Natural Resources
Conservation Service

Ecological site F022AC003CA
Frigid-Cryic Sandy Slopes

Accessed: 05/07/2024

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 a 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, arêtes, 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. Soil temperature regime ranges from mesic, frigid, and cryic. Due to the extreme elevational range found within this MLRA, Land Resource Units (LRUs) were designated to group the MLRA into similar land units.

LRU "C" Northern Sierra Subalpine: Elevations are typically between 7,800 and 9,800 feet. The frost free period is between 30 and 90 days, MAAT is between 35 and 44 degrees, MAP is between 45 and 65 inches. Soils are typically cryic, but frigid soils may occur at lower elevations on southern aspects. Forests are dominated by whitebark pine (Pinus albicaulis), Sierra lodgepole pine (*Pinus contorta* spp. murrayana), mountain hemlock (Tsuga mertensiana) and/or California red fir (Abies magnifica).

Classification relationships

Forest Alliance = Abies magnifica – California red fir forest; Association = tentatively Abies magnifica-Pinus monticola/Arctostaphylos nevadensis. (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 gentle to steep mountain slopes with moderately to very deep poorly developed gravelly coarse sandy soils over decomposed granite. It occurs at the lower elevations of the subalpine LRU, typically between 7600 and 9000 feet, where soils may have a cryic or frigid temperature regime. Slopes are typically between 15 and 50 percent. The vegetation is mixed upper montane forest, dominated by red fir (Abies magnifica) and western white pine (Pinus monticola). Pinemat manzanita (Arctostaphylos nevadensis) is common in the canopy openings in the understory. California red fir is a slow-growing, long-lived tree that has high frost tolerance and low drought tolerance, and reaches dominance only in cooler and moister upper elevation. Pinemat manzanita is indicative of cold, dry sites.

Associated sites

F022AC001CA	**Cryic Sandy Mountain Slopes** Occurs on adjacent higher elevation slopes at or near treeline with shallow to moderately deep, sandy skeletal soils over decomposed granite. Vegetation is a whitebark pine (Pinus albicaulis) forest with very little understory
F022AC002CA	**Cryic Sandy North Apsect Mountain Slopes** Occurs on north-facing slopes at or near treeline. Vegetation is a whitebark pine (Pinus albicaulis) - mountain hemlock (Tsuga mertensiana) forest with very little understory.
F022AC006CA	**Moderately Deep Cryic Sandy Till** Occurs on adjacent south-facing moderately deep, loamy-skeletal soils over dense till, primarily from volcanic parent material.Vegetation is an open lodgepole pine forest (Pinus contorta var. murrayana) with red fir (Abies magnifica) and western white pine (Pinus monticola).
F022AC007CA	**North-Facing Cryic Loamy Mountain Slopes** Occurs on adjacent north-facing slopes with moderately deep andic soils. Vegetation is subalpine mixed conifer forest with mountain hemlock (Tsuga mertensiana), red fir (Abies magnifica), western white pine (Pinus monticola), and occassionally lodgepole pine (Pinus contorta var. murrayana).
F022AE007CA	**Frigid, Sandy, Moraines And Hill Slopes** Occurs on adjacent moraines and moderately sloping hills with sandy soils derived from glacial outwash and till from mixed parent materials. Vegetation is a productive Jeffrey pine (Pinus jeffreyi) - white fir (Abies concolor) forest.
F022AF004CA	**Frigid, Shallow To Deep, Sandy Mountain Slopes** Occurs on lower elevation slopes with moderately to very deep sandy soils. Vegetation is open Jeffrey pine (Pinus jeffreyi) forest with high shrub cover.
F022AX100CA	**Frigid, Sandy, Moist, Outwash Fan** Occurs on adjacent very deep, poorly drained soils that formed in alluvium from glacial outwash fans. The vegetation is a Sierra lodgepole pine (Pinus contorta var. murrayana) forest with willows and forbs.
F022AX101CA	**Moist Colluvial Headwater System** Occurs on adjacent headwater swales and first order streams. A complex of vegetation community types is present, and quaking aspen (Populus tremuloides) is a characteristic species.

Similar sites

F022AC006CA	**Moderately Deep Cryic Sandy Till** This site is found on south-facing slopes with moderately deep loamy-skeletal soils over dense till, primarily from volcanic parent material. The dense till acts as a root restrictive layer that perches water for a short period.Sierra lodegepole pine (Pinus contorta var. murrayana) dominates and red fir (Abies magnifica) and western white pine (Pinus monticola) are secondary species.
F022AC007CA	**North-Facing Cryic Loamy Mountain Slopes** This is a moister site that occurs on north-facing slopes with moderately deep skeletal, andic soils. Mountain hemlock (Tsuga mertensiana) and Sierra lodgepole pine (Pinus contorta var. murrayana) are important canopy species with red fir (Abies magnfica) and western white pine (Pinus monticola).
F022AC004CA	**Cryic Very Gravelly Loamy Mountain Slopes** Site occurs on soils developed from metamorphic parent material that have loamy and silty clay loam subsurface textures, with argillic horizons. Jeffrey pine (Pinus jeffreyi) is co-dominant with red fir (Abies magnifica), and a dense shrub layer of roundleaf snowberry (Symphoricarpos rotundifolius) and wax currant (Ribes cereum) is present.
F022AC008CA	**Cryic Volcanic Mountain Slopes** This site is found on very deep soils derived from andesitic bedrock. Soils are more developed, and have argillic horizons. White fir (Abies concolor) is co-dominant with red fir (Abies magnifica), and shrub diversity and production is higher. Greenleaf manzanita (Arctostaphylos patula) and whitethorn ceanothus (Ceanothus cordulatus) are common shrub species.

Table 1. Dominant plant species

Tree	(1) *Abies magnifica* (2) *Pinus monticola*
Shrub	(1) *Arctostaphylos nevadensis*
Herbaceous	Not specified

Physiographic features

This ecological site is found on mountain and hill slopes, which may range from 5 to 70 percent but are typically between 15 and 50 percent. Elevations may ranges from 6,860 to 9,890 feet but are typically between 7600 and 9000 feet. Aspects are variable. Runoff class is low to high.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Hill
Flooding frequency	None
Ponding frequency	None
Elevation	2,091–3,014 m
Slope	5–70%

Climatic features

The average annual precipitation ranges from 29 to 61 inches, mostly in the form of snow in the winter months (November through April). The average annual air temperature ranges from 35 to 45 degrees Fahrenheit. The frost-free (>32F) season is 25 to 90 days, and the freeze-free (>28F) season is 50 to 90 days.

Maximum and minimum monthly climate data for this ESD were generated using PRISM data (PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu, created 4 Feb 2004.) and the ArcGIS ESD extract tool.

Table 3. Representative climatic features

Frost-free period (average)	58 days
Freeze-free period (average)	70 days
Precipitation total (average)	1,143 mm

Influencing water features

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

Soil features

The soils associated with this ecological site are moderately deep to very deep (shallow in the case of Temo), and formed in colluvium over residuum derived from granodiorite, colluvium derived from granodiorite, and colluvium derived from granodiorite over grus. They are somewhat excessively drained to excessively drained with moderate to rapid permeability. The soil moisture regime is typic xeric and the soil temperature regime is cryic or frigid. Surface rock fragments smaller than 3 inches in diameter range from 10 to 40 percent cover, and larger fragments range from 5 to 20 percent. Surface textures are gravelly, very gravelly, and very cobbly loamy coarse sand and gravelly coarse sand. Subsurface textures are loamy coarse sand or gravelly loamy coarse sand. Subsurface rock fragments smaller than 3 inches in diameter range from 3 to 15 percent by volume, and larger fragments range from 22 to 45 percent (for a depth of 59 inches). The soils correlated to this site include Dagget (Sandy-skeletal, mixed Typic Cryorthents), Cassenei moist (Mixed, frigid Dystric Xeropsamments), Temo (Mixed, shallow Typic Cryopsamments), Sofgran (Sandy-skeletal, mixed Typic Cryorthents), and Witefels (Mixed Typic Cryopsamments). Dagget soils are deep, Cassenei and Sofgran soils are very deep, and Witefels soils are moderately deep. Temo soils are shallow over weathered granodiorite.

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

Area_sym ; Musym ; MUname ; Compname ; Local_phase ; Comp_pct
7425 ; Cassenai cobbly loamy coarse sand, moist, 5 to 15 percent slopes, very bouldery ; Cassenai ; moist ; 80
7426 ; Cassenai cobbly loamy coarse sand, moist, 15 to 30 percent slopes, very bouldery ; Cassenai ; moist ; 80
7427 ; Cassenai cobbly loamy coarse sand, moist, 30 to 50 percent slopes, very bouldery ; Cassenai ; moist ; 80
7428 ; Cassenai cobbly loamy coarse sand, moist, 50 to 70 percent slopes, very bouldery ; Cassenai ; moist ; 80
9401 ; Dagget very gravelly loamy coarse sand, 15 to 30 percent slopes, extremely bouldery ; Dagget ; very gravelly loamy coarse sand ; 75; Temo ; ; 5; Witefels ; ; 4; Cassenai ; moist ; 2
9402 ; Dagget very gravelly loamy coarse sand, 30 to 50 percent slopes, extremely bouldery ; Dagget ; very gravelly loamy coarse sand ; 75; Temo ; ; 5; Witefels ; ; 4; Cassenai ; moist ; 2
9403 ; Dagget very gravelly loamy coarse sand, 50 to 70 percent slopes, extremely bouldery ; Dagget ; very gravelly loamy coarse sand ; 75; Temo ; ; 5; Witefels ; ; 4; Cassenai ; moist ; 2
9441 ; Temo-Witefels complex, 5 to 15 percent slopes ; Temo ; ; 45; Witefels ; ; 35; Dagget ; very gravelly loamy coarse sand ; 5
9442 ; Temo-Witefels complex, 15 to 30 percent slopes ; Temo ; ; 45; Witefels ; ; 35; Dagget ; very gravelly loamy coarse sand ; 5
9443 ; Temo-Witefels complex, 30 to 50 percent slopes ; Temo ; ; 45; Witefels ; ; 35; Dagget ; very gravelly loamy coarse sand ; 5
9444 ; Temo-Witefels complex, 50 to 70 percent slopes ; Temo ; ; 45; Witefels ; ; 35; Dagget ; very gravelly loamy coarse sand ; 5
9431 ; Sofgran-Klauspeak-Temo association, 15 to 50 percent slopes ; Sofgran ; ; 40; Temo ; ; 15
7511 ; Shalgran-Rock outcrop complex, 30 to 75 percent slopes ; Sofgran ; ; 6; Temo ; ; 2
9407 ; Dagget-Rock outcrop complex, moist, 30 to 70 percent slopes ; ; Temo ; ; 5; Witefels; ; 5; Cassenai ; moist ; 2
7411 ; Cagwin-Rock outcrop complex, 5 to 15 percent slopes, extremely stony ; Dagget ; very gravelly loamy coarse sand ; 5; Witefels ; ; 2; Temo ; ; 2
7412 ; Cagwin-Rock outcrop complex, 15 to 30 percent slopes, extremely stony ; Dagget ; very gravelly loamy coarse sand ; 5; Witefels ; ; 2; Temo ; ; 2
7413 ; Cagwin Rock outcrop complex, 30 to 50 percent slopes, extremely stony ; Dagget ; very gravelly loamy

coarse sand ; 5; Witefels ; ; 2; Temo ; ; 2
7414 ; Cagwin-Rock outcrop complex, 50 to 70 percent slopes, extremely stony ; Dagget ; very gravelly loamy coarse sand ; 5; Witefels ; ; 2; Temo ; ; 2
7422 ; Cassenai gravelly loamy coarse sand, 15 to 30 percent slopes, very stony ; Dagget ; very gravelly loamy coarse sand ; 5
7532 ; Toem-Rock outcrop complex, 30 to 50 percent slopes ; Dagget ; very gravelly loamy coarse sand ; 5
7501 ; Rock Outcrop-Rockbound complex, 5 to 30 percent slopes ; Temo ; ; 5; Witefels ; ; 5
7502 ; Rock Outcrop-Rockbound complex, 30 to 70 percent slopes ; Temo ; ; 5; Witefels ; ; 5
9404 ; Dagget very gravelly loamy coarse sand, moist, 5 to 15 percent slopes, rubbly ; Cassenai ; moist ; 5; Temo ; ; 2; Witefels ; ; 2
9405 ; Dagget very gravelly loamy coarse sand, moist, 15 to 30 percent slopes, rubbly ; Cassenai ; moist ; 5; Temo ; ; 2; Witefels ; ; 2
9406 ; Dagget very gravelly loamy coarse sand, moist, 30 to 70 percent slopes, rubbly ; Cassenai ; moist ; 5; Temo ; ; 2; Witefels ; ; 2
9151 ; Shakespeare silt loam, 9 to 30 percent slopes ; Dagget ; very gravelly loamy coarse sand ; 2; Witefels ; ; 1; Temo ; ; 1
9152 ; Shakespeare silt loam, 30 to 50 percent slopes, very stony ; Dagget ; very gravelly loamy coarse sand ; 2; Witefels ; ; 1; Temo ; ; 1

Table 4. Representative soil features

Parent material	(1) Colluvium–granodiorite
Surface texture	(1) Cobbly loamy coarse sand (2) Coarse sand (3) Very gravelly loamy coarse sand
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained to excessively drained
Permeability class	Moderate to rapid
Soil depth	51 cm
Surface fragment cover <=3"	5–30%
Surface fragment cover >3"	2–15%
Available water capacity (0-101.6cm)	1.02–10.67 cm
Soil reaction (1:1 water) (0-101.6cm)	4.5–7
Subsurface fragment volume <=3" (Depth not specified)	3–15%
Subsurface fragment volume >3" (Depth not specified)	22–45%

Ecological dynamics

This ecological site occurs on gentle to steep mountain slopes with moderately to very deep poorly developed gravelly coarse sandy soils over decomposed granite. It occurs at the lower elevations of the subalpine LRU, at elevations of 6,800 to 9,900 feet, where soils may have a cryic or frigid temperature regime. The vegetation is mixed upper montane forest, dominated by red fir and western white pine. Pinemat manzanita is common in the canopy openings in the understory. California red fir is a slow-growing, long-lived tree that has high frost tolerance and low drought tolerance, and reaches dominance only in cooler and moister upper elevation. Pinemat manzanita is indicative of cold, dry sites.

Ecological Factors:
Fire, wind throw, or tree die off from disease that create openings in the forest for both California red fir and western

white pine tree regeneration are necessary for the development and maintenance of the reference phase of this site (Griffith 1992, Cope 1993). These forests develop patchy mosaics of multi-aged forests, from continuous small-scale patch disturbances. Large overstory California red fir may have clumps of regeneration in the understory, with large open areas of shrubs in between. Western white pine is less shade tolerant, and does best in the canopy overstory and open sunny locations, establishing after fire or other disturbance. Sierra lodgepole pine (*Pinus contorta* var. murrayan) establishes after fire in some areas. Sierra lodgepole pine is shade intolerant, and does not regenerate well in the forest understory. It has a shorter lifespan than California red fir and western white pine, and will decline in cover as the stand ages in the absence of disturbance.

Historically, this ecological site developed with mean fire return interval of 10 to 76 years with a range 10–175 years (Bancroft 1979, Taylor and Halpern 1991, Scholl and Taylor 2006). Fires were typically small and of low intensity due to low fuels and open canopies, but moderate severity fires also occurred causing canopy mortality and stand regeneration. Mature red fir and western white pine can survive moderate or low intensity fires, but both are killed by high intensity fires (Cope 1993). Both tree species are easily killed by fire when young. The bark of western white pine can be damaged by fire, which can prompt an infestation of pathogens that may eventually kill the tree. Lower elevations of California red fir historically had shorter fire return intervals than higher elevations. Increased understory growth of California red fir in lower elevation plots indicates higher production of ladder fuels, and an increased potential to produce denser forest phases in the absence of fire. Lightning strikes are a common source of ignition, but seldom do the fires burn more than an acre (Kilgore 1978). Decades of fire suppression have reduced the frequency of fire in these forests, causing an increase stand density, but not beyond historic variability (Meyer 2013). In the absence of fire, a denser community phase develops from continuous regeneration of California red fir in the understory. Without fire or other canopy disturbance, Sierra lodgepole pine and western white pine decline over time. Understory canopy becomes less diverse as pinemat manzanita and other shrubs decline in the shady understory..

The primary pathogen that affects California red fir is red fir dwarf mistletoe (*Arceuthobium abietinum* f. sp. magnificae). Infestation of red fir dwarf mistletoe can cause reduced growth and vigor, which weakens the tree and allows other pathogens to infest it. The mistletoe cankers create an entry point for other diseases such as heart rots and the cytospora canker (Cytospora abietis) (Burns and Honkala 1990). When trees are under stress from drought conditions, red fir dwarf mistletoe infections can become more severe, and there is concern that a warmer drier climate may increase the infection rate of red fir dwarf mistletoe (Meyer 2013).

White pine blister rust (Cronartium ribicola) is a serious threat to western white pine. White pine blister rust is a non-native disease that was introduced from Europe and Asia in the 1920s. White pine blister rust often kills younger trees, and causes branch die-back and reduced cone production on older trees. It can severely inhibit regeneration in infested areas by greatly reducing the western white pine population. In this ecological site where western white pine is already present at low abundances, white pine blister rust could eliminate western white pine. These pathogens may also have played a role in diminishing the importance of pines relative to fir species in contemporary forests (Beardsley et al. 1999).

The reference state consists of the most successionally advanced community phase (numbered 1.1) as well as other community phases, which 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

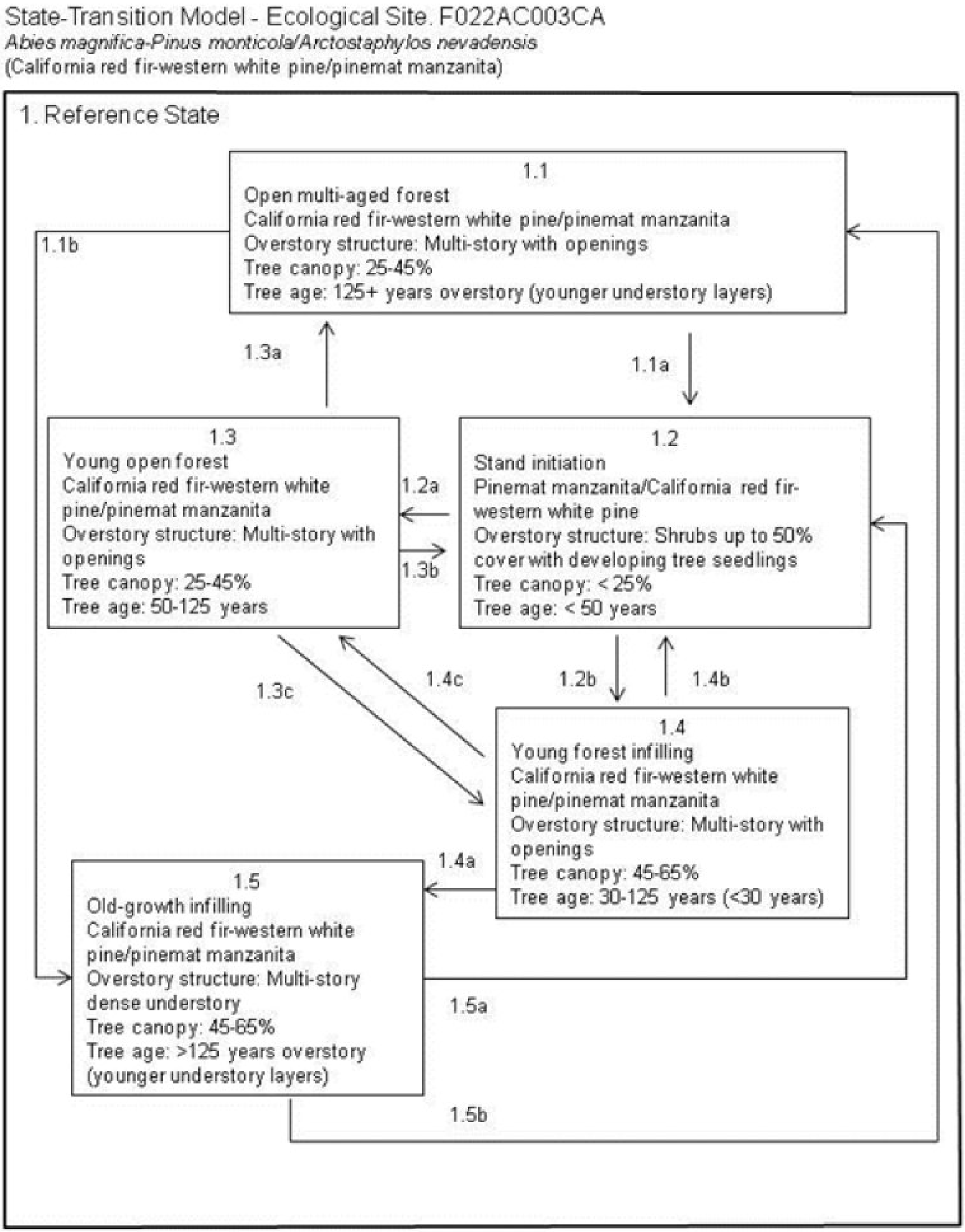

Figure 6. F022C003CA STM

State 1
Reference

Community 1.1
Open Multi-Aged Forest

Figure 7. Red Fir Western White Pine Forest

The most successionally advanced community phase is a mature California red fir - western white pine forest. The canopy is open with pinemat manzanita being the most common understory shrub. The oldest trees are typically over 100 feet tall with diameters over 30 inches. The age of the dominant trees may range from 250 to 500 years old (Potter 1998). This community is still present in many areas because it is located at upper elevations in remote areas that weren't heavily logged during the Comstock era (from the mid-1870s to the mid-1890s). Small lightning initiated fires, with patchy mortality of overstory trees and light understory burns help keep this forest open.

Forest overstory. Total canopy cover averages 35 percent, with a range from 25 to 45 percent. California red fir has a higher proportion of canopy cover than western white pine. White fir (Abies concolor) and Jeffrey pine (Pinus jeffreyi) are minor components in lower elevation forests, and whitebark pine (Pinus albicaulis) and mountain hemlock (Tsuga mertensiana) are minor components in higher elevation forests.

Forest understory. Cover of Pinemat manzanita ranges from 35 to 60 percent. Other shrubs include greenleaf manzanita (Artostaphylos patula), snowbrush ceanothus (Ceanothus velutinus), bush chinquapin (Chysolepis sempervirons), roundleaf snowberry (Symphoricarpos rotundifolius), and wax currant (Ribes cereum). Cover of forbs is low, and pioneer rockcress (Arabis platysperma), sanddune wallflower (Erysimum capitatum var. perenne), slender penstemon (Penstemon gracilentus), spreading phlox (Phlox diffusa), and mountain monardella (Monardella odoratissima) are common species. Conifer regeneration is patchy, with 2 to 15 percent cover of California red fir and western white pine (white fir and Jeffrey pine at lower elevations).

Community 1.2
Stand Initiation

This community phase develops after a moderate to severe canopy fire. California red fir and western white pine germinate and establish readily after fire. Sierra lodgepole pine may become established and temporarily dominant post fire. Data is lacking for this phase, but diversity is likely to increase as forbs and grasses fill increase in response to increased light and nutrient availability, and as shrubs resprout or regenerate from seed.

Forest overstory. Remnant California red fir and western white pine may be present.

Forest understory. Pinemat manzanita is killed by fire and does not re-sprout from the root crown, but will re-establish from seed. It colonizes disturbed sites and continues to grow well under an open canopy with sufficient sunlight (Howard 1993). Greenleaf manzanita and snowbrush ceanothus vigorously resprout from underground lignotubers, and regenerate from fire dependent, heat scarified seeds that may survive in the soil for more many years (Anderson 2001, Nagal and Taylor 2005, Hauser 2007). Snowbrush ceanothus is short lived (25 years) but greenleaf manzanita can survive much longer. Bush chinquapin resprouts after fire, but seeds do not require heat scarification. Bush chinquapin is a long-lived shrub that can persist 300 years or more in the absence of disturbance (Howard 1992). Forb cover may increase, as seeds germinate on the exposed soil and open canopy. Forbs may include pioneer rockcress, sanddune wallflower, slender penstemon, spreading phlox, and mountain monardella, but a high diversity of other forbs may establish as well.

Community 1.3
Young Open Forest

This community develops with time and a natural fire regime. This is a young, open red fir and western white pine forest. It is open and patchy due to past and recent fire mortality patterns. There may be some relic older trees, with a younger canopy and open patches from recent small fires. Canopy cover ranges from 25 to 45 percent. The open canopy allows for dense shrub cover of pinemat manzanita.

Forest overstory. The canopy cover ranges from 25 to 45 percent, with an average of 35 percent cover.

Forest understory. Pinemat manzanita is the dominant shrub with an average of 20 percent cover.

Community 1.4
Young Forest Infilling

This community phase develops with the absence of fire. California red fir seedlings develop and persist in the understory, increasing forest density and creating ladder fuels.

Community 1.5
Old Growth Infilling

Figure 8. Old Growth infilling

This community phase develops in the absence of fire or other disturbances. Red fir regeneration in the understory, and persistence into mid canopy layers increases forest density and canopy cover. Canopy fire is more likely during this phase due to abundant ladder fuels and increased woody fuel on the ground layer. Pinemat manzanita does poorly in the shade, and gradually declines in the understory.

Forest overstory. California red fir dominates the overstory with 20 to 40 percent cover, and tree heights of 80 to 100 feet. Western white pine has 1 to 20 percent cover in the overstory. Tree understory is dominated by California red fir with 5 to 15 percent cover. Whitebark pine is a trace species at higher elevations, and white fir and Jeffrey pine are trace species at lower elevations. Sierra lodgepole pine is present in some areas with low cover in the overstory.

Forest understory. The forest understory is relatively sparce, with 0 to 20 percent cover of pinemat manzanita. All other species have trace cover.

Pathway 1.1a
Community 1.1 to 1.2

This pathway develops with moderate to severe fire, which initiates stand regeneration.

Pathway 1.1b
Community 1.1 to 1.5

Open Multi-Aged Forest

Old Growth Infilling

This pathway develops with a prolonged absence of fire.

Pathway 1.2a
Community 1.2 to 1.3

This pathway develops with time, growth and a natural fire regime that keeps the forest open with a diverse age distribution.

Pathway 1.2b
Community 1.2 to 1.4

This pathway develops with time, growth and the absence of fire.

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 moderately frequent surface fires or partial tree mortality from a pest outbreak. Manual thinning or prescribed burning can be implemented to replace the natural disturbances that keep this forest open. This pathway leads to community phase 1.1.

Pathway 1.3c
Community 1.3 to 1.4

This pathway develops with time and the absence of fire.

Pathway 1.4b
Community 1.4 to 1.3

This pathway develops with a low intensity fire, which causes mortality in younger trees and patches of overstory trees, creating a more open and multi-aged canopy.

Pathway 1.4a
Community 1.4 to 1.5

This pathway develops with time and growth in the absence of fire.

Pathway 1.5a
Community 1.5 to 1.1

Old Growth Infilling

Open Multi-Aged Forest

This pathway develops in the event of a low severity fire, which causes high mortality in the understory, and low mortality of the overstory, opening up the forest structure.

Additional community tables

Table 5. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)	Diameter (Cm)	Basal Area (Square M/Hectare)
Tree							
California red fir	ABMA	*Abies magnifica*	Native	10.7–27.4	3–20	–	–
western white pine	PIMO3	*Pinus monticola*	Native	15.2–29	1–18	–	–
California red fir	ABMA	*Abies magnifica*	Native	1.5–16.8	1–8	–	–
western white pine	PIMO3	*Pinus monticola*	Native	6.1–18.3	2–8	–	–
white fir	ABCO	*Abies concolor*	Native	1.5–19.8	0–3	–	–
Jeffrey pine	PIJE	*Pinus jeffreyi*	Native	13.7–27.4	0–2	–	–
whitebark pine	PIAL	*Pinus albicaulis*	Native	1.5–13.7	0–1	–	–
Sierra lodgepole pine	PICOM	*Pinus contorta var. murrayana*	Native	13.7–24.4	0–1	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Forb/Herb					
pioneer rockcress	ARPL	*Arabis platysperma*	Native	–	0–2
spreading phlox	PHDI3	*Phlox diffusa*	Native	–	0–1
sanddune wallflower	ERCAP	*Erysimum capitatum var. perenne*	Native	–	0–1
slender penstemon	PEGR4	*Penstemon gracilentus*	Native	–	0–0.1
Shrub/Subshrub					
pinemat manzanita	ARNE	*Arctostaphylos nevadensis*	Native	–	35–65
greenleaf manzanita	ARPA6	*Arctostaphylos patula*	Native	–	0–10
snowbrush ceanothus	CEVE	*Ceanothus velutinus*	Native	–	0–10
bush chinquapin	CHSE11	*Chrysolepis sempervirens*	Native	–	0–3
roundleaf snowberry	SYRO	*Symphoricarpos rotundifolius*	Native	–	0–2
mountain monardella	MOOD	*Monardella odoratissima*	Native	–	0–2
Tree					
California red fir	ABMA	*Abies magnifica*	Native	–	0–5
western white pine	PIMO3	*Pinus monticola*	Native	–	0–2
Jeffrey pine	PIJE	*Pinus jeffreyi*	Native	–	0–0.1
white fir	ABCO	*Abies concolor*	Native	–	0–0.1

Table 7. Community 1.5 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)	Diameter (Cm)	Basal Area (Square M/Hectare)
Tree							
California red fir	ABMA	*Abies magnifica*	Native	6.1–24.4	20–40	–	–
western white pine	PIMO3	*Pinus monticola*	Native	15.2–27.4	10–25	–	–
California red fir	ABMA	*Abies magnifica*	Native	1.5–16.8	5–15	–	–
western white pine	PIMO3	*Pinus monticola*	Native	4.6–16.8	0–1	–	–
whitebark pine	PIAL	*Pinus albicaulis*	Native	0.6–13.7	0–1	–	–

Table 8. Community 1.5 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Forb/Herb					
pioneer rockcress	ARPL	*Arabis platysperma*	Native	–	0–1
spreading groundsmoke	GADI2	*Gayophytum diffusum*	Native	–	0–1
mountain monardella	MOOD	*Monardella odoratissima*	Native	–	0–1
Shrub/Subshrub					
pinemat manzanita	ARNE	*Arctostaphylos nevadensis*	Native	–	0–20
Tree					
California red fir	ABMA	*Abies magnifica*	Native	–	1–3
white fir	ABCO	*Abies concolor*	Native	–	0–2
western white pine	PIMO3	*Pinus monticola*	Native	–	0–2
whitebark pine	PIAL	*Pinus albicaulis*	Native	–	0–1

Animal community

Red fir and western white pine forests provide critical habitats for rodents, birds, mammals and insects. Some of the animals that use this forest include the martin, fisher, mountain beaver, wolverine, black bear, squirrels, chickadee, pileated woodpecker, great gray owl, Williamson's sapsucker, and pocket gopher (Cope 1993). Squirrels eat and cache the seeds of red fir and western white pine, and western white pine is an important food for deer mice. Deer graze on the young tree shoots of both trees, but prefer red fir (Cope 1993, Griffith 1992).

Recreational uses

This area is used for hiking and biking trails, as well as backcountry skiing in winter. If the slope is appropriate it can provide scenic campsites.

Wood products

The wood of California red fir is of high quality and is stronger than other firs. The wood is used for fuel, coarse lumber, quality veneer, solid framing, plywood, printing paper, and high-quality wrapping paper, and is preferred for pulping (Cope 1993).

Western white pine can produce valuable timber and it is often used for finish work. It is used to build doors, paneling, dimension stock, matches, and toothpicks. The wood is also excellent for carving (Griffith 1992).

Other products

Red fir is used as Christmas trees and western white pine cones are collected for wreaths and other arts and crafts.

Native Americans chewed the resin of western white pine, wove baskets from the bark, made a poultice for dressing wounds from the pitch, and collected the cambium in the spring for food (Griffith 1992).

Pinemat manzanita can be used in restoration projects as a ground cover since it will grow on shallow sandy soils. Plants can be started from stem cuttings. It was shown in a study in Lake Tahoe that container plants survived better when planted in spring instead of fall (Howard 1993).

Other information

Site index documentation:

Schumacher (1928), Dunning (1942) and Alexander (1966) were used to determine forest site productivity for red fir, western white pine and lodgepole pine, respectively. 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.(CMAI values are not available for western white pine, so zeros were used to indicate the lack of data.) 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.

Trees appropriate for site index measurement typically occur in stands of community phase 1.3. Site trees are selected according to guidance in the cited publications. Please refer to the Tahoe Basin Area Soil Survey for detailed site index information by soil component.

Table 9. 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*	25	30	90	104	140	050	–	
Sierra lodgepole pine	*PICOM*	60	60	49	49	100	520	–	
western white pine	*PIMO3*	90	95	0	0	0	605	–	

Inventory data references

The following NRCS plots describe this community.

1.1
GSF04223- Type location
RTF04h126
RTG03h101
RX03026
TRF03h102

1.5
GSF02h60
MTE02h40
RTF02h17a
UME04040

Type locality

Location 1: Douglas County, NV	
UTM zone	N
UTM northing	4323678
UTM easting	249697
General legal description	The site location is south of Spooner Summit Peak north of Genoa Peak.

Other references

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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):**

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:**
