USDA Natural Resources Conservation Service

Ecological site F022BI119CA
Low Precip Frigid Sandy Moraine Slopes

Accessed: 11/06/2024

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.

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): 022B–Southern Cascade Mountains

Site concept:
Landform: Moraine
Elevation (feet): 5980-7600
Slope (percent): 20-65
Water Table Depth (inches): n/a
Flooding-Frequency: None
Ponding-Frequency: None
Aspect: West, Northwest, Southwest
Mean annual precipitation (inches): 25.0-45.0
Primary precipitation: Winter months in the form of snow
Mean annual temperature: 42 to 44 degrees F (5.5 to 6.6 degrees C)
Restrictive Layer: Densic layer
Temperature Regime: Frigid
Moisture Regime:Xeric
Parent materials: Deposited tephra (350 years old) over till from volcanic rocks
Surface Texture: Ashy Sand
Surface Fragments <=3" (% Cover): 0-5
Surface Fragments > 3" (% Cover): 0-3

Soil Depth (inches): 40-60
Vegetation: White fir (*Abies concolor*) prevails over Jeffrey pine (*Pinus jeffreyi*). Fire exclusion has permitted white fir to become dense in the understory. Understory cover is sparse, consisting of rabbitbrush (*Ericameria bloomeri*), slender penstemon (*Penstemon gracilentus*), little prince's pine (*Chimaphila menziesii*), whitevein shinleaf (*Pyrola picta*), lettuce wirelettuce (*Stephanomeria lactucina*), and bush chinquapin (*Chrysolepis sempervirens*).
Notes: This ecological site is found on moraines on the eastern side of Butte Lake.

Classification relationships

Forest Alliance = *Pinus jeffreyi* - Jeffrey Pine forest; Association = (no matching species). (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.)

Associated sites

F022BI107CA	**Frigid Moderately Deep Slopes** This red fir-white fir-Jeffrey pine forest is found above this site.
R022BI200CA	**Talus Slope** This is a rangeland site with scattered Jeffrey pine found on rocky slopes.

Similar sites

F022BI100CA	**Low Precip Frigid Sandy Tephra Gentle Slopes** This Jeffrey pine forest is on lower foot slopes and valley bottoms.
F022BI110CA	**Frigid Humic Loamy Gentle Slopes** This is a white fir-mixed conifer forest found at lower elevations on the south-eastern portion of the park.
F022BI103CA	**Frigid Tephra Over Slopes And Flats** This white fir-Jeffrey pine forest has the potential to develop a dense shrub community after fire.

Table 1. Dominant plant species

Tree	(1) *Abies concolor* (2) *Pinus jeffreyi*
Shrub	Not specified
Herbaceous	(1) *Chimaphila menziesii*

Physiographic features

This ecological site is found on moraines on the eastern side of Butte Lake at elevations between 5,980 and 7,600 feet. Slopes range from 20 to 65 percent.

Table 2. Representative physiographic features

Landforms	(1) Moraine
Flooding frequency	None
Ponding frequency	None
Elevation	5,980–7,600 ft
Slope	20–65%
Aspect	SW, W, NW

Climatic features

This ecological site receives most of its annual precipitation in the winter months in the form of snow. The mean annual precipitation ranges from 25 to 45 inches (635 to 1,143 mm) and the mean annual temperature is between

42 to 44 degrees F (5.5 to 6.6 degrees C). The frost free (>32 degrees F) season is 60 to 85 days. The freeze free (>28 degrees F) season is 75 to 190 days.

There are no representative climate stations for this site.

Table 3. Representative climatic features

Frost-free period (average)	85 days
Freeze-free period (average)	190 days
Precipitation total (average)	45 in

Influencing water features

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

Soil features

This ecological site is associated with the Buttelake soil series on 20 to 65 percent slopes. The Buttelake soils are deep and well-drained and formed in deposited tephra over till from volcanic rocks. The tephra deposits are from the eruption of Cinder Cone, about 350 years ago. The surface texture is ashy sand, with coarse sand textures in the lower horizons. Dense material is at a depth of 40 to 60 inches.

This site is in the driest region of the park and has very droughty soils due to the coarse tephra deposits. The tephra may not have killed all the existing trees at the time of the eruption, but it left the surface sterile, black, and coarse textured. The thickness, texture and chemistry of the ash deposits affect the survival and regeneration of the pre-existing vegetation. Ash layers greater than 15 centimeters are considered thick burials. A thick burial isolates the old soil from oxygen, effectively sterilizing it. Younger trees were probably killed by the Cinder Cone ash deposits, while older trees were most likely injured by the weight of the ash on their branches (http://volcanoes.usgs.gov/ash/agric/index.html#intro).

This ecological site is associated with the following soil components within the Lassen Volcanic National Park Soil Survey Area (CA789):

Map Unit Component, Component %
107 Buttelake, 3
120 Buttelake,65

Table 4. Representative soil features

Surface texture	(1) Ashy sand
Family particle size	(1) Sandy
Drainage class	Well drained
Permeability class	Very slow
Soil depth	40–60 in
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0–3%
Available water capacity (0-40in)	0.77–6.57 in
Soil reaction (1:1 water) (0-40in)	5.9–7.5
Subsurface fragment volume <=3" (Depth not specified)	1–55%

Subsurface fragment volume >3" (Depth not specified)	0–55%

Ecological dynamics

This site is similar to F022BI100CA, which has a Jeffery pine forest associated with the Buttelake and Buttewash soils. This site correlates with steeper slopes and less solar radiation however, allowing white fir (*Abies concolor*) to prevail over Jeffrey pine (*Pinus jeffreyi*). Fire exclusion has permitted white fir to become dense in the understory. Understory cover is sparse, consisting of rabbitbrush (*Ericameria bloomeri*), slender penstemon (*Penstemon gracilentus*), little prince's pine (*Chimaphila menziesii*), whitevein shinleaf (*Pyrola picta*), lettuce wirelettuce (*Stephanomeria lactucina*), and bush chinquapin (*Chrysolepis sempervirens*). Total canopy cover ranges from 60 to 80 percent.

Jeffrey pine is a relatively large and long-lived tree. It can attain heights of 200 feet and live for 400 to 500 years or more. It produces 3 to 8 inch needles in bundles of three. The female seed cones range in length from 4.7 to 12 inches. Jeffrey pine produces a deep taproot and extensive lateral roots (Gucker, 2007) that are intolerant of wet conditions. Jeffrey pine looks similar to ponderosa pine but has a vanilla-like odor in the bark, which is not as yellow as the ponderosa pine. Jeffrey pine is shade intolerant and can be replaced over time by white fir if fire is excluded from the system. Mature Jeffrey pines are somewhat adapted to fire because their thick bark offers protection from moderate intensity flames. Additionally, the branches of Jeffrey pine tend to thin out along the lower portion of the tree trunk, leaving the crown 65 to 100 feet above the forest floor.

White fir is also a large and long-lived tree. In this area it can commonly attain heights of 120 to 140 feet and live for 300 to 400 years. It produces single needles from 1.2 to 2.8 inches long that are distributed along the young branches. The female cones open and fall apart while still attached to the tree, so cones are not often seen on the forest floor. White fir tends to develop a shallow root system that can graft to other white fir roots and spread root rots (Zouhar, 2001).

This ecological site is affected by tephra deposits from the eruption of Cider Cone. The tephra may have killed many trees and injured others. Understory species may have been killed as well, and their seed source buried, which could be a factor leading to the barren understory that is present today.

Historically, this community phase developed with frequent low to moderate intensity fires. Fire regime studies of tree rings and fire scars report historic median fire return intervals in the Jeffrey pine-white fir forest of 14.0, 18.8, and 70.0 years (Bekker and Taylor; Skinner and Chang; Taylor and Solem, respectively). Beaty and Taylor report that fire frequency and intensity is also associated with slope position, aspect, and climatic fluctuations. Fire return intervals are longer on north facing slopes than on south facing slopes, and fire intensity increases from lower slope to upper slope positions. Their study also indicates a slightly later burn season in the Southern Cascades than in the Sierra Nevada. Fire scars in the Southern Cascades are primarily found at the annual tree ring boundary, indicating that the trees were dormant at the time of the fire, whereas in the Sierra Nevada fires scars are often in the late-season wood. This timing shift may be due to summer drought conditions, which begin earlier in the south. In July and August thunderstorms are common in Lassen Volcanic National Park and summer drought conditions begin, initiating the fire season. Large fires and multiple small fires in the same season are associated with dry and very dry years (Beaty and Taylor, 2001). Moderate and low intensity fires seem to have kept this forest open by removing the less fire tolerant white fir seedlings and saplings from the understory. Beaty and Taylor report that stand replacing fires are more common on the upper slopes while low to moderate intensity fires occur only along the lower slopes. This is probably due to the tendency of fires to burn upslope, preheating the fuels as they go (Beaty and Taylor, 2001). After a stand replacing fire, a more evenly aged forest is formed. With the current management practices of fire suppression, there has been a shift in forest density and composition. Fire suppression has created a change in species composition by allowing the fire intolerant and shade tolerant firs to increase in cover and density, eventually out-competing the fire tolerant-shade intolerant pines (Taylor and Solem, 2001).

Tree pathogens and insect infestations can have significant impacts on the composition and structure of mid and upper montane coniferous forests. Small infestations may affect just a few trees but large outbreaks can kill the dominant trees over large areas of forest, creating large canopy openings and stand regeneration. Most of these pathogens represent a natural cycle of regulation and can push the closed forest types to a more open forest. Fuel loads are often high after outbreaks, creating ideal conditions for high intensity fires.

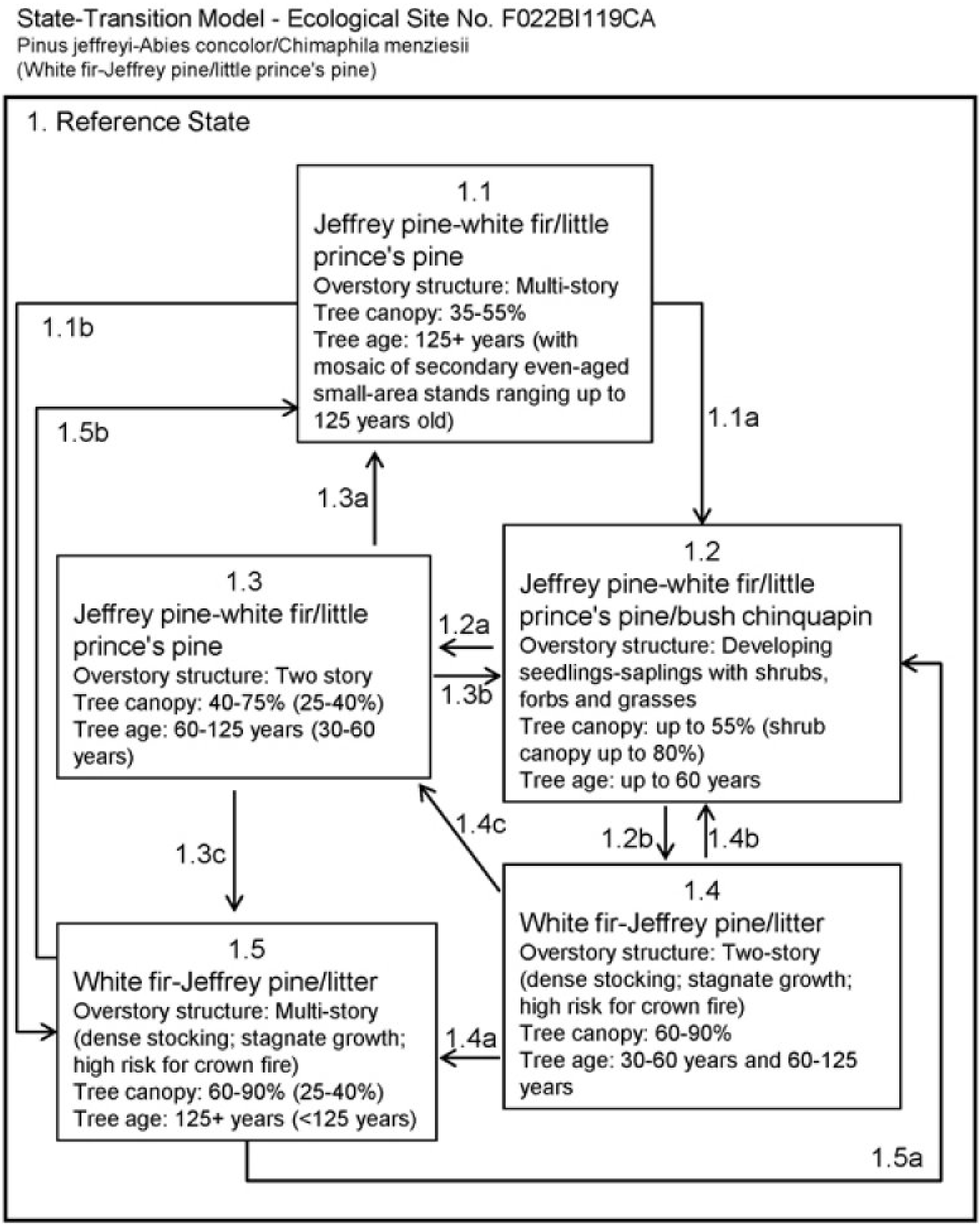
Jeffrey pine is susceptible to several diseases and insect infestations, especially in periods of drought or when overcrowded. Pathogens that affect Jeffrey pine in this area are dwarf mistletoe (Arceuthobium campylopodium), root disease (Phaeoleus schweinitzii), needle cast (Elytroderma deformans), Jeffrey pine bark beetle (Dendroctonus jeffreyi), red turpentine beetle (D. valens), and pine engravers (Ips species). The most threatening of these are the dwarf mistletoe and the Jeffrey pine bark beetle (Bohne, 2006; Jenkinson, 1990).

Pathogens that affect white fir are dwarf mistletoe (*Arceuthobium abietinum* f. sp. concoloris), Cytospora canker (Cytospora abietis), broom rust (Melampsporella 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 (Bohne, 2006; Laacke, 1990).

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



State 1
Reference

Community 1.1
Jeffrey pine-white fir/little princes pine

This is the reference community phase for this ecological site, but data was not collected from a representative site. This phase develops 150 to 300 years after a major disturbance event such as fire. The trees are large with wide reaching canopies. White fir and Jeffrey pine co-dominate. This forest develops with frequent low intensity fires or occasional small high severity fires that either remove understory trees or create small openings in the forest for gap regeneration. This community phase needs continual disturbance from low intensity fires to maintain the open understory and reduce competition between the trees for water, nutrients, and sunlight. It is difficult to find a representative site for this community phase because most of the area has missed several fire rotations, resulting in a large amount of cover of white fir in the understory.

Community 1.2
Jeffrey pine-white fir/little princes pine/bush chinquapin

This community phase develops when the majority of the overstory trees succumb to a high intensity canopy fire. A few overstory trees may survive, becoming important seed sources for regeneration. Mature Jeffrey pine, with thicker bark and higher tree branches than white fir, are more likely to survive a fire and supply seed for regeneration. White fir prefers partial shade for regeneration. Because Jeffrey pine seedlings germinate well in full sun and mineral soils after fire, it has the advantage during early phases of regeneration which assures their existence and sometimes prevalence in older stands. Bush chinquapin (Chrysolepis sempervirons) is the only documented shrub in this area, and it can resprout from the roots, root crown and stump after being top-killed by fire.

Community 1.3
Jeffrey pine-white fir/little princes pine

This forest community phase develops with a 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, although severe high-intensity canopy fires are possible. If Jeffrey pine establishes during stand initiation it will maintain a fair percentage of cover in the upper canopy. Jeffrey pine is shade intolerant and has difficulty regenerating and growing well in the understory canopy. Its growth and presence is dependent upon fire or other disturbances to maintain an open forest structure with canopy openings.

Community 1.4
White fir-Jeffrey pine/litter

This community phase is defined by a dense canopy and high basal area dominated by white fir. Jeffrey pine is slowly being replaced by shade tolerant white fir. Canopy cover ranges from 65 to 85 percent. The trees are overcrowded and stressed due disease or competition for water and nutrients. This stress makes the trees more susceptible to death from disease and drought. Fire hazard is high in this community phase, a result of the deep accumulation of litter, standing dead and down trees, and the dense multi-layered structure of the forest.

Community 1.5
White fir-Jeffrey pine/litter

The mature closed white fir-Jeffrey pine forest develops with the continued exclusion of fire, allowing tree density to increase to unhealthy levels. Competition for water and sunlight continues, and tree health and vigor decreases. Jeffrey pine is less and less prevalent because it does not reproduce well under the dense forest canopy. An estimated age for this community phase is from around 125 to 200+ years.

Forest overstory. This forest has a mixed canopy of Jeffrey pine and white fir. Data collected at this site indicates an overstory canopy dominated by older and taller Jeffrey pine. The larger Jeffrey pines are over 150 years old. There are several understory canopy layers dominated by white fir. One major canopy layer of white fir is between 60 to 70 feet tall, with 70 to 90 year old trees. Total canopy cover ranges from 60 to 90 percent.

Forest understory. The understory is sparse due to the high canopy cover from the dense forest. Common forbs are little prince's pine (Chimaphila menziesii), rabbitbush (Ericameria bloomeri), slender penstemon (Penstemon gracilentus), whitevein shinleaf (Pyrola picta), and lettuce wirelettuce (Stephanomeria lactucina). Scattered individual bush chinquapins (Chrysolepis sempervirens) are present in small canopy openings.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	0	21	52
Tree	7	17	31
Forb	0	1	6
Total	**7**	**39**	**89**

Pathway 1.1a
Community 1.1 to 1.2

The primary threat to a Jeffrey pine-white fir forest is a severe canopy fire. In the event of a severe canopy fire this community phase would return to the regeneration community phase (Community Phase 1.2).

Pathway 1.1b
Community 1.1 to 1.5

If fire is excluded from the old growth community phase, tree density continues to increase and shifts the community toward the closed white fir-Jeffrey pine community phase (Community Phase 1.5).

Pathway 1.2a
Community 1.2 to 1.3

The natural pathway is to Community Phase 1.3, a Jeffrey pine-white fir forest. This pathway is followed with a natural fire regime. Manual thinning with prescribed burns can imitate the natural cycle and lead to a similar community phase.

Pathway 1.2b
Community 1.2 to 1.4

An alternate pathway is created when fire is excluded from the system and leads to the dense white fir-Jeffrey pine 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, and/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 the reference community phase(Community Phase 1.1).

Pathway 1.3b
Community 1.3 to 1.2

In the event of a canopy fire this community phase would return to Community Phase 1.2, forest regeneration.

Pathway 1.3c
Community 1.3 to 1.5

If fire does not occur, forest density increases. This will favor white fir over Jeffrey pine. The increased density shifts this community phase toward the closed white fir community phase (Community Phase 1.5).

Pathway 1.4b
Community 1.4 to 1.2

At this point the density of ground fuels and ladder fuels formed in the mid-canopy create conditions for a high intensity canopy fire. A severe fire would initiate forest regeneration (Community Phase 1.2).

Pathway 1.4c
Community 1.4 to 1.3

The natural event of a moderate or surface fire in this forest is unlikely due to the high accumulation of fuels. Considerable management efforts would be needed to create the open forest conditions that should exist in this forest had it developed with fire over time. Manual treatments to thin the white fir and other fuels in the understory, and/or prescribed burns, could be implemented to shift this forest back to its natural state of an open Jeffrey pine-white fir forest (Community Phase 1.3). A partial mortality disease or pest infestation could also create a shift toward Community Phase 1.3.

Pathway 1.4a
Community 1.4 to 1.5

If fire continues to be excluded from this system the mature closed white fir–Jeffrey pine forest community phase develops (Community Phase 1.5).

Pathway 1.5b
Community 1.5 to 1.1

The natural event of a moderate or surface fire in this forest is unlikely due to the high accumulation of fuels. Considerable management efforts would be needed to create the open forest conditions that should exist in this forest had it developed with fire over time. Manual treatments to thin the understory trees and other fuels, and/or prescribed burns, could be implemented to shift this forest back to its natural state of an open white fir-mixed conifer community (Community Phase 1.1). A partial mortality disease or pest infestation could also create a shift toward 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 regeneration (Community Phase 1.2).

Additional community tables

Table 6. Community 1.5 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Tree					
0	**Tree (understory only)**			7–31	
	white fir	ABCO	*Abies concolor*	5–25	1–5
	Jeffrey pine	PIJE	*Pinus jeffreyi*	2–6	1–3
Shrub/Vine					
0	**Shrub**			0–52	
	bush chinquapin	CHSE11	*Chrysolepis sempervirens*	0–45	0–4
	rabbitbush	ERBL2	*Ericameria bloomeri*	0–5	0–1
	whiteveined wintergreen	PYPI2	*Pyrola picta*	0–1	0–1
	little prince's pine	CHME	*Chimaphila menziesii*	0–1	0–1
Forb					
0	**Forb**			0–6	
	lettuce wirelettuce	STLA	*Stephanomeria lactucina*	0–3	0–2
	slender penstemon	PEGR4	*Penstemon gracilentus*	0–3	0–1

Table 7. Community 1.5 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
Jeffrey pine	PIJE	*Pinus jeffreyi*	Native	–	40–50	–	–
white fir	ABCO	*Abies concolor*	Native	–	20–40	–	–

Table 8. Community 1.5 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Forb/Herb					
lettuce wirelettuce	STLA	*Stephanomeria lactucina*	Native	–	0–2
slender penstemon	PEGR4	*Penstemon gracilentus*	Native	–	0–1
Shrub/Subshrub					
bush chinquapin	CHSE11	*Chrysolepis sempervirens*	Native	–	0–4
rabbitbush	ERBL2	*Ericameria bloomeri*	Native	–	0–1
little prince's pine	CHME	*Chimaphila menziesii*	Native	–	0–1
whiteveined wintergreen	PYPI2	*Pyrola picta*	Native	–	0–1
Tree					
white fir	ABCO	*Abies concolor*	Native	–	1–5
Jeffrey pine	PIJE	*Pinus jeffreyi*	Native	–	1–3

Animal community

White fir-Jeffrey pine forests provide browse, cover and nesting sites for a variety of wildlife species. The type and quality of the wildlife habitat varies with the community type. The mature open forests, closed dense white fir forests, young forests, and shrub lands provide different opportunities for habitat and forage. Deer and bear can heavily browse young fir shoots. Porcupines eat the bark of white fir and can kill saplings. Rodents feed on white fir cambial tissue; young white fir seedlings and seeds are eaten by animals as well. Douglas squirrels cut and cache white fir cones before the cones are fully mature.

There are about 33 species of mammals commonly present in the white fir forest type in California and, of these, 7 are generally associated with mature forests. About 123 species of birds are found in the white fir forest type of

California and southern Oregon, about 50 of which are associated primarily with mature forests. Many of these birds use mature white fir trees and snags for foraging, roosting, nesting and/or breeding. Included are bald eagle, California spotted owl, brown creeper, pileated woodpecker, white-headed woodpecker and, when near lakes or streams, osprey. Reptiles in white fir forests are represented by 17 species, mostly at lower elevations, 8 of which are associated with mature forests (Zouhar, 2001).

Recreational uses

These areas are suitable for hiking trails.

Wood products

White fir wood is used for framing, plywood and, sometimes, pulpwood. The heartwood of white fir decays rapidly if not properly preserved. White fir wood has a low specific gravity and heat production, hence it provides poor firewood compared to other conifers (Zouhar, 2001).

Jeffrey pine wood is used for lumber. No commercial distinction is made between ponderosa pine and Jeffrey pine lumber (Gucker, 2007).

Other products

Jeffrey pine seeds are edible. Jeffrey pine sap was used by Native Americans to treat pulmonary disorders and, later, heptane was distilled from the sap and sold to treat pulmonary problems and tuberculosis. Jeffrey pine heptane was also used to develop the octane scale used to rate petroleum used in automobiles (Gucker, 2007).

Other information

Additional information on the common white fir pathogens:

White fir dwarf mistletoe (*Arceuthobium abietinum* f. sp. concoloris) is a parasitic plant common in the survey area as evident by witches brooms, top kill, stem cankers and swellings. The vegetative shoots of the dwarf mistletoe are often present from spring to fall. A fungus (Cytospora abietis) kills the branches that are infected with dwarf mistletoe. The reduced vigor makes the tree more susceptible to bark beetle and other diseases. The mistletoe cankers crack the bark, creating entry points for other diseases such as heart rots (Burns and Honkala, 1990).

Fir broom rust (Melampsorella caryophyllacearum) is a disease that causes dense witches brooms with stunted yellow needles. The infected branch sheds its needles in fall, leaving it barren and dead looking. The alternate host for this rust is the chickweeds (Stellaria spp. and Cerastium spp.). This disease can damage tree growth by reducing crown development. Mortality is less common in mature trees than in younger regeneration trees. Secondary infection is possible from heart rots entering through openings in the infected areas (Burns and Honkala, 1990).

Annosus root rot (Heterobasidion annosum) can affect large acres of fir forest. It spreads from infected roots to healthy roots. 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 also be spread aerially, 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. The rot itself does not often kill red fir directly, but it weakens the tree and makes it easier for bark beetles (Scolytus spp.) to infest the tree (Burns and Honkala, 1990).

The fir engraver beetle (Scolytus ventralis) can cause extensive damage to white fir forests. Outbreaks can cause mortality to several acres of trees. It can reach epidemic levels when the trees are stressed due to drought, annosus root rot, dwarf mistletoe, or from fire damage.

Additional information on Jeffrey pine pathogens:

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

Jeffrey pine bark beetles (Dendroctonus jeffreyi) are native beetles that can only reproduce in Jeffrey pine. They are a natural cycle in maintaining forest health. They generally attack older weaker trees, but in times of drought or other disturbances such as lightning or fire, 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 a 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 changing color of the pine needles from green to yellow or reddish brown, beginning from the top down (Hagle et al., 2003; Smith, 1971).

SITE INDEX DOCUMENTATION:

Schumacher (1926) and Meyer (1961) were used to determine forest site productivity for white fir and Jeffrey 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. 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.

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
white fir	*ABCO*	45	45	77	77	70	030	–	
white fir	*ABCO*	45	45	77	77	–	–	100TA	Meyer, Walter H. 1961. Yield of even-aged stands of ponderosa pine. USDA Technical Bulletin 630. (1938 version revised in 1961).
Jeffrey pine	*PIJE*	66	66	51	51	–	–	100TA	Meyer, Walter H. 1961. Yield of even-aged stands of ponderosa pine. USDA Technical Bulletin 630. (1938 version revised in 1961).
Jeffrey pine	*PIJE*	66	66	51	51	52	600	–	

Inventory data references

The following NRCS vegetation plot was used to describe this ecological site:

789108- type location

Type locality

Location 1: Lassen County, CA	
Township/Range/Section	T31 N R6 E S11
UTM zone	N
UTM northing	4491575
UTM easting	645813
General legal description	The type location is about 0.5 miles north-north east of Sunrise Peak, in Lassen Volcanic National Park.

Other references

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Bohne, Michael (eds.) (2006). California Forest Pest Conditions – 2006. Forest Health Protection, USDA Forest Service, Pacific Southwest Region in cooperation with other member organizations. California Forest Pest Council.

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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:

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:**