USDA Natural Resources
Conservation Service

Ecological site F022BI102CA
Frigid Bouldery Glacially Scoured Ridges Or Headlands

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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) Headland, (2) Ridge, (3) Mountain slope
Elevation (feet): 5,500-8,190 but generally 6,300-8,000
Slope (percent): 2 to 80 percent, but generally 8-40
Water Table Depth (inches): n/a
Flooding-Frequency: None
Ponding-Frequency: None
Aspect: South, East, West
Mean annual precipitation (inches): 33-109, but generally 33 to 53 inches
Primary Precipitation: Snow from November to May
Mean annual temperature: 38 to 43 degrees F (4 to 6 degrees C)
Restrictive Layer: Indurated bedrock is encountered between 20 to 40 inches
Temperature Regime: Frigid
Moisture Regime: Xeric
Parent Materials: Tephra over colluvium and/or residuum from volcanic rocks
Surface Texture: Very bouldery medial loamy sand
Surface Fragments <=3" (% Cover): 3-46
Surface Fragments > 3" (% Cover): 6-85

Soil Depth (inches): 20-40
Vegetation: Open forest dominated by large mature California red fir (*Abies magnifica*), western white pine (*Pinus monticola*), and Sierra lodgepole pine (*Pinus contorta* spp. murrayana) with pinemat manzanita (*Arctostaphylos nevadensis*) and forbs in the canopy openings.
Notes: This area is undulating with rocky bedrock ridges, open slopes, small swales, and small tarns. The forest is open and discontinuous due to the bedrock outcrops and rocky soils.

Classification relationships

Forest Alliance = *Abies magnifica* – Red fir forest; Association = *Abies magnifica*/*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.)

Associated sites

F022BI112CA	**Frigid Sandy Loam Moraines Or Lake Terraces** This site is associated with the Juniperlake soils which are deeper, and have a dense California red fir forest.

Similar sites

F022BI115CA	**Frigid And Cryic Gravelly Slopes** This site is associated with an open California red fir and western white pine forest, with less Sierra lodgepole pine.

Table 1. Dominant plant species

Tree	(1) *Abies magnifica*
Shrub	(1) *Arctostaphylos nevadensis*
Herbaceous	(1) *Carex rossii* (2) *Penstemon gracilentus*

Physiographic features

This ecological site is found between 5,500 and 8,190 feet in elevation, but the best representation is between 6,300 and 8,000 feet. This site is situated on glacially scoured ridges and glacial headlands. Slopes range from 2 to 80 percent, but are generally between 8 to 40 percent. This site is often found on east to south aspects, but can be found on all aspects.

Table 2. Representative physiographic features

Landforms	(1) Headland (2) Ridge (3) Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	1,676–2,496 m
Slope	2–40%
Aspect	E, S, W

Climatic features

This ecological site receives most of its annual precipitation in the form of snow from November to May. The mean annual precipitation is between 33 and 109 inches (838 and 2768 mm) and the mean annual temperature ranges from 38 to 43 degrees F (4 to 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 available for this site. The nearest site is near Chester, which has lower precipitation and warmer temperatures.

Table 3. Representative climatic features

Frost-free period (average)	85 days
Freeze-free period (average)	190 days
Precipitation total (average)	2,769 mm

Influencing water features

This site is not influenced by water features.

Soil features

The Scoured soil series is associated with this site, which consists of moderately deep, well drained soils that formed in tephra over colluvium and/or residuum from volcanic rocks. The surface texture is very bouldery medial loamy sand. The combined A, AB, and C horizons have 2 percent clay, 17 to 24 percent gravel, 10 percent cobbles, 10 percent stones, and 10 to 15 percent boulders. The C horizon begins at 17 inches and has a bouldery texture, with 20 percent gravel and 75 percent cobbles, stones, and boulders. Indurated bedrock is encountered between 20 to 40 inches. Permeability is very rapid in the upper horizons and very slow through the bedrock. These moderately deep soils have very low AWC.

The scoured soils are classified as Medial-skeletal over fragmental, amorphic over isotic, frigid Humic Haploxerands.

This ecological site has been correlated with the following map units and major soil components within the Lassen Volcanic National Park Soil Survey (CA789):

Map Unit / Component / Component percent
103 Scoured 75%
104 Scoured 55%

This site is associated with Scoured as a minor component in several additional mapunits.

Table 4. Representative soil features

Family particle size	(1) Sandy
Drainage class	Well drained
Permeability class	Very rapid
Soil depth	51–102 cm
Surface fragment cover <=3"	3–46%
Surface fragment cover >3"	6–85%
Available water capacity (0-101.6cm)	0–6.2 cm
Soil reaction (1:1 water) (0-101.6cm)	5.6–6.5
Subsurface fragment volume <=3" (Depth not specified)	15–55%
Subsurface fragment volume >3" (Depth not specified)	15–75%

Ecological dynamics

This ecological site is characterized by an open forest dominated by large mature California red fir (*Abies magnifica*), western white pine (*Pinus monticola*), and Sierra lodgepole pine (*Pinus contorta* spp. murrayana) with pinemat manzanita (*Arctostaphylos nevadensis*) and forbs in the canopy openings. This area is undulating with rocky bedrock ridges, open slopes, small swales, and small tarns. The forest is open and discontinuous due to the bedrock outcrops and rocky soils. Tree growth is relatively slow on this site. The inherently open forest provides an opportunity for the shrubs, forbs and grasses to grow in the open sunlight.

California red fir, western white pine and Sierra lodgepole pine are tall, long- lived conifers with short branches and narrow crowns. California red fir prefers cold wet winters in areas with deep snow accumulation, followed by warm summers.

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).

This ecological site has evolved with natural disturbances such as fire, wind throw and disease that create canopy gaps which allow for tree regeneration. Since this forest is open, the fuel loads are lower than a fully stocked red fir forest. Fires are likely to remain at low to moderate intensities, killing some of the young saplings yet leaving the mature red fir and western white pine with minor damage. Western white pine bark, when damaged by fire, can allow infestation of pathogens that can eventually kill the tree. Overstory trees would likely be killed in a high severity fire (Cope, 1993). Sierra lodgepole pine has thin bark and a shallow root system which make it vulnerable to low and moderate intensity fires. However, it often regenerates well from windblown seed after fire and may dominate the regenerating forest for several decades.

The point fire return interval for the red fir-western white pine forest on Prospect Peak between the years of 1685 and 1937 ranged from 26 to 109 years, with a mean of 70 (Taylor, 2000). In the Thousand Lakes Wilderness point fire return interval ranges from 4 to 55 years with a mean of 24 for red fir-white fir forests, and 9 to 91 years with a mean of 20 for red fir-mountain hemlock forests (Bekker and Taylor, 2001). In the Caribou Wilderness the mean fire return interval between the years of 1768 and 1874 was 66 years for red fir-western white pine forest (Taylor and Solem, 2001). The stand densities and fuel characteristics of the forests in these studies are not specific enough to directly compare to fire return intervals for this site, but it seems likely that this ecological site is more open than the red fir-white fir forests on Prospect Peak or in Thousand Lakes Wilderness, so the fire return interval may lean toward the longer interval of 70 years or more. 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 the upper slopes, while low to moderate intensity fires occur only along the 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).

This forest is susceptible to several pathogens that can break out to epidemic levels and cause extensive stand mortality. 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). Inspects 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 1920's. 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 the needle cast fungi: Lophodermella arcuata, Lophodermium nitens, and Bifusella lineari; the butt-rot fungi, Phellinus pini, Phaeolus schweinitzii, and Heterobasidion annosum, and Armillaria spp. Insects that can cause damage include the mountain pine beetle (Dendroctonus ponderosae), emarginate ips (Ips emarginatus), and ips beetle (Ips montanus) (Graham, 1990).

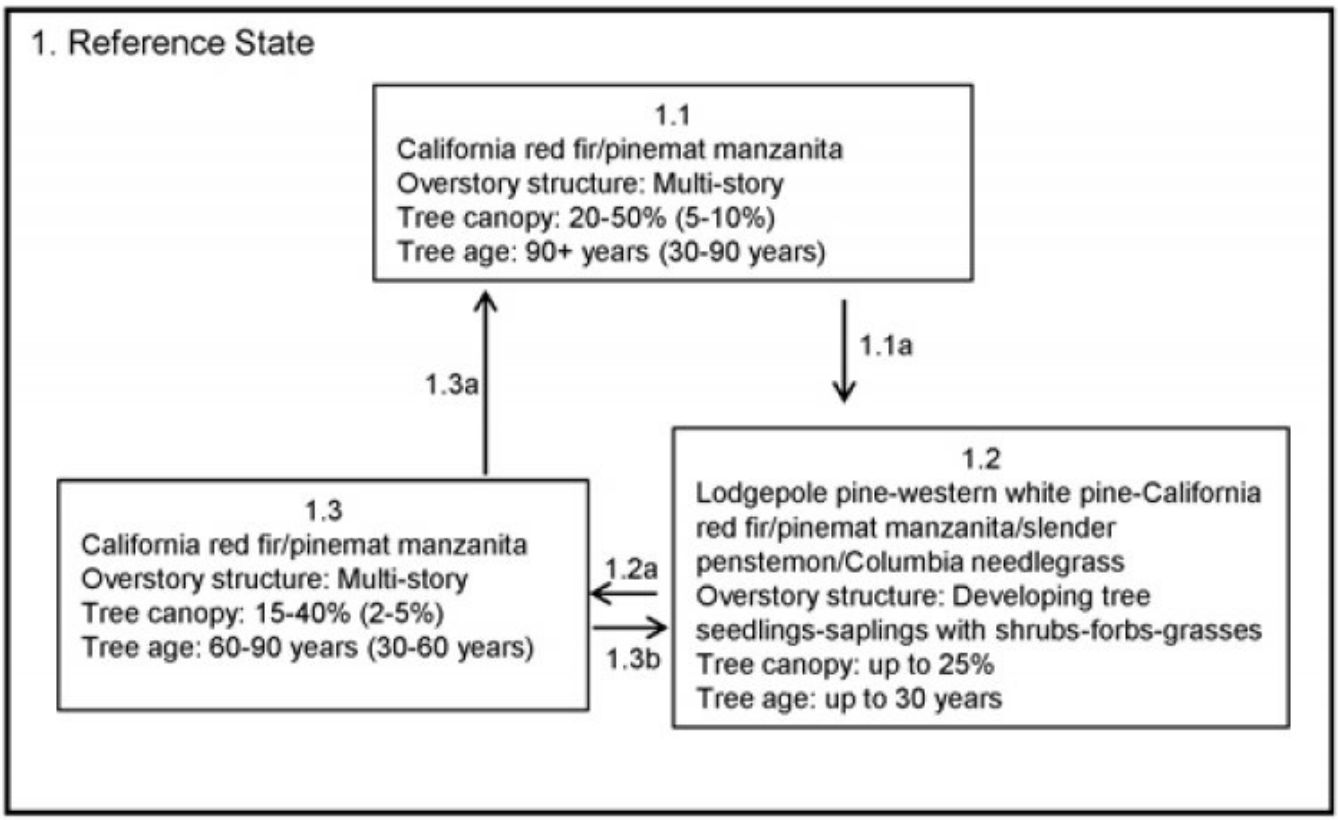
The major pathogens of Sierra lodgepole pine are Annosus root disease (Heterobasidion annosum), Lodgepole pine dwarf mistletoe (*Arceuthobium americanum*), and the mountain pine beetle (Dendroctonus ponderosae).

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-Transition Model - Ecological Site F022BI102CA
Abies magnifica/Arctostaphylos nevadensis
(California red fir/pinemat manzanita)



State 1
Reference

Community 1.1
California red fir/pinemat manzanita

The mature open California red fir, western white pine, and Sierra lodgepole pine forest is the reference community phase for this ecological site. It is relatively unchanged from its natural condition since most of this area has never been logged and the fire regime has not been markedly altered. The fire frequency for red fir forest is estimated from 10 to 65 years (Bancroft, 1979; Taylor et al., 1991). However this forest is so open, it would burn less frequently than a pure red fir forest. Large severe crown fires are uncommon due to lower ground fuels and the open canopy structure of the forest. Lightning strikes are a common source of ignition, but seldom do the fires reach farther than an acre (Kilgore, 1981). Large fires do occur but the fire hazard is lower than the white fir mixed conifer types at lower elevations. (Cope, 1993). At lower elevations this forest's fuel load, type and stand density tends to increase, and stand replacing fires may be more common.

Forest overstory. The canopy cover ranges from 20 to 50 percent with large openly spaced trees. The canopy cover of California red fir averages 25 percent, with 8 percent cover of western white pine and 5 percent cover of Sierra lodgepole pine. There is an occasional large Jeffrey pine with about 1 percent cover across the site. The overstory trees are 90 to 100 feet tall with diameters of 25 to 35 inches. The dominant trees are usually over 200 years old and a minimum of 90 years.

This forest does not have many canopy layers. A secondary layer may be present making up about 5-10% cover with ages of 30-90 years.

Forest understory. The cover of pinemat manzanita (Arctostaphylos nevadensis) averages about 50 percent but

may be as high as 70 percent. There is about 30 percent cover from other species, of which Columbia needlegrass (Achnatherum nelsonii), carex (Carex sp.), Sierra chinkapin (Chrysolepis sempervirens), and squirreltail (Elymus elymoides) dominate. Less abundant species include western needlegrass (Achnatherum occidentale), pioneer rockcress (Arabis platysperma), Whitney's sedge (Carex whitneyi), oceanspray (Holodiscus microphyllus (Syn)), mountain monardella (Monardella odoratissima), slender penstemon (Penstemon gracilentus), mountain pride, (Penstemon newberryi), and pinewoods lousewort (Pedicularis semibarbata).

Total annual production is about 726 lbs per acre, with about 500 lbs of this from pinemat manzanita. The remaining 226 lbs is moderate to low quality forage.

The unvegetated areas have minimal litter cover and exposed soils with 3 to 46 percent gravels and 6 to 85 percent cobbles, stones, and boulders. There is approximately 8 percent cover from trees less than 13 feet tall, which are generally in the open areas.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	392	684	1048
Grass/Grasslike	7	93	275
Tree	4	35	46
Forb	–	3	6
Total	**403**	**815**	**1375**

Table 6. Soil surface cover

Tree basal cover	20-50%
Shrub/vine/liana basal cover	30-88%
Grass/grasslike basal cover	1-42%
Forb basal cover	1-15%
Non-vascular plants	0-10%
Biological crusts	0%
Litter	30-80%
Surface fragments >0.25" and <=3"	3-46%
Surface fragments >3"	6-85%
Bedrock	0-5%
Water	0%
Bare ground	5-50%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	0-2%	0-1%
>0.15 <= 0.3	–	30-70%	1-22%	0-2%
>0.3 <= 0.6	–	0-3%	0-20%	0-12%
>0.6 <= 1.4	0-2%	0-15%	–	–
>1.4 <= 4	2-7%	–	–	–
>4 <= 12	0-5%	–	–	–
>12 <= 24	5-10%	–	–	–
>24 <= 37	15-35%	–	–	–
>37	–	–	–	–

Community 1.2
Lodgepole pine-western white pine-California red fir/pinemat manzanita/slender penstemon

This community phase develops after a stand replacing fire or in small gaps (1/2 acre to 3 acres) created by a canopy disturbance. While several large California red fir and western white pine trees may survive, the thin barked Sierra lodgepole pine is very susceptible to fire and would have a high mortality rate. California red fir, western white pine, and Sierra lodgepole 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 in 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 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 the litter for up to 4 years, but viability decreases quickly (Griffith, 1992). Sierra lodgepole pine produces abundant viable seeds that are wind dispersed up to 200 feet from the parent tree (Cope, 1993). Birds, squirrels and other rodents 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 re-sprout 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 re-sprout after low to moderate intensity fires.

Community 1.3
California red fir/pinemat manzanita

California red fir, Sierra lodgepole pine, 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. If fire spreads through this site, Sierra lodgepole pine would have a high mortality rate, reducing its abundance in the forests. This community 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 and Sierra lodgepole pine between 4 to 8 years (Cope, 1993, and Griffith, 1992). Therefore California red fir needs a longer fire free interval to develop new seed crops. As canopy cover increases, California red fir and western white pine can overtop and eventually shade out the Sierra lodgepole pine (this is unlikely to have much affect on this naturally open site). This community begins with pole sized trees and lasts until the trees are about 100 to 150 years old. California red fir may 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, western white pine, and Sierra lodgepole pine regeneration (to Community Phase 1.2).

Pathway 1.2a
Community 1.2 to 1.3

The natural pathway is to community 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, 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 1.1).

Pathway 1.3b
Community 1.3 to 1.2

In the event of a canopy fire or mortality of older trees (e.g. drought combined with a pathogen concentration), this community would return to Community 1.2.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Tree					
0	**Tree (understory only)**			4–46	
	California red fir	ABMA	*Abies magnifica*	2–28	1–5
	Sierra lodgepole pine	PICOM	*Pinus contorta var. murrayana*	2–9	1–3
	western white pine	PIMO3	*Pinus monticola*	0–6	0–3
	Jeffrey pine	PIJE	*Pinus jeffreyi*	0–3	0–1
Shrub/Vine					
0	**Shrub**			392–1048	
	pinemat manzanita	ARNE	*Arctostaphylos nevadensis*	392–729	30–70
	bush chinquapin	CHSE11	*Chrysolepis sempervirens*	0–135	0–15
	slender penstemon	PEGR4	*Penstemon gracilentus*	0–84	0–5
	mountain monardella	MOOD	*Monardella odoratissima*	0–45	0–5
	mountain pride	PENE3	*Penstemon newberryi*	0–45	0–2
Grass/Grasslike					
0	**Grass/Grasslike**			7–275	
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	0–112	0–20
	sedge	CAREX	*Carex*	7–67	1–10
	Whitney's sedge	CAWH	*Carex whitneyi*	0–56	0–5
	squirreltail	ELEL5	*Elymus elymoides*	0–28	0–5
	western needlegrass	ACOC3	*Achnatherum occidentale*	0–11	0–2
Forb					
0	**Forb**			0–6	
	pinewoods lousewort	PESE2	*Pedicularis semibarbata*	0–4	0–2
	pioneer rockcress	ARPL	*Arabis platysperma*	0–1	0–1

Table 9. 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	–	13–32	–	–
western white pine	PIMO3	*Pinus monticola*	Native	–	4–10	–	–
Sierra lodgepole pine	PICOM	*Pinus contorta var. murrayana*	Native	–	3–6	–	–
Jeffrey pine	PIJE	*Pinus jeffreyi*	Native	–	0–2	–	–

Table 10. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	Native	–	0–20
sedge	CAREX	*Carex*	Native	–	1–10
Whitney's sedge	CAWH	*Carex whitneyi*	Native	–	0–5
squirreltail	ELEL5	*Elymus elymoides*	Native	–	0–5
western needlegrass	ACOC3	*Achnatherum occidentale*	Native	–	0–2
Forb/Herb					
pinewoods lousewort	PESE2	*Pedicularis semibarbata*	Native	–	0–2
pioneer rockcress	ARPL	*Arabis platysperma*	Native	–	0–1
Shrub/Subshrub					
pinemat manzanita	ARNE	*Arctostaphylos nevadensis*	Native	–	30–70
bush chinquapin	CHSE11	*Chrysolepis sempervirens*	Native	–	0–15
mountain monardella	MOOD	*Monardella odoratissima*	Native	–	0–5
slender penstemon	PEGR4	*Penstemon gracilentus*	Native	–	0–5
mountain pride	PENE3	*Penstemon newberryi*	Native	–	0–2
Tree					
California red fir	ABMA	*Abies magnifica*	Native	–	1–5
Sierra lodgepole pine	PICOM	*Pinus contorta var. murrayana*	Native	–	0–3
western white pine	PIMO3	*Pinus monticola*	Native	–	0–3
Jeffrey pine	PIJE	*Pinus jeffreyi*	Native	–	0–1

Animal community

The mature open California red fir, western white pine, and Sierra lodgepole pine forest provides forage and shelter for many animals. Cavity-nesting birds utilize holes in snags and dying trees for their nests, while ground nesting birds and animals find homes in the fallen trees.

Animals that use California red fir forests include: martin, fisher, wolverine, black bear, squirrels, 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.

The grasses provide forage for deer and small rodents.

Hydrological functions

This site is in hydrological soil group B.

Recreational uses

This ecological site provides scenic vistas with partial shade for hiking trails. There may be suitable campsites on the gently sloped to flat areas.

Wood products

The wood from California red fir, western white pine and Sierra lodgepole pine is straight-grained and light. California red fir wood 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, and high-quality wrapping paper, and is preferred for pulping (Cope, 1993).

Western white pine wood is used to make window and door sashes, doors, paneling, dimension stock, matches, wood carvings and toothpicks (Griffin).

The wood of Sierra lodgepole pine is used for lumber, light framing materials, interior paneling, exterior trim, posts, railroad ties, pulp and paper (Cope, 1993).

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 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 also 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 (Graham, 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 (Graham, 1990).

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

Site index documentation:

Schumacher (1928) and Alexander (1966) were used to determine forest site productivity for red fir 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. 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 phases 1.3 and younger stands in 1.1. Red fir and lodgepole pine site trees are selected according to guidance in Schumacher (1928) and Alexander (1966), respectively.

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*	29	29	101	101	140	050	–	
Sierra lodgepole pine	*PICOM*	73	73	75	75	100	520	–	
western white pine	*PIMO3*	30	30	67	67	100	570	–	

Inventory data references

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

789150
789151
789180 (modal- site location)
789280
789293
789301

Type locality

Location 1: Plumas County, CA	
Township/Range/Section	TT30N RR6E S23
UTM zone	N
UTM northing	4478059
UTM easting	645871
General legal description	The site location is just to the west of the road to Juniper Lake, about 5,100 feet south southeast of the new Juniper Lake ranger station, in Lassen Volcanic National Park.

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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:**