USDA Natural Resources Conservation Service

Ecological site R026XF015CA
Mahogany Slope 8-12" P.Z.

Last updated: 4/10/2024
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): 026X–Carson Basin and Mountains

The area lies within western Nevada and eastern California, with about 69 percent being within Nevada, and 31 percent being within California. Almost all this area is in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. Isolated north-south trending mountain ranges are separated by aggraded desert plains. The mountains are uplifted fault blocks with steep side slopes. Most of the valleys are drained by three major rivers flowing east across this MLRA. A narrow strip along the western border of the area is in the Sierra Nevada Section of the Cascade-Sierra Mountains Province of the Pacific Mountain System. The Sierra Nevada Mountains are primarily a large fault block that has been uplifted with a dominant tilt to the west. This structure leaves an impressive wall of mountains directly west of this area. This helps create a rain shadow affect to MLRA 26. Parts of this eastern face, but mostly just the foothills, mark the western boundary of this area. Elevations range from about 3,806 feet (1,160 meters) on the west shore of Pyramid Lake to 11,653 feet (3,552 meters) on the summit of Mount Patterson in the Sweetwater Mountains.

Valley areas are dominantly composed of Quaternary alluvial deposits with Quaternary playa or alluvial flat deposits often occupying the lowest valley bottoms in the internally drained valleys, and river deposited alluvium being dominant in externally drained valleys. Hills and mountains are dominantly Tertiary andesitic flows, breccias, ash flow tuffs, rhyolite tuffs or granodioritic rocks. Quaternary basalt flows are present in lesser amounts, and Jurassic and Triassic limestone and shale, and Precambrian limestone and dolomite are also present in very limited amounts. Also of limited extent are glacial till deposits along the east flank of the Sierra Nevada Mountains, the result of alpine glaciation.

The average annual precipitation in this area is 5 to 36 inches (125 to 915 millimeters), increasing with elevation. Most of the rainfall occurs as high-intensity, convective storms in spring and autumn. Precipitation is mostly snow in winter. Summers are dry. The average annual temperature is 37 to 54 degrees F (3 to 12 degrees C). The freeze-free period averages 115 days and ranges from 40 to 195 days, decreasing in length with elevation.

The dominant soil orders in this MLRA are Aridisols and Mollisols. The soils in the area dominantly have a mesic soil temperature regime, an aridic or xeric soil moisture regime, and mixed or smectitic mineralogy. They generally are well drained, are clayey or loamy and commonly skeletal, and are very shallow to moderately deep.

This area supports shrub-grass vegetation characterized by big sagebrush. Low sagebrush and Lahontan sagebrush occur on some soils. Antelope bitterbrush, squirreltail, desert needlegrass, Thurber needlegrass, and Indian ricegrass are important associated plants. Green ephedra, Sandberg bluegrass, Anderson peachbrush, and several forb species also are common. Juniper-pinyon woodland is typical on mountain slopes. Jeffrey pine, lodgepole pine, white fir, and manzanita grow on the highest mountain slopes. Shadscale is the typical plant in the drier parts of the area. Sedges, rushes, and moisture-loving grasses grow on the wettest parts of the wet flood plains and terraces. Basin wildrye, alkali sacaton, saltgrass, buffaloberry, black greasewood, and rubber rabbitbrush grow on the drier sites that have a high concentration of salts.

Some of the major wildlife species in this area are mule deer, coyote, beaver, muskrat, jackrabbit, cottontail, raptors, pheasant, chukar, blue grouse, mountain quail, and mourning dove. The species of fish in the area include trout and catfish. The Lahontan cutthroat trout in the Truckee River is a threatened and endangered species.

LRU notes

The Mono-Adobe-Long Valleys LRU is comprised of the basins surrounding Mono Lake, Adobe Valley, and Long Valley to the southeast. Pleistocene and Holocene age alluvium and lacustrine deposits predominate. Ash layers occur from eruptions of the numerous volcanic domes that are mostly in adjacent LRUs. Soil temperature regimes are mesic and soil moisture regimes are aridic. Elevations range from 1310 to 2680 meters and slopes are typically less than 10 percent, however there are some ecological sites within the Mono-Adobe-Long Valleys LRU that are greater than 10 percent. Frost free days (FFD) range from 97-125.

Ecological site concept

The Mahogany Slope 8-12" P.Z. site is found on volcanic flows. Elevations are 6400 to 7500 feet. Slopes range from 15 to 50 percent. The soils are very shallow or shallow and somewhat excessively drained. They are formed in volcanic ash. Surface textures are very stony loamy sands. The plant community is dominated by curl-leaf mountain mahogany (Cercocarpus ledifolius), mountain big sagebrush (Artemisia tridentata ssp. vaseyana), and needlegrass (Achnatherum spp).

Associated sites

R026XF012CA	**Ashy Loam 8-12" P.Z.** Site is found on moderately deep to deep soil.
R026XF014CA	**Granitic Loam 8-12" P.Z.** Site is found on glacial moraines.

Table 1. Dominant plant species

Tree	(1) *Cercocarpus ledifolius*
Shrub	(1) *Artemisia tridentata ssp. vaseyana*
Herbaceous	(1) *Achnatherum*

Physiographic features

This site occurs on volcanic flows. Slopes range from 15 to 50 percent.

Table 2. Representative physiographic features

Landforms	(1) Lava flow
Runoff class	Very high
Elevation	6,400–7,500 ft
Slope	15–50%
Aspect	Aspect is not a significant factor

Climatic features

The climate on this site is characterized by cold winters (20 to 45 degrees F) and warm, mostly dry summers (40 to 85 degrees F). The average annual precipitation ranges from 8 to 12 inches, with most falling as snow from November to March.

Table 3. Representative climatic features

Frost-free period (characteristic range)	

Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	8-12 in
Frost-free period (average)	108 days
Freeze-free period (average)	135 days
Precipitation total (average)	10 in

Influencing water features

The Mahogany Slope 8-12" P.Z. site is not influenced by water features.

Soil features

The soils that characterize this site are very shallow and somewhat excessively drained. They are formed in volcanic ash or residuum weathered from welded tuff. Surface textures are very stony loamy sands. The surface is covered with about 15 percent boulders. Available water capacity is very low and the hazard of water erosion is moderate. Wind erosion hazard is slight. Effective rooting depth is 6 to 20 inches. Soft tuffaceous sandstone occurs from 9 to 60 inches or more.

Soil Survey Area: Component (Mapunit)
CA732: Cashbaugh (285bo, 286bo)
CA802: Cashbaugh (285, 286)

Table 4. Representative soil features

Parent material	(1) Volcanic ash (2) Residuum–welded tuff
Surface texture	(1) Very stony loamy sand
Drainage class	Somewhat excessively drained
Depth to restrictive layer	6–20 in
Surface fragment cover <=3"	16%
Surface fragment cover >3"	14%
Available water capacity (Depth not specified)	0.7–0.9 in
Subsurface fragment volume <=3" (Depth not specified)	12%
Subsurface fragment volume >3" (Depth not specified)	2%

Ecological dynamics

Where management results in abusive livestock and big game use, the under-story grasses and forbs decrease while mountain big sagebrush and snowberry increase. Species likely to invade this site are annuals such as cheatgrass.

This is a general text description of the states, phases, transitions, and community pathways possible in the State and Transition model for the MLRA 26 Disturbance Response Group 15. Site included in this Disturbance Response Group are R026XY009NV and R026XY015CA.

Reference State 1.0:

The Reference State 1.0 represents the natural range of variability under pristine conditions. The reference state has three general community phases; a shrub-grass dominant phase, a perennial grass dominant phase and a

shrub dominant phase. State dynamics are maintained by interactions between climatic patterns and disturbance regimes. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. Plant community phase changes are primarily driven by fire, periodic drought and/or insect or disease attack.

Community Phase 1.1:
This community is dominated by curl-leaf mountain mahogany. Mountain big sagebrush and snowberry make up the shrub components of the understory. Needlegrasses and bluegrasses are dominant perennial bunchgrasses. A diversity of other grasses and forbs exist in the understory.

Community Phase Pathway 1.1a from phase 1.1 to 1.2:
Fire will reduce the mahogany overstory and allow the understory species to dominate the site. Due to low fuel loads, fires will typically be low severity, resulting in a mosaic pattern.

Community Phase Pathway 1.1b from phase 1.1 to 1.3:
Time and lack of disturbance or fire, drought, herbivory, or combinations of these causes mountain mahogany to increase. The shrub and herbaceous understory components decline due to increased shading from the trees. Muttongrass increases with more shade.

Community Phase 1.2:
This community phase is characteristic of a post-disturbance, early- to mid-seral plant community. Snowberry and rabbitbrush are sprouting. Perennial grasses and forbs dominate. Mahogany and mountain big sagebrush may be present, but only in patches.

Community Phase Pathway 1.2a from phase 1.2 to 1.1:
Time and lack of disturbance or fire, drought, herbivory, or combinations of these allows the mountain mahogany and sagebrush to increase.

Community Phase 1.3 (At-Risk):
Mahogany density will increase in the absence of disturbance. Shrubs and deep-rooted perennial bunchgrasses will be shaded out by the dense mahogany. Bluegrasses are more shade tolerant, however, and increase in the understory. Mahogany in dense stands will lose lower branches due to shading and/or herbivory, resulting in a more tree-like appearance.

Community Phase Pathway 1.3a fro, phase 1.3 to 1.2:
A low-severity or spot fire, snow loading, or insect damage will decrease the overstory and allow for the herbaceous plants in the understory to increase.

T1A: Transition from Reference State 1.0 to Current Potential State 2.0:
Trigger: This transition is caused by the introduction of non-native annual weeds, such as cheatgrass, mustard and Russian thistle. These non-native species were often introduced with livestock grazing.
Slow variables: Over time, the annual non-native plants will increase within the community decreasing organic matter inputs from deep-rooted perennial bunchgrasses resulting in reductions in soil water availability for perennial bunchgrasses.
Threshold: Any amount of introduced non-native species causes an immediate decrease in the resilience of the site. Annual non-native species cannot be easily removed from the system and have the potential to significantly alter disturbance regimes from their historic range of variation.

T1B: Transition from Reference State 1.0 to Tree State 3.0:
Trigger: Time and lack of disturbance allows pinyon to increase and overtop the mountain mahogany. Litter increases while understory plants decrease.
Slow variables: Over time, abundance and size of singleleaf pinyon will increase.
Threshold: Pinyon dominate(s) ecological processes. Trees overtop and outcompete mountain mahogany and shrubs for water and sunlight. Shrub skeletons exceed live shrubs with minimal recruitment of new cohorts.

Current Potential State 2.0:
This state is similar to the Reference State 1.0. Ecological function has not changed, however the resiliency of the

state has been reduced by the presence of invasive weeds. This state has the same three general community phases. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These include the presence of all structural and functional groups, low fine fuel loads and retention of organic matter and nutrients. Positive feedbacks decrease ecosystem resilience and stability of the state. These include the non-natives high seed output, persistent seed bank, rapid growth rate, ability to cross-pollinate and adaptations for seed dispersal. Additionally, the presence of highly flammable, non-native species reduces State resilience because these species can promote fire where historically fire has been infrequent leading to positive feedbacks that further the degradation of the system.

Community Phase 2.1:
This community is dominated by curl-leaf mountain mahogany. Mountain big sagebrush and snowberry make up the shrub components of the understory. Needlegrasses and bluegrasses are dominant perennial bunchgrasses. A diversity of other grasses and forbs exist in the understory. Annual non-native species like cheatgrass are present.

Community Phase Pathway 2.1a from phase 2.1 to 2.2:
Fire will decrease or eliminate the overstory of mahogany and allow the perennial bunchgrasses to dominate the site. Fires will typically be small and patchy due to low fuel loads.

Community Phase Pathway 2.1b from phase 2.1 to 2.3:
Time and lack of disturbance or fire, drought, herbivory, or combinations of these causes mountain mahogany to increase. The shrub and herbaceous understory components decline due to increased shading from the mahogany and/or pinyon pine. Muttongrass increases with more shade.

Community Phase 2.2:
This community phase is characteristic of a post-disturbance, early to mid-seral community phase. Needlegrasses and other perennial grasses dominate the site. Snowberry and/or rubber rabbitbrush may be sprouting. Mountain mahogany and mountain big sagebrush are patchy. Annual non-native species are present.

Community Phase Pathway 2.2a from phase 2.2 to 2.1:
Time and lack of disturbance or fire, drought, herbivory, or combinations of these allows the mountain mahogany and sagebrush to increase.

Community Phase Pathway 2.2b from phase 2.2 to 2.4:
Higher than normal spring precipitation favors annual non-native species such as cheatgrass. Non-native annual species will increase in production and density throughout the site. Perennial bunchgrasses may also increase in production. Fire may also play a part in this pathway.

Community Phase 2.3 (At-Risk):
Mahogany density will increase in the absence of disturbance. Shrubs and deep-rooted perennial bunchgrasses will be shaded out by the dense mahogany. Bluegrasses are more shade tolerant, however, and increase in the understory. Mahogany in dense stands will lose lower branches due to shading and/or herbivory, resulting in a more tree-like appearance. Pinyon pine may be present.

Community Phase Pathway 2.3a from phase 2.3 to 2.2:
Fire reduces the shrub overstory and allows perennial bunchgrasses to dominate the site. Fires are typically low severity resulting in a mosaic pattern due to low fuel loads. A fire following an unusually wet spring or a change in management favoring an increase in fine fuels may be more severe and reduce sagebrush cover to trace amounts. Annual non-native species are likely to increase after fire.

Community Phase Pathway 2.3b from phase 2.3 to 2.4:
Fall, winter, and spring precipitation and temperatures mediate the ability for annual grasses and perennial grasses to germinate and/or survive. Higher than normal spring precipitation creates high annual production of annual grasses (Bradley et al. 2016). Non-native annual species increase in production and density throughout the site. Perennial bunchgrasses may also increase in production.

Community Phase 2.4 (At-Risk):
This community is at risk of crossing into an annual state. Native bunchgrasses dominate; however, annual non-native species such as cheatgrass may be sub- or co-dominant in the understory. Annual production and abundance

of these annuals may increase drastically in years with heavy spring precipitation. This site is susceptible to further degradation from grazing, drought, and fire. Pinyon pine may be present.

T2A: Transition from Current Potential State 2.0 to Tree State 3.0:
Trigger: Time and lack of disturbance allows pinyon to increase and overtop the mountain mahogany. Litter increases while understory plants decrease.
Slow variables: Over time, abundance and size of pinyon will increase.
Threshold: Pinyon pine dominate(s) ecological processes. Trees overtop and outcompete mountain mahogany and shrubs for water and sunlight. Shrub skeletons exceed live shrubs with minimal recruitment of new cohorts.

T2B: Transition from Current Potential State 2.0 to Annual State 4.0:
Trigger: Fire or a failed range seeding leads to plant community phase 4.1. Inappropriate grazing management that favors shrubs in the presence of non-native annual species leads to community phase 4.2.
Slow variables: Increased production and cover of non-native annual species.
Threshold: Cheatgrass or other non-native annuals dominate understory.

Tree State 3.0:
This state has two community phases that are characterized by the dominance of singleleaf pinyon in the overstory. Mountain big sagebrush and perennial bunchgrasses may still be present, but they are no longer controlling site resources. Soil moisture, soil nutrients, soil organic matter distribution and nutrient cycling have been spatially and temporally altered.

Community Phase 3.1:
Pinyon pine and mountain mahogany dominate the site. Mountain big sagebrush and snowberry are minor component. Bluegrasses dominate understory. Annual non-native species may be present or dominant.

Community Phase Pathway 3.1a from phase 3.1 to 3.2:
Time and lack of disturbance or fire, drought, inappropriate grazing management, or combinations of these allows for maturation of the pinyon/juniper community.

Community Phase 3.2:
Pinyon pine dominates the site. Mountain mahogany is decadent and the stand lacks recruitment. Bluegrasses are present. Understory is reduced overall. Annual non-native species may be present.

T3A: Transition from Tree State 3.0 to Annual State 4.0:
Trigger: To community phase 4.1: Overgrazing in the presence of non-native annual species can cause a decrease in perennial bunchgrasses and an increase in annual species. Spring and/or fall moisture may also increase annual species. To community phase 4.2: Fire in the presence of annual invasive grasses.
Slow variables: Cover and production of annual non-native species increase in the understory.
Threshold: Loss of mahogany overstory, mountain big sagebrush, and deep-rooted perennial bunchgrasses changes nutrient cycling, nutrient redistribution, and reduces soil organic matter. Increased, continuous fine fuels modify the fire regime by changing intensity, size and spatial variability of fires.

R3A: Restoration from Tree State 3.0 to Current Potential State 2.0:
Removal of pinyon from site will allow mountain mahogany to again become the dominant overstory.

Annual State 4.0:
This state has two community phases: one with annual invasive plants in the understory of an intact mahogany stand, and another post-fire phase where mahogany is a minor component or missing from the site. This state is characterized by the dominance of annual non-native species such as cheatgrass and/or tansy mustard in the understory. Ecological dynamics are significantly altered in this state. Annual non-native species create a highly combustible fuel bed that shortens the fire return interval. Nutrient cycling is spatially and temporally truncated as annual plants contribute significantly less to deep soil carbon. Because this is a productive site, some deep-rooted perennial grasses may remain, even in the annual state. Without management, it is unlikely these plants will be able to recruit in the presence of dominant annual grasses.

Community Phase 4.1:
Mountain mahogany dominates the overstory and annual non-native plants such as cheatgrass dominate the

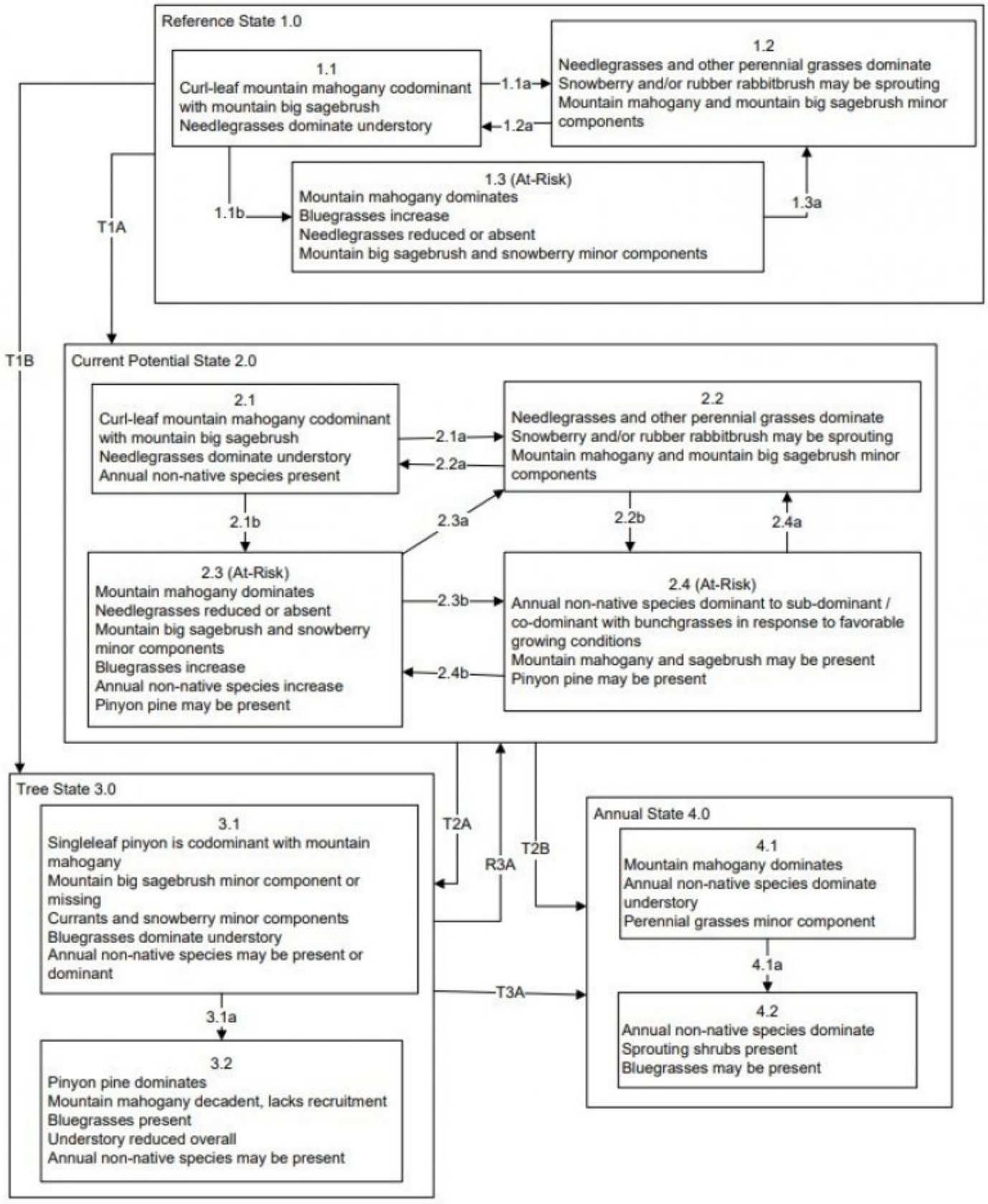
understory. Native perennial grasses and forbs are significantly reduced. Sagebrush and snowberry may or may not be present.

Community Phase Pathway 4.1a:
Catastrophic fire reduces the mountain mahogany overstory and allows annual species to dominate.

Community Phase 4.2:
Annual non-native species dominate the site. The open canopy may allow sprouting shrubs and bluegrasses to increase.

State and transition model

Mahogany Slope 8-12" P.Z.



Reference State 1.0 Community Pathways
1.1a: Low severity fire creates mosaic pattern of shrubs and grasses.
1.1b: Time and lack of disturbance or fire, drought, herbivory, or combinations of these. Muttongrass increases with more shade.
1.2a: Time and lack of disturbance or fire, drought, herbivory, or combinations of these.
1.3a: Low severity fire creates mosaic pattern.

Transition T1A: Introduction of non-native annual species.
Transition T1B: Time and lack of disturbance allows pinyon to increase and overtop mahogany. Litter increases while understory plants decrease.

Current Potential State 2.0 Community Pathways
2.1a: Low severity fire, snow loading, or insect damage reduces mahogany.
2.1b: Time and lack of disturbance allows mahogany to reach peak canopy cover. Cusick's bluegrass increases with more shade.
2.2a: Time and lack of disturbance.
2.2b: Late spring moisture that favors the germination and production of non-native, annual grasses. Pathway typically occurs 3 to 5 years post-fire and may be a transitory plant community.
2.3a: Low severity fire, snow loading, or insect damage reduces mahogany.
2.3b: Late spring moisture that favors the germination and production of non-native, annual grasses. May be a transitory plant community. Effect may be exacerbated by long-term excessive herbivory.
2.4a: Rainfall pattern favoring perennial bunchgrass production and reduced cheatgrass production.
2.4b: Rainfall pattern favoring perennial bunchgrass production and reduced cheatgrass production.

Transition T2A: Time and lack of disturbance allows pinyon to increase and overtop mahogany. Litter increases while understory plants decrease.
Transition T2B: Inappropriate grazing in the presence of non-native annual species (4.1) Catastrophic fire (4.2).

Tree State 3.0 Community Pathways
3.1a: Time and lack of disturbance or fire, drought, inappropriate grazing management, or combinations of these allows for maturation of the pinyon/juniper community.

Transition T3A: Fire (to state 4.2.)
Restoration Pathway R3A: Removal of pinyon from site will allow mountain mahogany to again become the dominant overstory.

Annual State 4.0 Community Pathways
4.1a: Catastrophic fire.

State 1
Reference State

Community 1.1
Reference Community Phase 1.1

The plant community is dominated by curl-leaf mountain mahogany, mountain big sagebrush, and needlegrass. Potential vegetation composition is about 50% trees and tree-like shrubs, 20 percent shrubs, 25 percent grasses, and 5 percent forbs.

Dominant plant species

- curl-leaf mountain mahogany (*Cercocarpus ledifolius*), tree
- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- antelope bitterbrush (*Purshia tridentata*), shrub
- needlegrass (*Achnatherum*), grass
- Indian ricegrass (*Achnatherum hymenoides*), grass
- Nuttall's linanthus (*Leptosiphon nuttallii ssp. nuttallii*), other herbaceous
- lupine (*Lupinus*), other herbaceous
- thorn skeletonweed (*Pleiacanthus spinosus*), other herbaceous

Additional community tables

Inventory data references

NASIS data from Soil Survey Areas CA732 and CA802

Type locality

Location 1: Mono County, CA	
Township/Range/Section	T4S R30E S29
General legal description	NW1/4 Sec. 29, T4S, R30E

Contributors

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Approval

Kendra Moseley, 4/10/2024

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:**

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):**

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

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

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

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:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

14. **Average percent litter cover (%) and depth (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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:**

17. **Perennial plant reproductive capability:**