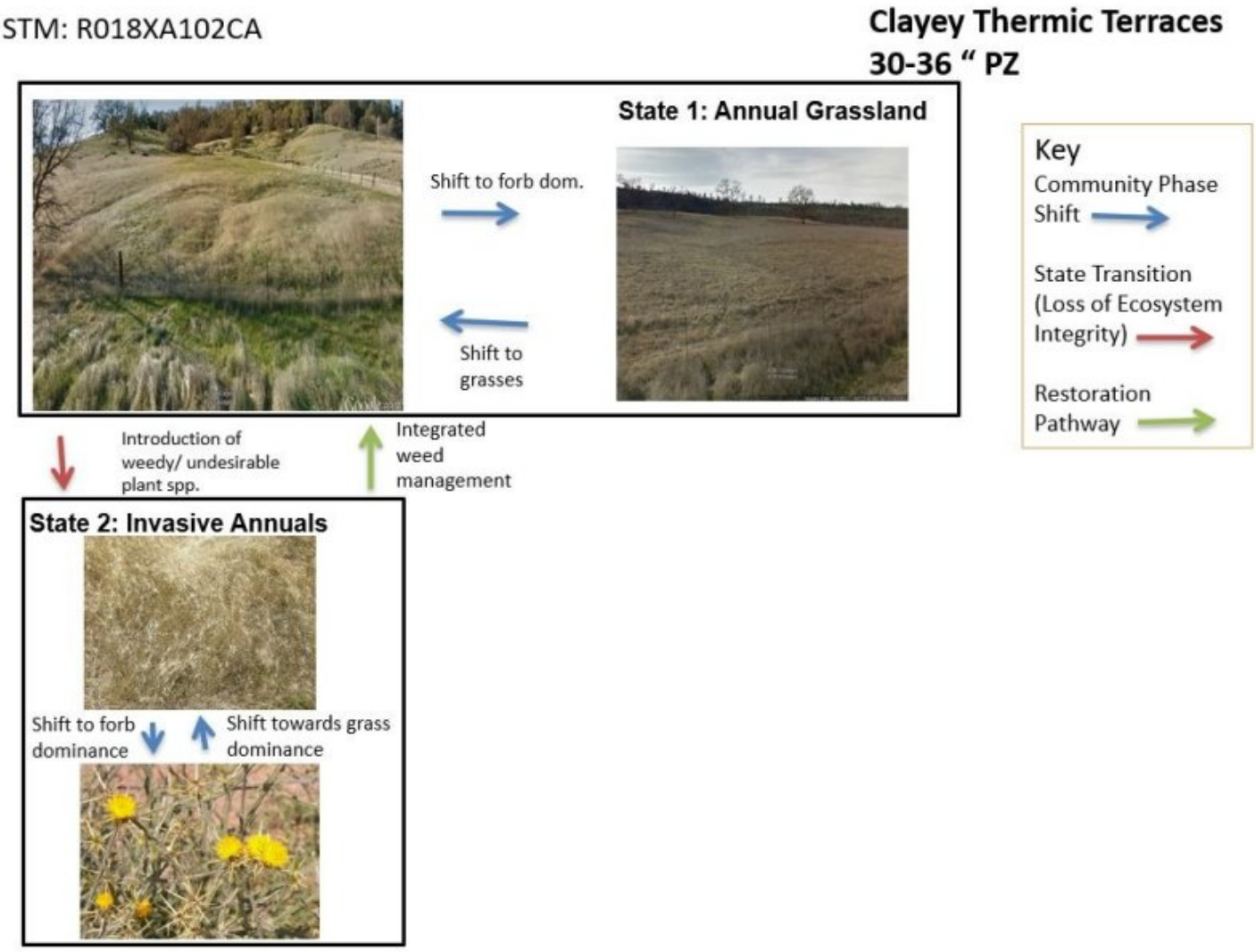


Figure 9. STM Photos: R018XA102CA

State 1
Representative State (Annual Grassland)

Community 1.1
Representative plant community

Community 1.2
Forb-dominated system (Erodium)

This community phase is dominated by annuals such as ERODI, TRIFO, and/or AGOSE.

Pathway 1.1a
Community 1.1 to 1.2

Representative plant community

Forb-dominated system (Erodium)

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

Pathway 1.2a
Community 1.2 to 1.1

Forb-dominated system (Erodium)

Representative plant community

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

State 2
Invasive Annuals State

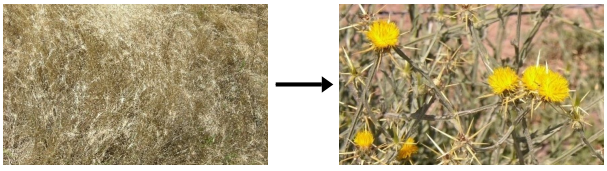
Community 2.1
Grass-dominated system

This community phase is dominated by invasive annuals. TACA8 & or AETR most common.

Community 2.2
Forb-dominated system

This community phase is dominated by annuals. CESO2, knapweed or other thistles are most frequent species.

Pathway 2.1a
Community 2.1 to 2.2



Grass-dominated system | Forb-dominated system

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

Pathway 2.2a
Community 2.2 to 2.1

Forb-dominated system | Grass-dominated system

This community pathway occurs as invasive grass species become dominant, often in response to increases in litter following high winter precipitation years.

Transition T1.a
State 1 to 2

This transition occurs after invasive plants posing extreme economic/environmental issues become established.

Restoration pathway R2.a
State 2 to 1

This restoration pathway occurs with integrated weed management. May require mowing, herbicides, and/or biological control.

Additional community tables

Inventory data references

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

References

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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	05/11/2025
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:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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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:**
