USDA Natural Resources Conservation Service

Ecological site F022BI114CA
Frigid Very Deep Cinder Cone Or Shield Volcano Slopes

Accessed: 05/11/2025

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: (1) Cinder cone, (2) Shield volcano
Elevation (feet): 6,040-8,200
Slope (percent): 8-60
Water Table Depth (inches): n/a
Flooding-Frequency: None
Ponding-Frequency: None
Aspect: South, East, West
Mean annual precipitation (inches): 27.0-83.0
Primary precipitation: Winter months in the form of snow
Mean annual temperature: 41 to 44 degrees F (5 to 6.6 degrees C)
Restrictive Layer: None
Temperature Regime: Frigid
Moisture Regime: Xeric
Parent Materials: Tephra over residuum from basalt and/or basaltic andesite; ash over colluvium and residuum from volcanic rocks
Surface Texture: (1) Ashy Fine sand, (2)Very gravelly ashy loamy sand
Surface Fragments <=3" (% Cover): 0-20

Surface Fragments > 3" (% Cover): 5-35
Soil Depth (inches): >60
Vegetation: Open California red fir (*Abies magnifica*) and western white pine (*Pinus monticola*) forest with pinemat manzanita (*Arctostaphylos nevadensis*) in the understory and a high cover of rubble across the landscape.
Notes: This ecological site is found on cinder cones and on shield volcanoes with a high cover of volcanic rubble exposed on the surface.

Classification relationships

Forest Alliance = *Abies magnifica* – Red fir forest; Associations = *Abies magnifica-Pinus monticola/Arctostaphylos nevadensis* and *Abies magnifica-Pinus monticola/Chrysolepis sempervirens*. (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

F022BI109CA	**Frigid Deep Coarse Sandy Cinder Cone Or Shield Volcano Slopes** This is a red fir-Jeffrey pine forest found on nearby slopes with less rubble.

Similar sites

F022BI115CA	**Frigid And Cryic Gravelly Slopes** This is an open California red fir-western white pine forest with pinemat manzanita.
F022BI102CA	**Frigid Bouldery Glacially Scoured Ridges Or Headlands** This is an open California red fir forest on glacially scoured areas.

Table 1. Dominant plant species

Tree	(1) *Abies magnifica* (2) *Pinus monticola*
Shrub	(1) *Arctostaphylos nevadensis* (2) *Chrysolepis sempervirens*
Herbaceous	(1) *Angelica breweri*

Physiographic features

This ecological site is found on cinder cones and on shield volcanoes with a high cover of volcanic rubble exposed on the surface. This site is found between 6,040 and 8,200 feet in elevation. Slopes range from 8 to 60 percent.

Table 2. Representative physiographic features

Landforms	(1) Cinder cone (2) Shield volcano
Flooding frequency	None
Ponding frequency	None
Elevation	6,040–8,200 ft
Slope	8–60%
Aspect	E, S, W

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 between 27 to 83 inches (686 mm to 2,108 mm) and the mean annual temperature ranges between 41 to 44 degrees F (5 to 6.6 degrees C). The frost free (>32 degrees F) season is 50 to 90 days. The freeze free (>28 degrees F) season is 60 to 200 days.

There are no representative climate stations for this site.

Table 3. Representative climatic features

Frost-free period (average)	90 days
Freeze-free period (average)	200 days
Precipitation total (average)	83 in

Influencing water features

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

Soil features

This site is associated with the Bearrubble and Vitrandic Xerorthents soil components. These soils are very deep and somewhat excessively drained or well drained. The Bearrubble soils formed in tephra over residuum from basalt and/or basaltic andesite. They have a 0 to 3 inch O horizon consisting of pine needles and twigs over tephra deposits. The tephra deposits have developed a thin A horizon between 3 and 6 inches, and have an ashy fine sand texture with very few rock fragments. The lower portion of the tephra deposits from 6 to 13 inches is designated as a C horizon, with an extremely cobbly loamy coarse sand texture. This horizon is probably a combination of tephra mixed with colluvium and residuum. Below 13 inches there are several 2Bwb horizons with extremely cobbly ashy sandy loam, extremely stony medial sandy loam, or very stony medial fine sandy loam textures. The Bearrubble soils are Medial-skeletal, amorphic, frigid Typic Vitrixerands. The Bearrubble soils have very low (0.0 inches/ 60 inches of soil) to moderate (6.92 inches/60 inches soil) available water capacity (AWC).

Vitrandic Xerorthents formed in ash over colluvium and residuum from volcanic rocks. These soils have a very gravelly ashy loamy sand texture in the A horizon from 1 to 5 inches. There are three Bw horizons from 5 to 34 inches with extremely or very stony medial sandy loam textures. A 3C1 horizon with a gravel texture is present from 34 to 46 inches, and a 3C2 horizon with stone texture is present below 46 inches. Neither of these soils have a restrictive layer or bedrock contact within the upper 60 inches of soil. The Vitrandic Xerorthents have very low (0.18 to 2.33 inches/ 60 inches of soil) AWC. The AWC is determined by soil texture and rock fragments.

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

Map Unit Component, Component %
102 Vitrandic Xerorthents, 25
109 Bearrubble, 10
110 Bearrubble, 50
120 Bearrubble, 3

Table 4. Representative soil features

Family particle size	(1) Sandy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	60 in
Surface fragment cover <=3"	0–20%
Surface fragment cover >3"	5–35%
Available water capacity (0-40in)	0–6.92 in

Soil reaction (1:1 water) (0-40in)	6.1–7.5
Subsurface fragment volume <=3" (Depth not specified)	2–90%
Subsurface fragment volume >3" (Depth not specified)	0–45%

Ecological dynamics

This ecological site is characterized by an open California red fir (*Abies magnifica*) and western white pine (*Pinus monticola*) forest with pinemat manzanita (*Arctostaphylos nevadensis*) in the understory and a high cover of rubble across the landscape. The tree canopy remains relatively open with a range from 15 to 40 percent. Other plants include Brewer's angelica (*Angelica breweri*), bush chinquapin (*Chrysolepis sempervirens*), white hawkweed (*Hieracium albiflorum*), oceanspray (*Holodiscus discolor*), mountain monardella (*Monardella odoratissima*), and wax currant (*Ribes cereum*).

The canopy cover in this forest site is often under 25 percent, with wide open patches of un-vegetated rubble land between forest patches. This site could pass for a rangeland site, but the trees produce pockets of denser canopy and forest structures in areas where finer textured soils have developed from ash and tephra deposits or from colluvial soil accumulation. This site is situated on southern to western exposures on upper cinder cones and shield volcanoes, which have high solar radiation. The snow pack melts early in the season on these aspects, and soil water is lost to evaporation and to evapotranspiration. Even though the soils are very deep, they have coarse textures and a high percentage of rock fragments that allow water to drain quickly. In addition, the volcanic rubble land surrounding the forest pockets probably drains rather than holds water in the area.

California red fir (*Abies magnifica*) is generally dominant in this ecological site. California red fir is a tall, long lived conifer with short branches and a narrow crown. It produces single 0.8 to 1.4 inch long needles that are distributed along the young branches. Firs produce upright cones that open and fall apart while still attached to the tree, so cones are not often seen on the forest floor unless cut by squirrels or chipmunks in fall. California red fir cones are about 9 inches long. California red fir prefers cold wet winters in areas with deep snow accumulation, followed by warm summers. The young trees have thin bark and are very susceptible to fire, but as trees mature the bark thickens and fire resistance increases.

Western white pine is usually present and increases in areas where there is less rubble and more soil. Western white pine is also a long lived conifer with a narrow crown. It has 2 to 4 inch long needles in bundles of 5. It produces a deep tap root and extensive lateral roots. Most of the lateral roots are within the upper 2 feet of soil. Young trees have thin bark and are very susceptible to fire due to damage to the cambial tissue. Mature trees develop thicker bark and have high branches, making them less prone to mortality from fire (Griffith, 1992). Western white pine bark, when damaged by fire, can allow infestation of pathogens that can eventually kill the tree.

Conifers have evolved with their environment developing characteristics that enable them to survive specific climatic conditions. Temperature and precipitation are important environmental variables that determine which conifer species are most likely to be present in a given area. Temperature is critical in initiating conifer growth after snowmelt. Trees generally start stem growth about 2 weeks after snow melt, a delay that may be related to the warming of soils and roots. If the snow melt is unusually early, trees will not begin annual growth until specific air temperatures and/or a photoperiod (a ratio of light hours to dark hours during one 24 hour period) is met. The pines associated with this site begin leader growth at cooler temperatures than the firs. The pines have heavily insulated terminal buds, whereas the terminal buds of the fir trees are less insulated and more susceptible to frost damage (Royce and Barbour, 2001). Seedling establishment and survival are also dependent upon the frost resistance of the species. After temperatures and the photo period criteria have been met, precipitation and soil available water determine the length of the growing season. The length of the leader growth is predetermined by growth conditions of the prior year. If drought conditions set in before the leader has reached its determinate length, growth will be terminated prematurely. If precipitation comes after the snow has melted, it can prolong the growing season. Conifer growth ceases with the onset of drought conditions and the decline of water potentials (Royce and Barbour, 2001). In addition to drought conditions, the growing season is shorter at higher elevations due to late snow melt and early frost dates in fall. California red fir takes advantage of the short growing season with rapid initial growth, which gradually declines through the summer (Royce and Barbour, 2001).

In the year 2000, Alan Taylor published a report on the historic fire regime of several forest types in relation to aspect on Prospect Peak. A portion of this ecological site is located on the south and western sides of Prospect Peak. This ecological site lies above the Jeffrey pine white fir forests at the lower elevations. In this study fire regimes were determined by dating cross sections of wood from fire scarred trees, or from radial growth changes in tree cores. The point fire return interval for the Jeffrey pine-white fir forest between the years of 1546 and 1903 ranged from 15.5 to 38 years, with a mean of 29.8. The point fire return interval for the red fir-western white pine forest between the years of 1685 and 1937 ranged from 26 to 109, with a mean of 70 (Taylor, 2000). Fire return intervals were shorter on the eastern slopes than on the southern and western slopes. Data was not analyzed for the northern slopes, which extend beyond the park boundary. Some of the variation in the fire return interval was attributed to the un-vegetated Fantastic Lava Beds, Painted Dunes and Cinder Cone formations to the south, which do not provide fuel and act as a fire barrier. It is probable that this red fir-western white pine ecological site has a longer fire interval than the mean listed above (70 years) for the red fir-western white pine site because of the un-vegetated rubble lands that finger through the area. Perhaps the maximum fire return interval of 109 years would be more appropriate for this site. In a separate study, Beaty and Taylor report that fire return intervals are longer on north facing slopes than on south facing slopes. Stand replacing fire is more common on upper slopes, while low to moderate intensity fires occur only along lower slopes. This is probably due to the tendency of fire to burn upslope, preheating the fuels as it goes. Large fires and multiple small fires in the same season are associated with dry and very dry years (Beaty and Taylor, 2001). Fire size on Prospect Peak between 1627 and 1904 ranged from 39 to 1537 ha, with a mean of 457 ha. The larger fires generally occurred in the lower elevation Jeffrey pine forests (Taylor, 2000).

This forest is susceptible to several pathogens that can break out to epidemic levels and cause extensive stand mortality. Native pathogens are a natural component of the ecosystem and, at times, have important functions within the forest cycle. If trees are overstressed due to drought or competition for sunlight they become more vulnerable to pests and disease. Pathogens often infest the weak trees and spread in overcrowded conditions. The surviving trees may benefit from the death of overstocked trees, where canopy gaps provide an opportunity for regeneration of the same or other species.

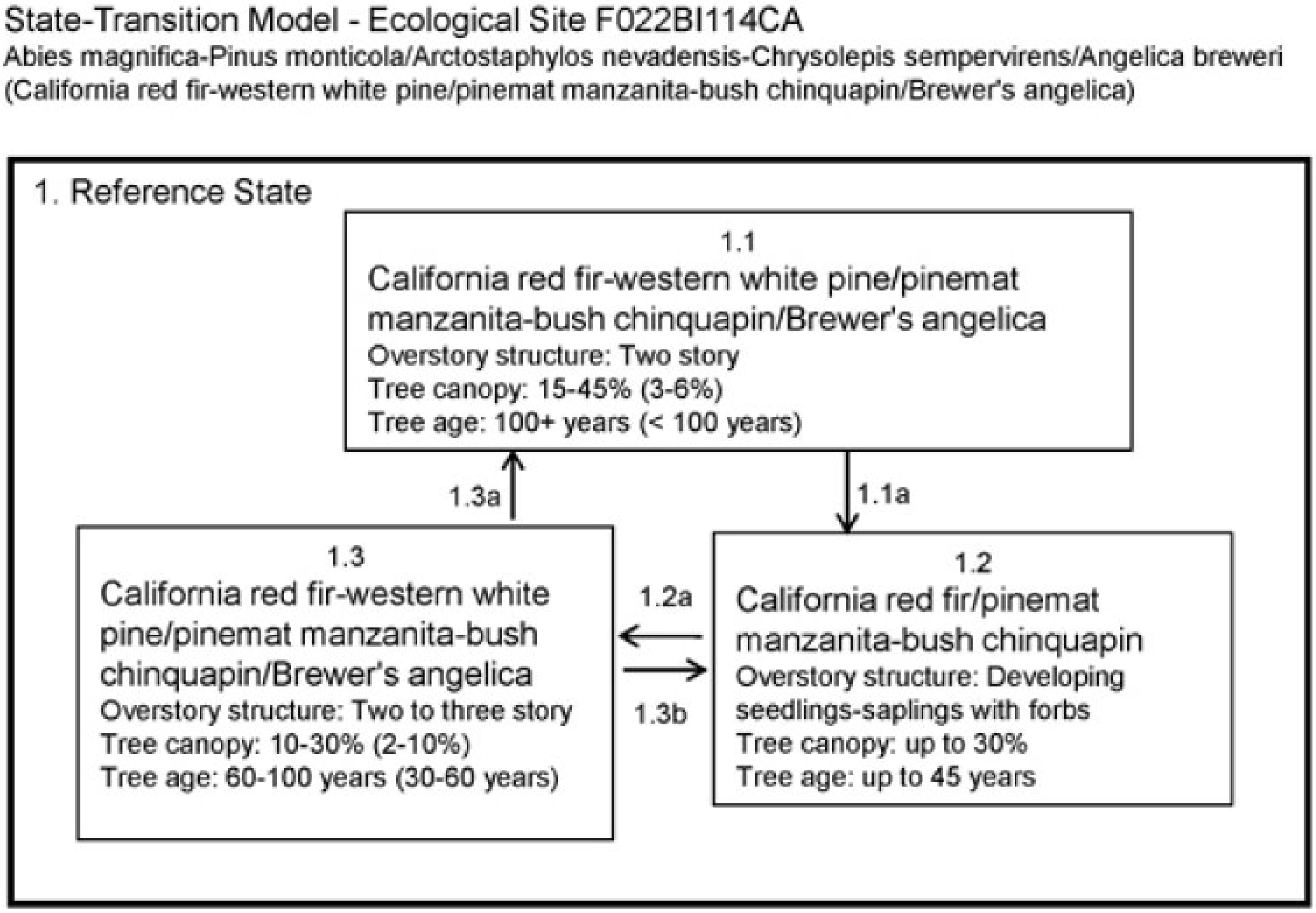
The major pathogens that affect California red fir in this area are red fir dwarf mistletoe (*Arceuthobium abietinum* f. sp. magnificae), fir broom rust (Melampsorella caryophyllacearum), annosus root rot (Heterobasidion annosum), and the fir engraver (Scolytus ventralis) (Murphy et al., 2000). Other diseases that can affect red fir are the heart rots yellow cap fungus (Pholiota limonella) and Indian paint fungus (Echinodontium tinctorium). Insects that can affect red fir are cone maggots (Earomyia spp.), several chalcids (Megastigmus spp.) and cone moths (Barbara spp. and Eucosma spp.) (Burns, et al., 1990).

The major pathogen affecting western white pine is the white pine blister rust (Cronartium ribicola). It is a non-native disease that was introduced from Europe and Asia in the 1920s. The fungus causes cankers on five-needle pines that eventually kill most of the infected trees. Visible symptoms are swollen cankers with an abundance of pitch flowing down the branch or stem. The cankers can eventually girdle the tree, killing the portions above. The leaves on the upper portion turn red and fall (Hagle et al., 2003). Pruning cankers from infected stems has shown to be beneficial. Some strains of western white pine have shown resistance to the disease. Other pathogens that affect western white pine are needle cast fungi (Lophodermella arcuata, Lophodermium nitens, and Bifusella linearis), butt-rot fungi (Phellinus pini, Phaeolus schweinitzii, Heterobasidion annosum, and Armillaria spp.). Insects that can cause damage include the mountain pine beetle (Dendroctonus ponderosae), and ips beetles (Ips emarginate and Ips montanus) (Graham, 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
California red fir-western white pine/pinemat manzanita-bush chinquapin/Brewers angelica

The mature open California red fir forest is the reference community phase for this ecological site. It is similar to its historic condition, with only minor changes in understory density due to the lack of fire. A natural fire regime reflects the time it takes for a forest to naturally develop fuels sufficient to carry fire. At the upper elevations in red fir dominated forests fuel accumulation is slow and relatively compact, reducing flammability. Red fir seedlings develop slowly due physiographic characteristics and climatic variables, so ladder fuels take decades to develop. The natural fire return interval may be more than 100 years for this site. There has been a significant drop in fire since the year 1905, just over 100 years ago (Taylor, 2000). Therefore this area is theoretically due for a fire according to the historic fire cycle, but it is not long overdue and impacts from fire suppression are minimal. Lightning is common in July and August, but the extensive rubble lands and open canopy limit the spread of fire.

Forest overstory. California red fir heavily dominates this forest, with western white pine found in the more lush locations of the site. The upper tree canopy height ranges from 70 to 85 feet with a canopy cover ranging from 15 to 45 percent. Mature trees are over 100 years old and have a DBH (diameter at breast height) ranging from 18 to 24 inches. Basal area ranges from 160 to 260 ft2/ acre.

Forest understory. The understory is dominated by pinemat manzanita (Arctostaphylos nevadensis), and to a lesser extent bush chinquapin (Chrysolepis sempervirens). Other common species are Brewer's angelica (Angelica breweri), white hawkweed (Hieracium albiflorum), oceanspray (Holodiscus discolor), mountain monardella (Monardella odoratissima) and wax currant (Ribes cereum). There is a high cover of un-vegetated rubble land between and among the forested areas.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	190	278	421
Tree	0	14	23
Forb	0	5	8
Total	**190**	**297**	**452**

Table 6. Ground cover

Tree foliar cover	15-45%
Shrub/vine/liana foliar cover	5-45%
Grass/grasslike foliar cover	0-2%
Forb foliar cover	0-6%
Non-vascular plants	0-1%
Biological crusts	0%
Litter	0-85%
Surface fragments >0.25" and <=3"	5-10%
Surface fragments >3"	30-80%
Bedrock	0%
Water	0%
Bare ground	0-5%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	0-2%	0-2%
>0.5 <= 1	–	5-40%	–	0-4%
>1 <= 2	0-1%	2-15%	–	–
>2 <= 4.5	0-1%	–	–	–
>4.5 <= 13	0-2%	–	–	–
>13 <= 40	0-2%	–	–	–
>40 <= 80	15-45%	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.2
California red fir/pinemat manzanita-bush chinquapin

This community phase develops after a stand replacing fire or in small gaps created by a canopy disturbance. California red fir and western white pine will germinate from wind or animal dispersed seed after a fire. California red fir seedling establishment may be delayed for 3 to 4 years after a fire. This may be due to the mortality of the seedlings during the first few years or be related to the timing of cone production, which occurs in 2 to 6 year intervals (Chappell and Agee 1996). The seeds germinate best in bare soil or light litter, in full sun to partial shade.

Initial growth of California red fir is best in dense shade, but as the seedlings get older they grow better in full sun. The winged red fir seeds are wind dispersed at 1 to 1.5 times the height of the parent tree. The seeds generally germinate the spring after they are shed and are not stored in the soil. It may take 10 to 25 years for California red fir to reach 4.5 feet (Cope, 1993). The seeds of western white pine can be dispersed over 2,000 feet by wind. The seeds can remain viable in litter for up to 4 years, but viability decreases quickly (Griffith, 1992). Birds, squirrels and other rodents will cache some of these seeds in the soil, which may germinate in bunches if not consumed. The severity and size of a fire influence the structure of regeneration. California red fir seems to regenerate better after a low to moderate intensity fire, or in high intensity fires of smaller size. This is most likely due to proximity to a seed source and the benefits from partial shade (Chappell and Agee 1996). Pinemat manzanita is killed by fire. It does not resprout from the root crown but re-establishes itself from seed. It colonizes disturbed sites and continues to grow well under an open canopy as long as there is sufficient sunlight (Howard, 1993). Other forbs and grasses germinate from onsite stored seed or wind dispersed seed from adjacent areas. Some of the understory species may resprout after low to moderate intensity fires. Bush chinquapin (*Chrysolepis sempervirens*) can resprout from the roots, root crown, or the stump after it has been top-killed by a fire. It can also regenerate from seed, but there is little data about seed dormancy or storage.

Community 1.3
California red fir-western white pine/pinemat manzanita-bush chinquapin/Brewers angelica

California red fir and western white pine continue to grow into an open forest due to the natural preference of sunlight and the occasional lightening induced surface fire. This community phase experiences rapid growth in conifer height and canopy cover. California red fir reaches seed bearing age between 35 to 40 years, but western white pine can bear seed at 10 years (Cope, 1993, and Griffith, 1992). Therefore California red fir needs a longer fire free interval to develop new seed crops. This community phase begins with pole-sized trees and lasts until the trees are about 100 years old. California red fir will slowly continue to regenerate under the forest canopy during this time.

Pathway 1.1a
Community 1.1 to 1.2

Wind-throw, fire, or tree die-off from disease creates openings in the forest that present suitable conditions for California red fir and western white pine regeneration (Community Phase 1.2)

Pathway 1.2a
Community 1.2 to 1.3

The natural pathway is to Community Phase 1.3, the young open California red fir forest. This pathway is followed with time and growth with small low to moderate intensity surface fires.

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 small low to moderate intensity surface fires, and/or partial tree mortality from a pest outbreak. This pathway leads to a mature open California red fir forest (Community Phase 1.1).

Pathway 1.3b
Community 1.3 to 1.2

In the event of a canopy fire this community would return to Community Phase 1.2, Stand Regeneration.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Tree					
0	**Tree (understory only)**			0–23	
	California red fir	ABMA	*Abies magnifica*	0–15	0–7
	western white pine	PIMO3	*Pinus monticola*	0–8	0–3
Shrub/Vine					
0	**Shrub**			190–421	
	pinemat manzanita	ARNE	*Arctostaphylos nevadensis*	130–270	25–40
	bush chinquapin	CHSE11	*Chrysolepis sempervirens*	60–120	10–20
	wax currant	RICE	*Ribes cereum*	0–15	0–5
	oceanspray	HODI	*Holodiscus discolor*	0–10	0–2
	mountain monardella	MOOD	*Monardella odoratissima*	0–6	0–5
Forb					
0	**Forb**			0–8	
	Brewer's angelica	ANBR5	*Angelica breweri*	0–8	0–3
	white hawkweed	HIAL2	*Hieracium albiflorum*	0–2	0–2

Table 9. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
California red fir	ABMA	*Abies magnifica*	Native	–	10–35	–	–
western white pine	PIMO3	*Pinus monticola*	Native	–	5–10	–	–

Table 10. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Forb/Herb					
Brewer's angelica	ANBR5	*Angelica breweri*	Native	–	0–3
white hawkweed	HIAL2	*Hieracium albiflorum*	Native	–	0–2
Shrub/Subshrub					
pinemat manzanita	ARNE	*Arctostaphylos nevadensis*	Native	–	25–40
bush chinquapin	CHSE11	*Chrysolepis sempervirens*	Native	–	10–20
mountain monardella	MOOD	*Monardella odoratissima*	Native	–	0–5
wax currant	RICE	*Ribes cereum*	Native	–	0–5
oceanspray	HODI	*Holodiscus discolor*	Native	–	0–2
Tree					
California red fir	ABMA	*Abies magnifica*	Native	–	0–7
western white pine	PIMO3	*Pinus monticola*	Native	–	0–3

Animal community

Animals that use California red fir forests include martin, fisher, wolverine, black bear, squirrel, chickadee, pileated woodpecker, great gray owl, Williamson's sapsucker, mountain beaver, and pocket gopher.

Deer browse the leaves of these conifers in winter and the new growth in the spring. Birds forage for insects in the foliage of mature conifers. Spruce grouse feed on Sierra lodgepole pine needles during the winter (Cope, 1993).

The California red fir cones are cut and cached by squirrels. Western white pine seeds are eaten by red squirrels and deer mice (Griffith, 1992). The seeds of Sierra lodgepole pine are eaten by squirrels, chipmunks, birds, and mice (Cope, 1993).

The fruit of pinemat manzanita is eaten by black bear, deer, coyote, and various birds and rodents. Young foliage after fire is browsed by deer, but older foliage is not desirable.

Grasses provide forage for deer and small rodents.

Recreational uses

This site is extremely rubbly, which maintains open areas for good views but is not easy to travel across.

Wood products

The wood from California red fir is straight-grained and light. California red fir is soft but stronger than the wood of other firs, and has a low specific gravity. The wood is used for fuel, coarse lumber, quality veneer, solid framing, plywood, printing paper, high-quality wrapping paper, and is preferred for pulping (Cope, 1993).

Western white pine wood is straight-grained, light and highly valued. The wood is used to make window and door sashes, doors, paneling, dimension stock, matches, wood carvings and toothpicks (Griffin, 1992).

Other products

California red fir is used for Christmas trees (Cope, 1993).

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

Cones of western white pine are collected for novelty items. The wood is good for carving. The tree is also planted as an ornamental (Griffin, 1992).

Other information

Forest Pathogens:

The parasitic red fir dwarf mistletoe (*Arceuthobium abietinum* f. sp. magnificae) is common in the survey area, as evident by witches brooms, top kill, stem cancers and swellings. The vegetative shoots of the dwarf mistletoe are often present from spring to fall. Infestation of the red fir dwarf mistletoe can cause reduced growth and vigor. A fungus, (Cytospora abietis), kills the branches that are infected with dwarf mistletoe. Dwarf mistletoe 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 (Burns, et al., 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 a barren dead looking branch. The alternate host for this rust is the chickweeds (Stellaria spp. and Cerastium spp.) (Hagle et al., 2003). This disease can damage tree growth by reducing crown development. Mortality is less common in mature trees than in younger regeneration trees.

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 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, et al., 1990).

The fir engraver (Scolytus ventralis) can cause extensive damage to red fir forests and outbreaks can cause mortality to several acres of trees. Mortality can reach epidemic levels when the trees are stressed due to drought, annosus root rot, dwarf mistletoe or from fire damage (Burns, et al., 1990).

SITE INDEX DOCUMENTATION:

Schumacher (1928) and Haig (1932) were used to determine forest site productivity for red fir and western white 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. They are selected according to guidance listed in the site index publication.

Table 11. 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*	66	66	241	241	140	050	–	
California red fir	*ABMA*	66	66	240	240	–	–	50TA	Haig, Irvine T. 1932. Second-growth yield, stand, and volume tables for the western white pine type. USDA, Forest Service. Northern Rocky Mountain Forest Experiment Station Technical Bulletin 323.
western white pine	*PIMO3*	47	47	96	96	–	–	50TA	Haig, Irvine T. 1932. Second-growth yield, stand, and volume tables for the western white pine type. USDA, Forest Service. Northern Rocky Mountain Forest Experiment Station Technical Bulletin 323.
western white pine	*PIMO3*	47	47	96	96	100	570	–	

Inventory data references

The following NRCS vegetation plots were used to describe this ecological site:

789113
789114
789157- Site location
789186

Type locality

Location 1: Plumas County, CA	
Township/Range/Section	T30 N R6 E S28
UTM zone	N
UTM northing	4476895
UTM easting	643213
General legal description	The type location for the vegetation plot is about 2,000 feet west-southwest from the Mt. Harkness fire lookout; the soil pit is another 1,000 feet to the west-southwest.

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Contributors

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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:**