USDA Natural Resources Conservation Service

Ecological site F018XI202CA
Deep Thermic Steep Hillslopes

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

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

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

This LRU (designated XI) is located on moderate to steep hills in the Sierra Nevada Foothills east of Sacramento and Stockton, CA. Various geologies occur in this region: metavolcanics, granodiorite, slate, marble, argillite, schist and quartzite, as well as ultramafic bands to a limited and localized extent. It includes mesa formations from volcanic flows, where vernal pool habitats occur. Soil temperature regime is thermic and soil moisture regime is xeric. Elevation ranges between 300 and 3400 ft above sea level. Precipitation ranges from 14 to 42 inches annually. Most precipitation falls between the months of November and March in the form of rain. Dominant vegetation includes annual grasslands, blue oak (Quercus douglasii), interior live oak (Quercus wislizeni), chamise (Adenostoma fasciculatum), buckbrush (Ceanothus cuneatus), and foothill pine (Pinus sabiniana).

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 6b, Northern Sierran Foothills.

Ecological site concept

This site occurs on steep sideslopes and backslopes (often north-facing) in soils derived from metasedimentary or metavolcanic parent material. Slopes typically range from 4-70%. Mean annual precipitation typically ranges from 32 to 49 inches, and elevation typically ranges from 600 feet to 2000 feet. Soil temperature regime is thermic, albeit on the cool side of thermic.

Soil depth and the slope aspect result in higher available water capacity which allow for closed woodlands (mean canopy cover of trees 38%) to dominate the site. Representative soil components include Sanguinetti, Motherlode, and Wardsferry soils. These soils are shallow to moderately deep and well drained. They have thermic soil temperature regimes and are classified as Typic Haploxerepts (Sanguinetti) and Ultic Haploxeralfs (Motherlode & Wardsferry).

The dominant vegetation in this ecological site consists of dense interior live oak (Quercus wislizeni), toyon (Heteromeles arbutifolia), manzanita (Arctostaphylos spp.), poison oak (Toxicodendron diversilobum), and sparse to moderate herbaceous annual forbs and grasses (comprising 10% or less of total annual production). Shrubs contribute an additional 15%, and annual production of the tree component ranges up to 75% of total production.

Associated sites

F018XI205CA	**Thermic Granitic Foothills** This site commonly occurs nearby.
F022AW007CA	**Deep Mesic Mountains >40"ppt** This site commonly occurs nearby.
F018XI201CA	**Moderately Deep Thermic Foothills** This site commonly occurs nearby.

Table 1. Dominant plant species

Tree	(1) *Quercus wislizeni* (2) *Quercus douglasii*
Shrub	(1) *Arctostaphylos* (2) *Heteromeles arbutifolia*
Herbaceous	(1) *Bromus hordeaceus* (2) *Bromus diandrus*

Physiographic features

This site is associated with backslopes and toe slopes of hills. Slopes generally range from 4-70%. Elevation generally ranges from 600 to 2000 feet.

Table 2. Representative physiographic features

Hillslope profile	(1) Backslope (2) Toeslope (3) Footslope
Landforms	(1) Foothills > Hill
Runoff class	Medium
Flooding frequency	None
Ponding frequency	None
Elevation	600–2,000 ft
Slope	4–70%
Aspect	W, NW, N, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Medium
Flooding frequency	None
Ponding frequency	None

Elevation	100–3,500 ft
Slope	0–90%

Climatic features

This ecological site is characterized by hot, dry summers and cool, wet winters, a typical Mediterranean climate. Mean annual precipitation ranges from 32 to 49 inches and usually falls from October to May. Mean annual temperature is 59 to 62 degrees F with 170 to 213 frost free days.

Table 4. Representative climatic features

Frost-free period (characteristic range)	170-213 days
Freeze-free period (characteristic range)	279-365 days
Precipitation total (characteristic range)	32-49 in
Frost-free period (actual range)	155-219 days
Freeze-free period (actual range)	236-365 days
Precipitation total (actual range)	30-56 in
Frost-free period (average)	191 days
Freeze-free period (average)	317 days
Precipitation total (average)	41 in

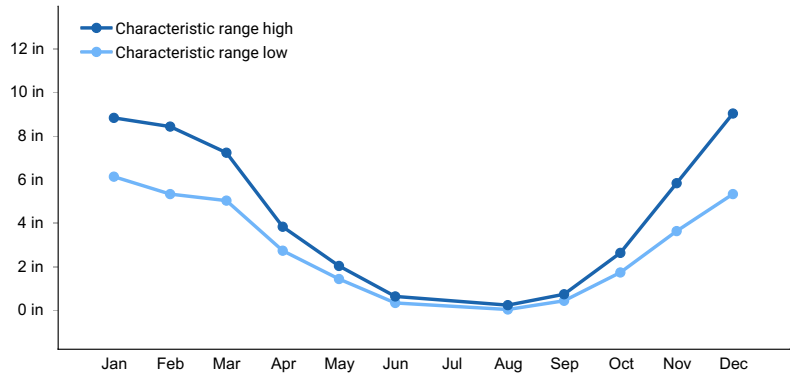

Figure 1. Monthly precipitation range

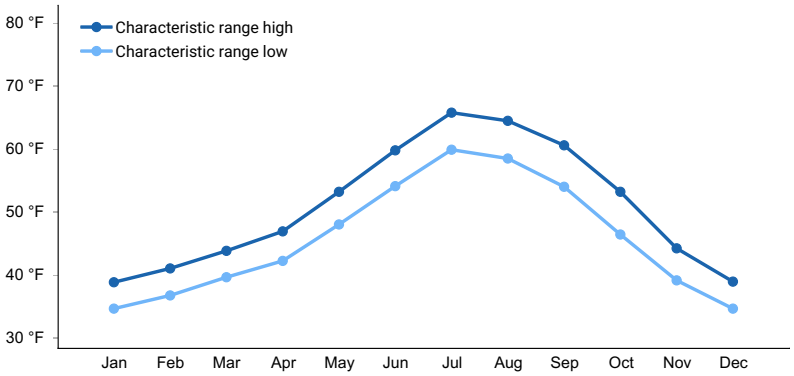

Figure 2. Monthly minimum temperature range

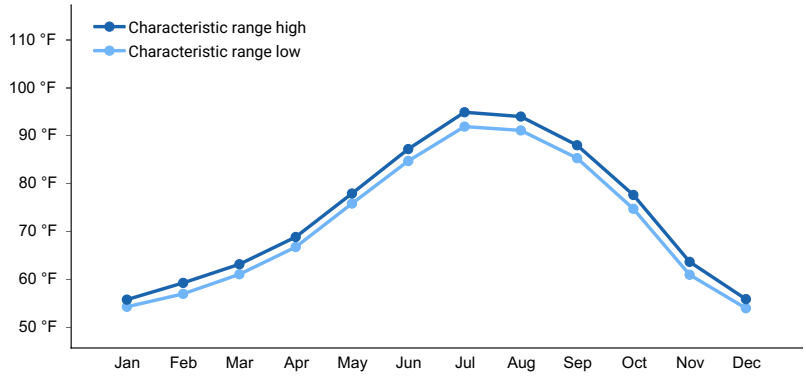

Figure 3. Monthly maximum temperature range

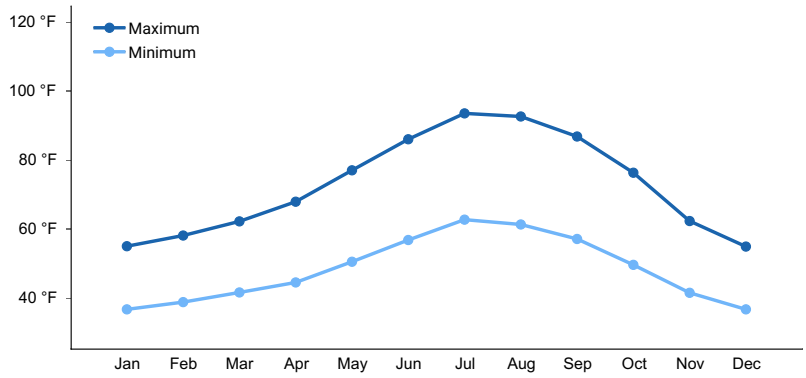

Figure 4. Monthly average minimum and maximum temperature

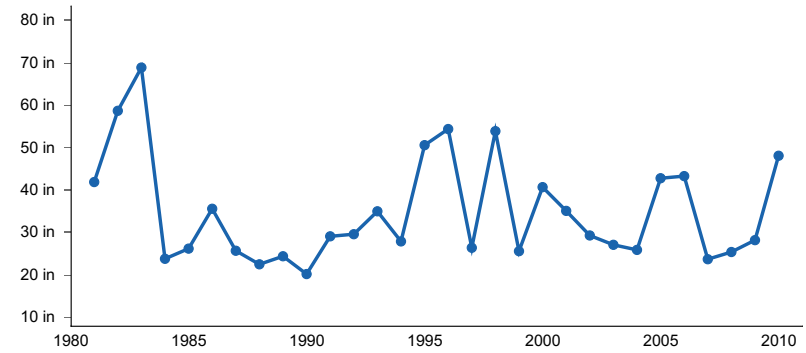

Figure 5. Annual precipitation pattern

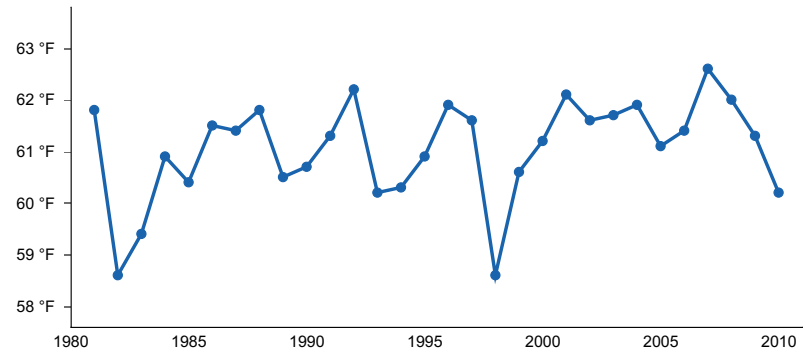

Figure 6. Annual average temperature pattern

Climate stations used

- (1) NEW MELONES DAM HQ [USC00046174], Angels Camp, CA
- (2) SONORA [USC00048353], Jamestown, CA
- (3) PARADISE [USC00046685], Chico, CA

Influencing water features

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

Wetland description

N/A

Soil features

The soils in this ecological site are formed from the colluvium and residuum of granitic or metamorphic rock. Soils are moderately deep and deep, and have fine-loamy to fine particle size control sections. Surface textures are usually loam or gravelly loam. The bedrock is a restrictive layer found between 30 and 49 inches of depth. Gravels (< 3 inch diameter) cover between 0 and 5% of the soil surface, and larger fragments (=> 3 inch diameter) occupy 0 to 10% of the surface. Subsurface gravels range between 5 to 30% by volume while larger fragments usually occupy between 0 and 30%. These soils are well drained and the permeability class ranges from moderate to moderately rapid. Available Water Capacity (AWC) is between 3.9 and 6.0 inches. The pH of the top 10 inches of the soil ranges from 5.8 to 6.7, and in the subsoil the range is from 5.7 to 6.7.

Common soils correlated to this ecological site include: Sobrante (Fine-loamy, mixed, active, thermic Mollic Haploxeralfs), Millvilla (Fine-loamy, mixed, active, thermic Ultic Haploxeralfs), and Timbuctoo (Fine, parasesquic, thermic Typic Rhodoxeralfs).

Table 5. Representative soil features

Parent material	(1) Residuum–granitoid (2) Colluvium–metamorphic rock (3) Colluvium–granitoid (4) Residuum–metamorphic rock
Surface texture	(1) Gravelly loam (2) Loam
Family particle size	(1) Fine-loamy (2) Fine
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Depth to restrictive layer	30–49 in
Soil depth	30–49 in
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0–10%
Available water capacity (0-40in)	3.9–6 in
Soil reaction (1:1 water) (0-10in)	5.8–6.7
Subsurface fragment volume <=3" (0-60in)	5–30%
Subsurface fragment volume >3" (0-60in)	0–30%

Table 6. Representative soil features (actual values)

Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Depth to restrictive layer	20–65 in

Soil depth	20–65 in
Surface fragment cover <=3"	0–35%
Surface fragment cover >3"	0–40%
Available water capacity (0-40in)	0.8–8.3 in
Soil reaction (1:1 water) (0-10in)	4.9–7.7
Subsurface fragment volume <=3" (0-60in)	0–35%
Subsurface fragment volume >3" (0-60in)	0–50%

Ecological dynamics

State and transition model

Community pathways and Transitions

T1.a This transition occurs after decades of little to no disturbance to the canopy layers, resulting in a build up of fuels and higher density of live vegetation (especially shrubs). A high severity, stand replacing fire will then trigger a shift towards chaparral vegetation communities. Shrubs adapted to the new fire regime, sprout and seed at a much higher rate than the tree component.

T1.b This transition occurs after repeated fires or active brush management/chemical treatment to produce an open savannah.

1.1a Time without fire or other natural disturbance to the forest canopy (or vegetation management).

1.1b This community pathway occurs with low to moderately severe fire promoting a sprouting response from the trees top-killed by the fire (normal fire return interval ~ 25 years).

1.2a Normal growth and progression without disturbance.

1.3a This community pathway occurs with moderate intensity, often patchy, fire. Mid canopy layers and shrubs are killed, creating a more open woodland. This community pathway also can result with firewood cutting, or shrub clearing.

T2.a This transition occurs with active brush management; chemical treatment, and repeated prescribed burning.

R2.a This restoration pathway occurs after active brush management, chemical treatment, followed up with tree planting.

2.1a This community pathway occurs following a high intensity wildfire.

2.2a This community pathway occurs over time with no management action.

R3.a This restoration pathway occurs with tree planting, often requires shade screens, and seedling protection from browsers to be successful.

3.1a This community pathway occurs as forbs become more dominant, often following low winter precipitation and reduced litter layers.

3.2a This community pathway occurs as grasses become more dominant, often in response to higher litter levels.

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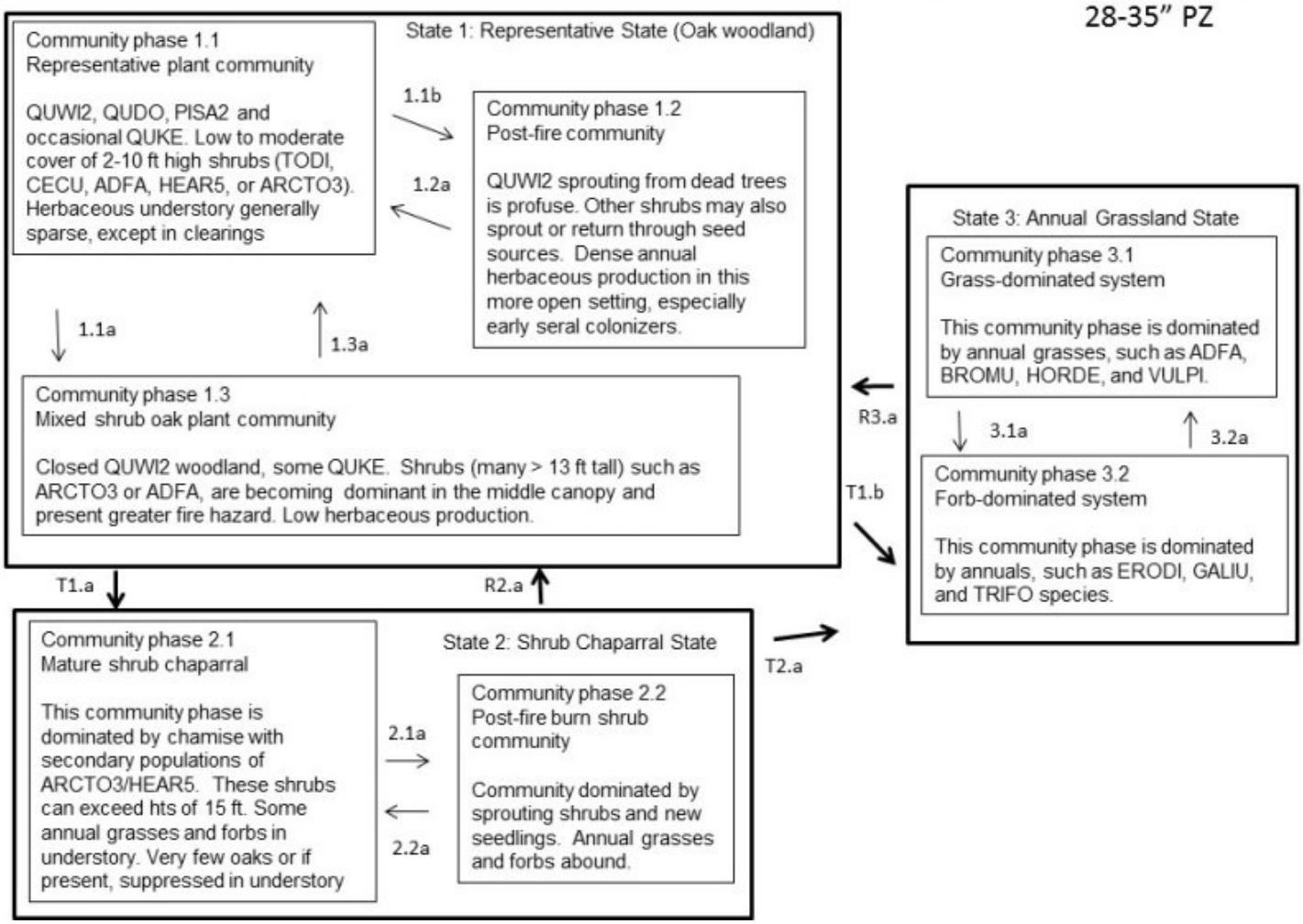
Deep Thermic Steep Hillslopes
28-35" PZ



State 1
Representative State (Oak woodland)

Community 1.1
Representative plant community

QUWI2, QUDO, PISA2 and occasional QUKE. Low to moderate cover of 2-10 ft high shrubs (TODI, CECU, ADFA, HEAR5, or ARCTO3). Herbaceous understory generally sparse, except in clearings

Community 1.2
Post-fire community

QUWI2 sprouting from dead trees is profuse. Other shrubs may also sprout or return through seed sources. Dense annual herbaceous production in this more open setting, especially early seral colonizers.

Community 1.3
Mixed shrub oak plant community

Closed QUWI2 woodland, some QUKE. Shrubs (many > 13 ft tall) such as ARCTO3 or ADFA, are becoming dominant in the middle canopy and present greater fire hazard. Low herbaceous production.

Pathway 1.1b
Community 1.1 to 1.2

Representative plant community

Post-fire community

This community pathway occurs with low to moderately severe fire promoting a sprouting response from the trees top-killed by the fire (normal fire return interval ~ 25 years).

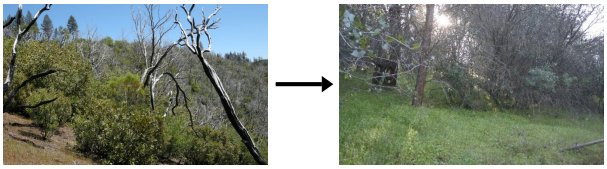
Pathway 1.1a
Community 1.1 to 1.3

Representative plant community

Mixed shrub oak plant community

Time without fire or other natural disturbance to the forest canopy (or vegetation management).

Pathway 1.2a
Community 1.2 to 1.1



Post-fire community

Representative plant community

Normal growth and progression without disturbance.

Pathway 1.3a
Community 1.3 to 1.1

Mixed shrub oak plant community

Representative plant community

This community pathway occurs with moderate intensity, often patchy, fire. Mid canopy layers and shrubs are killed, creating a more open woodland. This community pathway also can result with firewood cutting, or shrub clearing.

State 2
Shrub Chaparral State

Community 2.1
Mature shrub chaparral

This community phase is dominated by chamise with secondary populations of ARCTO3/HEAR5. These shrubs can exceed hts of 15 ft. Some annual grasses and forbs in understory. Very few oaks or if present, suppressed in understory

Community 2.2
Post-fire burn shrub community

Community dominated by sprouting shrubs and new seedlings. Annual grasses and forbs abound.

Pathway 2.1a
Community 2.1 to 2.2

Mature shrub chaparral

Post-fire burn shrub community

This community pathway occurs following a high intensity wildfire.

Pathway 2.2a
Community 2.2 to 2.1

Post-fire burn shrub community

Mature shrub chaparral

This community pathway occurs over time with no management action.

State 3
Annual Grassland State

Community 3.1
Grass-dominated system

This community phase is dominated by annual grasses, such as ADFA, BROMU, HORDE, and VULPI

Community 3.2
Forb-dominated system

This community phase is dominated by annuals, such as ERODI, GALIU, and TRIFO species.

Pathway 3.1a
Community 3.1 to 3.2

Grass-dominated system **Forb-dominated system**

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

Pathway 3.2a
Community 3.2 to 3.1

Forb-dominated system **Grass-dominated system**

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

Transition T1.a
State 1 to 2

This transition occurs after decades of little to no disturbance to the canopy layers, resulting in a build up of fuels and higher density of live vegetation (especially shrubs). A high severity, stand replacing fire will then trigger a shift towards chaparral vegetation communities. Shrubs adapted to the new fire regime, sprout and seed at a much higher rate than the tree component.

Transition T1.b
State 1 to 3

This transition occurs after repeated fires or active brush management/chemical treatment to produce an open savannah.

Restoration pathway R2.a
State 2 to 1

This restoration pathway occurs after active brush management, chemical treatment, followed up with tree planting.

Transition T2.a
State 2 to 3

This transition occurs with active brush management; chemical treatment, and repeated prescribed burning.

Restoration pathway R3.a
State 3 to 1

This restoration pathway occurs with tree planting, often requires shade screens, and seedling protection from browsers to be successful.

Additional community tables

Inventory data references

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

References

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Other 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	05/05/2024
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

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2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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5. **Number of gullies and erosion associated with gullies:**

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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:**
