USDA Natural Resources Conservation Service

Ecological site F022AE008CA
Frigid Loamy Moraine Slopes

Accessed: 04/25/2024

General information

Approved. An approved ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model, enough information to identify the ecological site, and full documentation for all ecosystem states contained in the state and transition model.

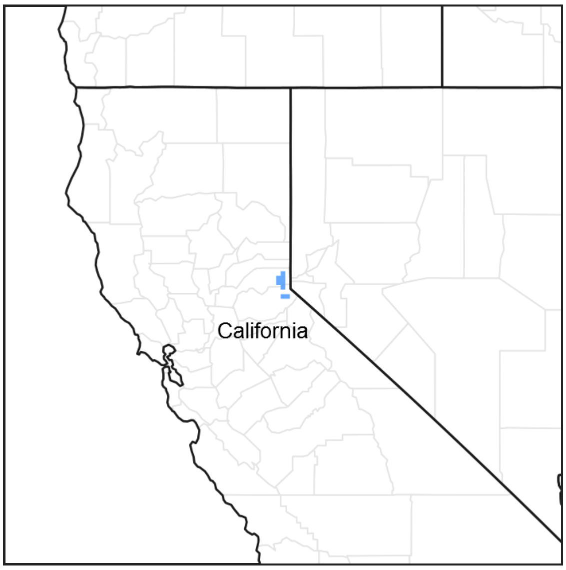

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 022A–Sierra Nevada and Tehachapi Mountains

Major Land Resource Area 22A, Sierra Nevada Mountains, is located predominantly in California and a small section of western Nevada. The area lies completely within the Sierra Nevada Section of the Cascade-Sierra Mountains Province. The Sierra Nevada range has s gentle western slope, and a very abrupt eastern slope. The Sierra Nevada consists of hilly to steep mountains and occasional flatter mountain valleys. Elevation ranges between 1,500 and 9,000 ft throughout most of the range, but peaks often exceed 12,000 ft. The highest point in the continental US occurs in this MLRA (Mount Whitney, 14,494 ft). Most of the Sierra Nevada is dominated by granitic rock of the Mesozoic age, known as the Sierra Nevada Batholith. The northern half is flanked on the west by a metamorphic belt, which consists of highly metamorphosed sedimentary and volcanic rocks. Additionally, glacial activity of the Pleistocene has played a major role in shaping Sierra Nevada features, including cirques, aretes, and glacial deposits and moraines. Average annual precipitation ranges from 20 to 80 inches in most of the area, with increases along elevational and south-north gradients. The soil temperature regime ranges from mesic, frigid, and cryic.

LRU "E" Northern Sierran Upper Montane: This LRU occurs at the mid elevations of the Sierra Nevada, from the Sonora Pass area to the higher mountains in the vicinity of Quincy. Elevations are typically between 5,500 feet to 8,500 feet, with the lower elevations typically on southern aspects, and the higher elevations on northern aspects. The frost-free season is 60 to 125 days, MAAT ranges from 40 to 50 F, and MAP ranges from 35 to 85 inches. The soil temperature regime is mostly frigid, with some cryic soil temperatures at the upper elevations and northern aspects. Soil moisture regimes are mostly xeric, but may be udic where snow persists through spring.

Classification relationships

Forested Communities of the Upper Montane in the Central and Southern Sierra Nevada (Potter, 1998) Red Fir- White Fir- Jeffrey Pine p. 185.

Forest Alliance = *Abies magnifica-Abies concolor* – Red fir - White fir forest; Association = tentatively Abies magnifica-*Abies concolor* [Sierra Nevada]. (Sawyer, John O., Keeler-Wolf, Todd, and Evens, Julie M. 2009. A Manual of California Vegetation. 2nd ed. California Native Plant Society Press. Sacramento, California.)

Ecological site concept

This site occurs on east-facing aspects on moderately sloping moraine slopes at elevations ranging from approximately 6,200 to 7,500 feet. Slopes are typically between 5 and 30 percent. Soils are very deep and developed from colluvium over till from volcanic parent materials. Vegetation is a California red fir (*Abies magnifica*) – white fir (*Abies concolor*) forest. Soils have high moisture holding capacity, and roundleaf snowberry (*Symphoricarpos rotundifolius*) and creeping snowberry (*Symphoricarpos mollis*) are dominant shrubs. Moist soils support a diverse forb community, with Fendler's meadow-rue (Thalactricum fendleri) a characteristic species.

Associated sites

F022AE013CA	**Frigid, Loamy, Volcanic Mountain Slopes** Occurs on adjacent slopes with loamy, moderately deep to deep andesitic soils. The vegetation is a white fir (Abies concolor) - mixed conifer forest.
R022AX107CA	**Frigid C Channel System** This riparian complex occurs along C-B type channels with gravelly to cobbly channel substrates and 2 - 3 percent slopes. The vegetation is characterized by willow (Salix ssp.) - aspen (Populus tremuloides) - cottonwood (Populus balsamifera) communities.

Similar sites

F022AC008CA	**Cryic Volcanic Mountain Slopes** This site occurs at higher elevations. The overstory is similar, but the understory is much less productive and less diverse. Pinemat manzanita (Arctostaphylos nevadensis) is the dominant understory species.
F022AC003CA	**Frigid-Cryic Sandy Slopes** This site occurs on higher elevation slopes with gravelly sandy soils over decomposed granite. Western white pine (Pinus monticola) co-dominates with California red fir (Abies magnifica), and pinemat manzanita (Arctostaphylos nevadensis) is the dominant understory species.
F022AC007CA	**North-Facing Cryic Loamy Mountain Slopes** This site occurs at higher elevations on moderately deep andic soils. Mountain hemlock (Tsuga mertensiana) co-dominates with red fir (Abies magnifica).
F022AE007CA	**Frigid, Sandy, Moraines And Hill Slopes** This site occurs on soils developed from granitic and mixed parent material, and soils have skeletal textures. Vegetation is white fir (Abies concolor) - Jeffrey pine (Pinus jeffreyi) forest.

Table 1. Dominant plant species

Tree	(1) *Abies magnifica* (2) *Abies concolor*
Shrub	(1) *Symphoricarpos rotundifolius* (2) *Symphoricarpos mollis*
Herbaceous	(1) *Thalictrum fendleri*

Physiographic features

This ecological site occurs on moraines at elevations ranging from 6,230 to 7,450 feet. Slopes may range from 5 to 60 percent, but are typically under 30 percent. It is found on all aspects, but is generally orientated on east facing aspects. Runoff class is low to medium.

Table 2. Representative physiographic features

Landforms	(1) Moraine
Flooding frequency	None
Ponding frequency	None
Elevation	6,230–7,450 ft
Slope	5–60%
Ponding depth	0 in
Water table depth	0 in

Climatic features

The average annual precipitation ranges from 31 to 63 inches, mostly in the form of snow in the winter months (November through April). The average annual air temperature ranges from 41 to 46 degrees Fahrenheit. The frost-free (>32F) season is 40 to 90 days and the freeze-free (>28F) season is 60 to 140 days.

Climate stations: (1) SO46, Fallen Leaf Lake Snotel. Period of record 1975-2003

Table 3. Representative climatic features

Frost-free period (average)	65 days
Freeze-free period (average)	100 days
Precipitation total (average)	47 in

Influencing water features

This ecological site is not influenced by wetland or riparian water features.

Soil features

The soils associated with this ecological site are very deep and formed in colluvium over till derived from volcanic rock. These soils are well drained with moderately rapid permeability. The soil moisture regime is xeric and the soil temperature regime is frigid. Surface rock fragments are generally absent. Surface textures are medial sandy loam. Partially decomposed organic matter overlies the mineral horizons (Oi horizon). Subsurface textures are medial cobbly sandy loam, cobbly sandy loam, and extremely stony coarse sandy loam.Subsurface rock fragments smaller than 3 inches in diameter average 5 percent by volume, and larger fragments average 8 percent (for a depth of 0 to 79 inches). The soils that are correlated to this ecological site are the Paige soils (Medial, mixed, frigid Humic Vitrixerands).

This ecological site has been correlated with the following mapunits and soil components in the Tahoe Basin soil survey area (CA693):

Musym ; MUname ; Compname ; Local_phase ; Comp_pct
7183 ; Paige medial sandy loam, 30 to 50 percent slopes ; Paige ; ; 84
7181 ; Paige medial sandy loam, 5 to 15 percent slopes ; Paige ; ; 80
7182 ; Paige medial sandy loam, 15 to 30 percent slopes ; Paige ; ; 80
7171 ; Kneeridge gravelly sandy loam, 2 to 9 percent slopes, extremely stony ; Paige ; ; 5
7172 ; Kneeridge gravelly sandy loam, well drained, 5 to 15 percent slopes, very stony ; Paige ; ; 5
7173 ; Kneeridge gravelly sandy loam, 2 to 5 percent slopes, very stony ; Paige ; ; 5

7174 ; Kneeridge gravelly sandy loam, 5 to 15 percent slopes, very stony ; Paige ; ; 5
7121 ; Ellispeak-Rock outcrop complex, 9 to 30 percent slopes ; Paige ; ; 2
7231 ; Waca very gravelly medial coarse sandy loam, 9 to 30 percent slopes ; Paige ; ; 2
7232 ; Waca very gravelly medial coarse sandy loam, 30 to 50 percent slopes ; Paige ; ; 2
7233 ; Waca very gravelly medial coarse sandy loam, 50 to 70 percent slopes ; Paige ; ; 2
7122 ; Ellispeak-Rock outcrop complex, 30 to 50 percent slopes ; Paige ; ; 1
7123 ; Ellispeak-Rock outcrop complex, 50 to 70 percent slopes ; Paige ; ; 1

Table 4. Representative soil features

Parent material	(1) Ablation till–volcanic breccia
Surface texture	(1) Medial sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately rapid
Soil depth	59–79 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	5.9–6.9 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	5.6–7
Subsurface fragment volume <=3" (Depth not specified)	5%
Subsurface fragment volume >3" (Depth not specified)	8%

Ecological dynamics

Abiotic factors
This site occurs on east-facing aspects on moderately sloping moraine slopes at elevations ranging from approximately 6,200 to 7,500 feet. Soils are very deep and developed from colluvium over till from volcanic parent materials. Vegetation is a California red fir (*Abies magnifica*) – white fir (*Abies concolor*) forest. Soils have high moisture holding capacity, and roundleaf snowberry (*Symphoricarpos rotundifolius*) and creeping snowberry (*Symphoricarpos mollis*) are dominant shrubs. Moist soils support a diverse forb community, with Fendler's meadow-rue (Thalactricum fendleri) a characteristic species.

Ecological/Disturbance factors
This ecological site is found along the west shore of Lake Tahoe at mid-elevations. It was almost entirely clear-cut during the 1870s to 1890s, during the period known as the Comstock Era (Murphy and Knopp 2000). It is found in the transition zone between the mixed conifer forest of the lower elevations, and the California red fir forest in the upper montane elevations. In this site, California red fir and white fir co-dominate, with scattered Jeffery pine (*Pinus jeffreyi*).

The reference phase was a mixed forest of large old-growth California red fir, white fir, and Jeffery pine. This phase may have had lower tree density in the understory, with a higher cover of grasses, forbs and shrubs. Due to stand replacing fires, patches of regenerating shrublands and young forest were also present. The reference plant community is dependent upon fire for regeneration and maintenance of the open forest structure. Without fire, this forest tends to increase in basal area density, which creates competition for light, water, and nutrients. This stresses the trees and makes them more vulnerable to disease and insect attacks. Some of these infestations are a natural process of thinning and maintaining the forest, while others can be very detrimental. Evidence of fire suppression is everywhere in this forest type. Even in the most open forests, young seedlings and saplings are filling in the understory and shading out understory vegetation. Some areas are further along than others in understory development, with several canopy layers dominated by California red fir and white fir. As the canopy cover increases, the shade intolerant Jeffry pine declines in composition. The pre-settlement phase is rare due to either fire suppression or clear-cutting. This ecological site was almost entirely clear-cut during the 1870s to 1890s during the period known as the Comstock Era (Elliot-Fisk et al. 1996, Murphy and Knopp 2000, Barbour et al. 2002, Taylor 2004), and forests that have developed since have higher density and basal area (Taylor 2004, Stephens and Fry 2005) A long-term policy of fire suppression has impacted these second-growth forests, as well as the few contemporary stands of old-growth forest (Barbour et al. 2002, Stephens and Fry 2005). Shade tolerant firs establish in the understory, increasing forest density and basal area. Understory trees provide ladder fuels, increasing the likelihood of large high severity fire.

Bekker and Tayler (2001) report a point median fire return interval for a California red fir-white fir forest in the southern Cascades of 24 years and a composite median of 9.5 years. Average time for a fire rotation was 50.4 years. Fire size was reported to average 373 acres with a range of 84 to 919 acres. Moderate to high severity fires were more common than surface fires. As elevation increases and red fir becomes more dominant, the fire return interval becomes longer and less severe. At lower elevations the fire return interval decreases. Other variables such as slope, aspect, location on landscape, moisture, and litter accumulation also affect the frequency and severity of fire.

California red fir, white fir, and Jeffrey pine are susceptible to several pathogens that can cause extensive stand mortality if they reach epidemic levels. Epidemic levels of disease and insect outbreaks can shift the state of the forest. They can kill patches of whole forest, or just scattered trees. These pathogens are part of they natural cycle of regulation and can push the closed forest types to a more open forest. However, fuel loads are high after outbreaks and fire may be more likely. Contemporary forests, with more crowded conditions and a higher frequency of drought (e.g. Jones et al. 2004) are more susceptible to pathogen induced mortality (Barbour et al. 2002).

California red fir and white fir are susceptible to several pathogens that can cause extensive stand mortality if they reach epidemic levels. Epidemic levels of disease and insect outbreaks can shift the state of the forest by killing large patches of forest or scattered individual trees. These pathogens are part of the natural cycle of regulation and can push the closed forest types to a more open forest. However, fuel loads are high after insect outbreaks, and fire may be more likely.

The reference state consists of the most successionally advanced community phase (numbered 1.1) as well as other community phases that result from natural and human disturbances. Community phase 1.1 is deemed the phase representative of the most successionally advanced pre-European plant/animal community including periodic natural surface fires that influenced its composition and production. Because this phase is determined from the oldest modern day remnant forests and/or historic literature, some speculation is necessarily involved in describing it.

All tabular data listed for a specific community phase within this ecological site description represent a summary of one or more field data collection plots taken in communities within the community phase. Although such data are valuable in understanding the phase (kinds and amounts of ground and surface materials, canopy characteristics, community phase overstory and understory species, production and composition, and growth), it typically does not represent the absolute range of characteristics nor an exhaustive listing of species for all the dynamic communities within each specific community phase.

State and transition model

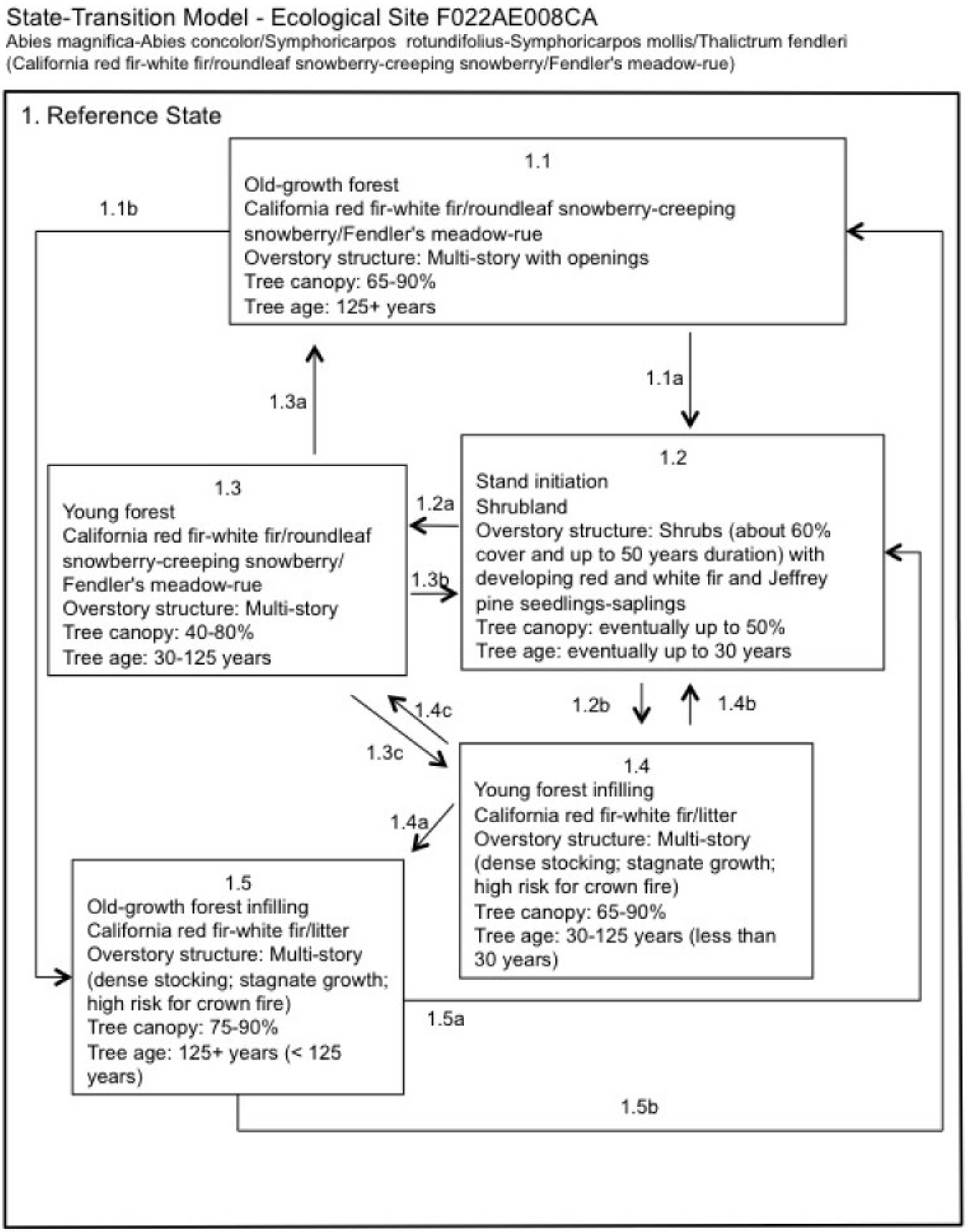

Figure 6. F022AE008CA

State 1
Reference

Community 1.1
Old-growth forest

This community phase represents the most successionally advanced community for this ecological site and is characterized by a multi-tiered forest composed of California red fir, white fir, and Jeffrey pine. Canopy cover may have been as high as 80 percent, but was from fewer, large mature trees rather than many tall, small-diameter trees that are present in most areas today (Beardsley et al., 1999).

Community 1.2
Stand initiation

This shrubland community phase thrives in the new openings created by large fires burning the forest canopy and killing the majority of the overstory trees. Species composition after a fire is highly dependent upon the stored seed bank, since in many areas, the understory has been shaded out by the time a moderate or severe intensity fire returns to this area. In rare cases, shrubs may not regenerate and a grass and forb community will dominate for a short period before the forest tree species regain dominance. Remnant overstory trees may be present in small numbers. Whitethorn ceanothus (*Ceanothus cordulatus*), greenleaf manzanita (*Arctostaphylos patula*), creeping snowberry, roundleaf snowberry and wax currant (*Ribes cereum*) may be common shrubs after a fire. They can resprout after a fire, but whitethorn ceanothus and greenleaf manzanita are the only shrubs that can withstand a severe fire. Creeping snowberry reproduces primarily from rhizomes, and can increase its cover after a fire (Snyder 1991). Young California red fir, white fir, and Jeffrey pine seedlings are scattered throughout the area, but need an opening in the shrubs to establish. The shrub community can be perpetuated by frequent fire or other disturbances such as grazing, human intervention, or heavy foot traffic. Once established, it may take more than 50 years for the trees to dominate over the shrub community (Sydney 1994, Azuma et al. 2004). The shrubs will eventually die in the shade of the tree canopy.

Community 1.3
Young forest

Figure 7. Community Phase 1.3

This forest community phase develops with the natural fire regime, or with manual thinning and prescribed fires. Low to moderate intensity fires clear the understory and remove fuels before they reach hazardous levels. Severe high-intensity canopy fires are also possible and would lead to stand initiation. The density of California red fir and white fir was historically maintained with re-occurring fires every 3 to 37 years that would burn at low to moderate intensity (Bekker and Tayler 2001). Red fir and white fir are shade tolerant and continue to regenerate under the multi-layered canopy. These young trees and seedlings have a high mortality rate even after low intensity fires which help maintain the open canopy. Jeffery pine is more fire resistant and shade intolerant so its presence in this forest type is dependent upon fire or other disturbances. Some reports suggest this forest type may also tend towards stand-replacing fires which would lead to even-aged stands with less diversity in the canopy structure.

Forest overstory. This forest community phase is dominated by a multi-layered forest of California red fir and white fir. The trees range from 90 to 120 years old. Canopy cover ranges from 40 to 80 percent, with an average of 70 percent cover. Jeffery pine and Sierra lodgepole pine (Pinus contorta var. murrayana) are common with low cover.

Forest understory. The understory cover and diversity increases as the canopy decreases. In canopy openings creeping snowberry, roundleaf snowberry, and whitethorn ceanothus, are common and abundant. Wax currant, Sierra currant (Ribes nevadense) and purpleflower honeysuckle (Lonicera conjugialis) are frequently present at lower abundances, and other less frequent shrub species are likely to be present. Combined shrub cover ranges from 15 to 45 percent. A diverse forb community is present, and cover ranges from 4 to 8 percent. Fendler's meadow-rue is a characteristic forb, and mountain monardella (Monardella odoratissima) and lettuce wirelettuce (Stephanomeria lactucina) may also be abundant. Grass cover is low, averaging 1 percent.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	200	300	400
Tree	0	10	40
Forb	4	6	8
Grass/Grasslike	0	0	2
Total	**204**	**316**	**450**

Table 6. Soil surface cover

Tree basal cover	2-5%
Shrub/vine/liana basal cover	1-2%
Grass/grasslike basal cover	0%
Forb basal cover	0.2-0.5%
Non-vascular plants	0%
Biological crusts	0%
Litter	70-95%
Surface fragments >0.25" and <=3"	0.0-0.5%
Surface fragments >3"	0.0-1.5%
Bedrock	0%
Water	0%
Bare ground	0.5-2.0%

Table 7. Woody ground cover

Downed wood, fine-small (<0.40" diameter; 1-hour fuels)	0-10%
Downed wood, fine-medium (0.40-0.99" diameter; 10-hour fuels)	0-15%

Downed wood, fine-large (1.00-2.99" diameter; 100-hour fuels)	0-15%
Downed wood, coarse-small (3.00-8.99" diameter; 1,000-hour fuels)	0-15%
Downed wood, coarse-large (>9.00" diameter; 10,000-hour fuels)	0-10%
Tree snags** (hard***)	–
Tree snags** (soft***)	–
Tree snag count** (hard***)	
Tree snag count** (hard***)	

*** Decomposition Classes: N - no or little integration with the soil surface; I - partial to nearly full integration with the soil surface.**

**** >10.16cm diameter at 1.3716m above ground and >1.8288m height--if less diameter OR height use applicable down wood type; for pinyon and juniper, use 0.3048m above ground.**

***** Hard - tree is dead with most or all of bark intact; Soft - most of bark has sloughed off.**

Table 8. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	0-1%	2-40%	0-1%	0-5%
>0.5 <= 1	0-1%	15-40%	0-2%	0-8%
>1 <= 2	0-2%	15-45%	0-2%	0-8%
>2 <= 4.5	0-2%	2-45%	–	0-5%
>4.5 <= 13	0-3%	0-5%	–	–
>13 <= 40	1-5%	–	–	–
>40 <= 80	15-65%	–	–	–
>80 <= 120	1-70%	–	–	–
>120	0-5%	–	–	–

Community 1.4
Young forest infilling

Figure 9. Community Phase 1.4

The young forest infilling phase develops in the prolonged absence of fire. This lack of fire allows dense stands of multi-layered, pole to medium-sized California red fir and white fir trees (typically 5 to 16 inch dbh) to develop. Jeffrey pine may be left from the time of stand initiation, but it will not be able to regenerate under the dense tree canopy. The understory vegetation is sparse due to the lack of sunlight, heavy litter, and woody debris accumulations. As this forest matures (> 16 inch dbh) the trees become tall, crowded, and physiologically stressed for water, nutrients, and sunlight. Crown depth of trees, particularly of lower stories, begins to diminish. Stress, combined with insect and disease infestation, creates a high level of tree mortality.

Forest overstory. California Red fir and white fir co-dominate in this forest with a dense canopy and multiple tree layers. Jeffrey pine is an occasional associate.

Forest understory. The understory is sparse to none under the dense canopy of white and red fir. White fir is common in the regeneration layer.

Community 1.5
Old-growth forest infilling

The mature closed red fir-white fir forest develops with the continued exclusion of fire, allowing the tree density to reach unhealthy levels. Competition for water and sunlight continue, and tree health and vigor declines. An estimated age for this community phase ranges from 125 to more than 200 years.

Forest overstory. Mature California red fir and white fir co-dominate this community phase with a few Jeffrey pines interspersed throughout the area. Total canopy cover ranges from 75 to 90 percent.

Forest understory. The understory cover is sparse due to the high tree canopy cover and deep litter accumulations on the forest floor.

Pathway 1.1a
Community 1.1 to 1.2

In the event of a severe canopy fire, or a clear-cut and prescribed burn, the old growth forest would transition to the stand initiation phase, 1.2.

Pathway 1.1b
Community 1.1 to 1.5

If fire is excluded from the old growth community phase, tree density will continue to increase, shifting this community phase towards the closed old-growth forest, community phase 1.5.

Pathway 1.2a
Community 1.2 to 1.3

The natural pathway is to community phase 1.3, the young open red fir-white fir forest. This pathway is followed with the natural fire regime of low to moderate severity fires occurring at intervals of approximately 25 years. Manual thinning with prescribed burns can emulate the natural cycle and lead to a similar more open community.

Pathway 1.2b
Community 1.2 to 1.4

An alternate pathway is created when natural fire is excluded from the system, and leads to the young closed red fir-white fir forest (community phase 1.4).

Pathway 1.3a
Community 1.3 to 1.1

This is the natural pathway for this community phase, which evolved with a historic fire regime of relatively frequent surface and moderate severity fires, or partial tree mortality from a pest outbreak. Manual thinning or prescribed burning can be implemented to replace the natural disturbances to keep this forest relatively open. This pathway leads to the community phase 1.1.

Pathway 1.3b
Community 1.3 to 1.2

In the event of a canopy fire this community phase would shift quickly to community phase 1.2.

Pathway 1.3c
Community 1.3 to 1.4

Young forest

Young forest infilling

If fire does not occur, then the density of the forest increases through crown growth and infill in lower canopies, shifting the forest to community phase 1.4.

Pathway 1.4b
Community 1.4 to 1.2

The density of ground and mid-canopy fuels create conditions for a high intensity canopy fire. A severe fire would initiate stand initiation (community phase 1.2).

Pathway 1.4c
Community 1.4 to 1.3

Young forest infilling

Young forest

A naturally occurring moderate or surface fire in this forest is unlikely due to high fuels. Considerable management effort would be needed to create the open forest conditions that should exist in this forest if it had developed with natural fire over time. Manual treatment to thin out fir and fuels in the understory, or prescribed burns could be implemented to shift this forest back to its natural state of an open red fir-white fir forest (community phase 1.3). A partial mortality disease or pest infestation could also create a shift towards community phase 1.3.

Pathway 1.4a
Community 1.4 to 1.5

If fire continues to be excluded from this system, the old-growth infilling forest community phase 1.5 develops.

Pathway 1.5b
Community 1.5 to 1.1

The event of a naturally occurring moderate or surface fire in this forest is unlikely due to the high fuels. Considerable management efforts would be needed to create the open forest conditions that should exist in this forest if it had developed with fire over time. Manual treatment to thin out the white and red fir and fuels in the understory or prescribed burns could be implemented to shift this forest back to its natural state of an open red fir-white fir forest (community phase 1.1). A partial mortality disease or pest infestation could also create a shift towards community phase 1.1.

Pathway 1.5a
Community 1.5 to 1.2

At this point, a severe fire is likely and would initiate stand initiation, community phase 1.2.

Additional community tables

Table 9. Community 1.2 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
white fir	ABCO	*Abies concolor*	Native	–	0–1	–	–
California red fir	ABMA	*Abies magnifica*	Native	–	0–1	–	–
Jeffrey pine	PIJE	*Pinus jeffreyi*	Native	–	0–1	–	–

Table 10. Community 1.2 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Shrub/Subshrub					
whitethorn ceanothus	CECO	*Ceanothus cordulatus*	Native	–	10–30
wax currant	RICE	*Ribes cereum*	Native	–	5–20
creeping snowberry	SYMO	*Symphoricarpos mollis*	Native	–	5–20
greenleaf manzanita	ARPA6	*Arctostaphylos patula*	Native	–	5–15
Tree					
white fir	ABCO	*Abies concolor*	Native	–	3–5
California red fir	ABMA	*Abies magnifica*	Native	–	1–2
Jeffrey pine	PIJE	*Pinus jeffreyi*	Native	–	0–2

Table 11. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Tree					
1	**Trees**			0–40	
	white fir	ABCO	*Abies concolor*	1–20	15–65
	Sierra lodgepole pine	PICOM	*Pinus contorta var. murrayana*	0–15	0–20
	California red fir	ABMA	*Abies magnifica*	1–10	10–35
	Jeffrey pine	PIJE	*Pinus jeffreyi*	0–5	5–10
Shrub/Vine					
2	**Shrubs**			200–400	
	roundleaf snowberry	SYRO	*Symphoricarpos rotundifolius*	100–300	5–10
	creeping snowberry	SYMO	*Symphoricarpos mollis*	10–140	2–40
	whitethorn ceanothus	CECO	*Ceanothus cordulatus*	1–25	1–8
	purpleflower honeysuckle	LOCO5	*Lonicera conjugialis*	1–15	1–2
	wax currant	RICEC2	*Ribes cereum var. cereum*	8–15	1–2
	Sierra currant	RINE	*Ribes nevadense*	0–5	0–1
Forb					
3	**Forbs**			4–8	
	lettuce wirelettuce	STLA	*Stephanomeria lactucina*	1–5	1–2
	Fendler's meadow-rue	THFE	*Thalictrum fendleri*	0–5	1–2
	mountain monardella	MOOD	*Monardella odoratissima*	0–5	0–1
	sweetcicely	OSBE	*Osmorhiza berteroi*	0–3	0–1
	pinewoods lousewort	PESE2	*Pedicularis semibarbata*	0–3	0–1
	whiteveined wintergreen	PYPI2	*Pyrola picta*	0–3	0–1
	snowplant	SASA5	*Sarcodes sanguinea*	0–3	0–1
	waxy checkerbloom	SIGL2	*Sidalcea glaucescens*	0–3	0–1
	wavyleaf Indian paintbrush	CAAP4	*Castilleja applegatei*	0–3	0–1
	little prince's pine	CHME	*Chimaphila menziesii*	0–3	0–1
	rose thistle	CIAN	*Cirsium andersonii*	0–3	0–1
	milk kelloggia	KEGA	*Kelloggia galioides*	0–3	0–1
	silvery lupine	LUAR3	*Lupinus argenteus*	0–3	0–1
Grass/Grasslike					
4	**Grasses and Grasslike**			0–2	
	squirreltail	ELEL5	*Elymus elymoides*	0–2	0–1

Table 12. Community 1.3 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
white fir	ABCO	*Abies concolor*	Native	–	15–65	–	–
California red fir	ABMA	*Abies magnifica*	Native	–	10–35	–	–
Sierra lodgepole pine	PICOM	*Pinus contorta var. murrayana*	Native	–	0–20	–	–
Jeffrey pine	PIJE	*Pinus jeffreyi*	Native	–	5–10	–	–

Table 13. Community 1.3 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
squirreltail	ELEL5	*Elymus elymoides*	Native	–	0–1
Forb/Herb					
lettuce wirelettuce	STLA	*Stephanomeria lactucina*	Native	–	1–2
Fendler's meadow-rue	THFE	*Thalictrum fendleri*	Native	–	1–2
mountain monardella	MOOD	*Monardella odoratissima*	Native	–	0–1
little prince's pine	CHME	*Chimaphila menziesii*	Native	–	0–1
wavyleaf Indian paintbrush	CAAP4	*Castilleja applegatei*	Native	–	0–1
whiteveined wintergreen	PYPI2	*Pyrola picta*	Native	–	0–1
snowplant	SASA5	*Sarcodes sanguinea*	Native	–	0–1
silvery lupine	LUAR3	*Lupinus argenteus*	Native	–	0–1
rose thistle	CIAN	*Cirsium andersonii*	Native	–	0–1
milk kelloggia	KEGA	*Kelloggia galioides*	Native	–	0–1
sweetcicely	OSBE	*Osmorhiza berteroi*	Native	–	0–1
pinewoods lousewort	PESE2	*Pedicularis semibarbata*	Native	–	0–1
waxy checkerbloom	SIGL2	*Sidalcea glaucescens*	Native	–	0–1
Shrub/Subshrub					
creeping snowberry	SYMO	*Symphoricarpos mollis*	Native	–	2–40
roundleaf snowberry	SYRO	*Symphoricarpos rotundifolius*	Native	–	5–10
whitethorn ceanothus	CECO	*Ceanothus cordulatus*	Native	–	1–8
purpleflower honeysuckle	LOCO5	*Lonicera conjugialis*	Native	–	1–2
wax currant	RICE	*Ribes cereum*	Native	–	1–2
Sierra currant	RINE	*Ribes nevadense*	Native	–	0–1
Tree					
white fir	ABCO	*Abies concolor*	Native	–	1–3
California red fir	ABMA	*Abies magnifica*	Native	–	1–2

Table 14. Community 1.4 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
white fir	ABCO	*Abies concolor*	Native	–	40–50	–	–
California red fir	ABMA	*Abies magnifica*	Native	–	18–35	–	–
Jeffrey pine	PIJE	*Pinus jeffreyi*	Native	–	2–4	–	–
Sierra lodgepole pine	PICOM	*Pinus contorta var. murrayana*	Native	–	0–1	–	–

Table 15. Community 1.4 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Forb/Herb					
milk kelloggia	KEGA	*Kelloggia galioides*	Native	–	0–1
lambstongue ragwort	SEIN2	*Senecio integerrimus*	Native	–	0–0.5
Shrub/Subshrub					
creeping snowberry	SYMO	*Symphoricarpos mollis*	Native	–	0–0.5
Tree					
white fir	ABCO	*Abies concolor*	Native	–	1–2
California red fir	ABMA	*Abies magnifica*	Native	–	1–2

Table 16. Community 1.5 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
white fir	ABCO	*Abies concolor*	Native	–	40–50	–	–
California red fir	ABMA	*Abies magnifica*	Native	–	35–38	–	–
Jeffrey pine	PIJE	*Pinus jeffreyi*	Native	–	0–2	–	–

Table 17. Community 1.5 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Tree					
white fir	ABCO	*Abies concolor*	Native	–	2–5
California red fir	ABMA	*Abies magnifica*	Native	–	1–3

Animal community

This forest provides food and shelter for squirrels, birds, deer and bear. The Jeffrey pine seeds are eaten by birds, and the roots and young stems are eaten by small mammals. The standing dead and down trees provides a habitat for nesting birds and shelter for cavity dwellers (Gucker 2007).

Hydrological functions

The hydrology of this site is characterized by heavy snowmelt in the spring with very little precipitation in the summer months.

Recreational uses

This ecological site has trails for walking, biking and cross-country skiing. It borders meadows and has views of Lake Tahoe.

Wood products

The wood of California red fir has a low specific gravity, is straight-grained, light and soft, but stronger than the wood of other firs. It is used for fuel, coarse lumber, quality veneer, solid framing, plywood, printing paper, and high-quality wrapping paper, and is preferred for pulping (Cope).

Historically, white fir was not a desirable timber species, but it is used more today. It is a general all-purpose, construction-grade wood used for framing, plywood, poles, pilings, and pulpwood. It requires large amounts of preservatives since the heartwood decays rapidly. It can be used as firewood, but it produces less heat than wood from other trees (Zouhar 2001).

Jeffrey pine trees are used as lumber and to create molding, mill work, cabinets, doors, windows, and other wood products (Gucker 2007).

Other products

Red fir is a desirable Christmas tree and the Jeffrey pine cones are suitable for arts and craft stores. A thin layer of pine needles could be a source of litter and duff for environmental restoration projects. Jeffrey pine pitch can be distilled for turpentine.

Other information

Forest Site Productivity:

Schumacher (1926), Schumacher (1928) and Meyer (1961) and were used to determine forest site productivity for white fir, red fir, and Jeffrey pine, respectively. (Red fir is of limited extent.) Low to High values of Site index and CMAI (culmination of mean annual increment) give an indication of the range of inherent productivity of this ecological site. Site index relates to height of dominant trees over a set period of time and CMAI relates to the average annual growth of wood fiber in the boles/trunks of trees. Site index and CMAI listed in the Forest Site Productivity section are in units of feet and cubic feet/acre/year, respectively. Both site index and CMAI are estimates; on-site investigation is recommended for specific forest management units for each soil classified to this ecological site. The historical and actual basal area of trees within a growing stand will greatly influence CMAI.

Conifer trees appropriate for site index measurement typically occur in community phases 1.3 and 1.4. They are selected according to guidance listed in the site index publications. Please refer to the Tahoe Basin Soil Survey for detailed site index information by soil component.

Forest Pathogen Information:
California red fir and white fir are susceptible to several pathogens that can cause extensive stand mortality if they reach epidemic levels. Epidemic levels of disease and insect outbreaks can shift the state of the forest. They can kill patches of whole forest, or just scattered trees. These pathogens are part of they natural cycle of regulation and can push the closed forest types to a more open forest. However, fuel loads are high after outbreaks and fire may be more likely.

In the Lake Tahoe Basin, many pathogens are found on white fir (*Abies concolor*). These include: dwarf mistletoe (Arceuthobium abietinum f. sp. concoloris), broom rust (Melamsporlla caryophyllacearum), annosus root disease (Heterobasidium annosum), trunk rot (Echinodontium tinctorium) and the fir engraver (Scotylus ventralis). The most threatening of these is the combination of the fir engraver and annosus root disease. These pathogens can kill large areas of white fir (Murphy and Knopp 2000).

The major pathogens that affect California red fir in this area include: red fir dwarf mistletoe (Arceuthobium abietinum f. sp. magnificae), fir broom rust (Melampsorella caryophyllacearum), annosus root rot (Heterobasidion annosum), and the fir engraver (Scolytus ventralis) (Murphy and Knopp 2000).
Other diseases also affecting red fir are known as heart rots, which cause the centers of limbs and trunks to decay. Commonly seen heart rots include: yellow cap fungus (Pholiota limonella) and Indian paint fungus (Echinodontium tinctorium). Common pests affecting red fir are: cone maggots (Earomyia spp.), several chalcids (Megastigmus spp.) and cone moths (Barbara spp. and Eucosma spp.) (Burns and Honkala 1990).

Red fir dwarf mistletoe (Arceuthobium abietinum f. sp. magnificae) is a parasitic plant common in the survey area. Visible symptoms include witches brooms, top kill, stem cancers, and swellings. The vegetative shoots of the dwarf mistletoe are also often present from spring to fall. Infestation of the red fir dwarf mistletoe can cause reduced growth and vigor, which weakens the tree and allows other pathogens to infest the tree. The mistletoe cankers create an entry point for other diseases such as heart rots and the cytospora canker (Cytospora abietis) (Burns and Honkala 1990).

Fir broom rust (Melampsorella caryophyllacearum) causes dense witches brooms with stunted yellow needles, and can damage tree growth by reducing crown development. Mortality is less common in mature trees than in the younger regeneration trees. The infected branch sheds its needles in fall leaving a barren dead looking branch. The alternate host for this rust is the chickweeds (Stellaria spp. and Cerastium spp.) (Hagle et al. 2003).

Annosus root rot (Heterobasidion annosum) can affect large acres of fir forest. It slowly decays the roots, the root collar and the stem butt for many years causing structural weaknesses and making the tree vulnerable to wind throw. Annosus root rot can spread from infected roots to healthy roots as well as aerially by infecting freshly cut stumps or other fresh tree wounds. Painting Borax on the freshly cut stumps restricts the entry of the fungus. In all management activities, it is important to reduce damage to the bark because the rot itself does not often kill red fir directly, but it weakens the tree and makes it easier for bark beetles (Scolytus spp), annosus root rot, or dwarf mistletoe to infect the tree (Burns and Honkala 1990).

The fir engraver (Scolytus ventralis) can cause extensive damage to a red fir forest and outbreaks can cause several acres of trees to die. It can reach epidemic levels when the trees are stressed due to annosus root rot, dwarf mistletoe, drought, or fire damage (Burns and Honkala 1990).

Infections from western dwarf mistletoe (Arceuthobium campylopodium) cause witches brooms, reduced growth, and tree mortality. Sticky seeds are spread in fall and infest nearby trees. In years of severe drought, dwarf mistletoe has induced a 60 to 80 percent mortality of the Jeffery pine (Burns and Honkala 1990).

Jeffrey pine bark beetles (Dedroctonus jeffreyi) are native beetles that can only reproduce in Jeffrey pine. They are part of the natural cycle and help maintain a healthy forest. They generally attack older trees that have been weakened by drought, lightning, fire, or other disturbance. However in times of severe drought or other disturbances, epidemic levels can break out and cause extensive damage to the forest. These beetles infest the lower stem and bole of the trees usually after pine engraver (Ips pini) infestation in the upper portion of the tree. The beetles slowly destroy the cambium, inhibiting the flow of nutrients. A sign of infestation is the change in color of the pine needles from green to yellow to reddish brown, beginning from the top and moving down the tree (Hagle et al. 2003)

Table 18. Representative site productivity

Common Name	Symbol	Site Index Low	Site Index High	CMAI Low	CMAI High	Age Of CMAI	Site Index Curve Code	Site Index Curve Basis	Citation
California red fir	*ABMA*	35	35	119	119	140	050	–	
white fir	*ABCO*	48	48	86	86	70	030	–	
Jeffrey pine	*PIJE*	84	84	75	75	40	600	–	

Inventory data references

The following NRCS TEUI plots provide data on this ecological site and plant community.

Tdd02- Site Location
Tdd02563
Tdd04053
Tdd04208

Type locality

Location 1: El Dorado County, CA	
Township/Range/Section	T15N R16E S15
UTM zone	N
UTM northing	4336948
UTM easting	742094
General legal description	Take Highway 89 to Timberland road in Ward Canyon. Turn Left on Charlemain, and turn into the Forest Service gate. The site is approximately 500 feet West of the dirt road.

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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	
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):**

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):

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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:

---

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:**
