Ecological site F022BI124CA
Upper Cryic Slopes

Accessed: 05/14/2025

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) Volcanic dome, (2) Mountain slope, (3) Roche moutonnée
Elevation (feet): 6,710 to 9,000
Slope (percent): 15-60
Water Table Depth (inches): n/a
Flooding-Frequency: None
Ponding-Frequency: None
Aspect: North, East, West
Mean annual precipitation (inches): 71.0-125.0
Primary precipitation: Winter months in the form of snow
Mean annual temperature: 38 to 41 degrees F (3.3 to 5 degrees C)
Restrictive Layer: Bedrock at 40-60 inches
Temperature Regime: Cryic
Moisture Regime: Xeric
Parent Materials: Tephra over colluvium and residuum
Surface Texture: Very gravelly ashy sandy loam
Surface Fragments <=3" (% Cover): 20-30
Surface Fragments > 3" (% Cover): 40-75

Soil Depth (inches): 40-60
Vegetation: The alpine forest is composed of whitebark pine (*Pinus albicaulis*) and mountain hemlock (*Tsuga mertensiana*). Although the cover of bluntlobe lupine (*Lupinus obtusilobus*) is often very high, it is absent in other areas.
Notes: This ecological site is found on convex back slopes on high mountains and ridges. Treeline varies due to climatic conditions and exposure, but generally stays consistent at approximately 9,000 feet.

Classification relationships

Forest Alliance = *Pinus albicaulis* - Whitebark pine forest; Association = *Pinus albicaulis-Tsuga mertensiana*. (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

R022BI205CA	**Cirque Floor** Forbs dominate this range site that is situated in cirque floors.
R022BI207CA	**Alpine Slopes** This sparsely vegetated alpine range site is found on slopes among the forest site.

Similar sites

F022BI104CA	**Cryic Coarse Loamy Colluvial Slopes** This mountain hemlock forest has more forest structure with taller trees and higher cover.

Table 1. Dominant plant species

Tree	(1) *Tsuga mertensiana* (2) *Pinus albicaulis*
Shrub	(1) *Holodiscus discolor*
Herbaceous	(1) *Lupinus obtusilobus* (2) *Polygonum davisiae*

Physiographic features

This ecological site is found on convex back slopes on high mountains and ridges at approximately 6,710 to 9,000 feet in elevation. This site is correlated to map units that extend up Lassen Peak to 10,457 feet, but the site itself does not extend above treeline. Treeline varies due to climatic conditions and exposure, but generally stays consistent at approximately 9,000 feet. Although slopes on this ecological site are generally between 15 and 60 percent, they are correlated with map units that range from 5 to 95 percent.

Table 2. Representative physiographic features

Landforms	(1) Volcanic dome (2) Mountain slope (3) Roche moutonnee
Flooding frequency	None
Ponding frequency	None
Elevation	2,045–2,743 m
Slope	5–95%
Aspect	N, E, 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 from 71 to 125 inches (1,803 to 3,175 mm) and the mean annual temperature is between 38 and 41 degrees F (3.3 and 5 degrees C).The frost free (>32 degrees F) season is 50 to 85 days. The freeze free (>28 degrees F) season is 70 to 185 days.

There are no representative climate stations for this site. The nearest one is Manzanita Lake, which receives substantially less precipitation than this area.

Table 3. Representative climatic features

Frost-free period (average)	85 days
Freeze-free period (average)	185 days
Precipitation total (average)	3,175 mm

Influencing water features

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

Soil features

The Readingpeak soil series associated with this site consists of deep well drained soils that formed in tephra over colluvium and residuum. Surface textures are very gravelly ashy sandy loam, with sandy subsurface textures. Most of the soil profile contains greater than 35 percent rock fragments, with gravels in the upper horizons and cobbles and stones prominent in the lower horizons. Bedrock occurs between 40 and 60 inches. There is very low to low AWC (available water capacity) in the upper 60 inches of soil. Permeability is moderately rapid to rapid in the upper horizons but the bedrock is impermeable.

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

Map Unit Component /Component percent
114 Readingpeak /20
149 Readingpeak /3
167 Readingpeak /20
174 Readingpeak /20

Table 4. Representative soil features

Family particle size	(1) Sandy
Drainage class	Well drained
Permeability class	Rapid
Soil depth	102–152 cm
Surface fragment cover <=3"	20–30%
Surface fragment cover >3"	40–75%
Available water capacity (0-101.6cm)	0.56–6.65 cm
Soil reaction (1:1 water) (0-101.6cm)	5.6–6.5
Subsurface fragment volume <=3" (Depth not specified)	20–65%
Subsurface fragment volume >3" (Depth not specified)	5–65%

Ecological dynamics

This alpine forest is composed of whitebark pine (*Pinus albicaulis*) and mountain hemlock (*Tsuga mertensiana*). Total canopy cover is about 25 percent. In some areas trees grow as single upright stems and reach approximately 45 feet in height, while in other areas they are multi-stemmed and shrub-like (Krummholz). Although the cover of bluntlobe lupine (*Lupinus obtusilobus*) is often very high, it is absent in other areas. Bare soil and gravels cover most of the surface, with 1 to 3 percent vegetative ground cover other than lupine. Common plants in addition to lupine are western needlegrass (*Achnatherum occidentale*), pioneer rockcress (*Arabis platysperma*), squirreltail (*Elymus elymoides*), marumleaf buckwheat (*Eriogonum marifolium*), oceanspray (*Holodiscus discolor*), and Davis' knotweed (*Polygonum davisiae*).

The whitebark pine-mountain hemlock forest is found near treeline in Lassen Volcanic National Park, but may be found in other similar elevations in the Southern Cascade Mountains. The trees at this elevation are very slow growing. Older trees may be 500 years old while younger trees appear to be 75 to 200 years old. On the steep slopes, this forest develops on bedrock controlled ridges. The depth to bedrock is 40 to 60 inches. The bedrock provides a solid anchor for the tree roots. The surrounding colluvial soils have a low cover of forbs and grasses, with very few trees. Trees may be inhibited in the nearby areas because of cold air that drains down the mountain to lower positions, where it pools in basins. These areas are more prone to summer frost, which can kill young mountain hemlock and whitebark pine seedlings. On steep southern slopes, whitebark pine may be inhibited by excessively warm temperatures.

The high elevations are buried with deep snow from November to June and remain cool for most of the year. Several physiological adaptations allow mountain hemlock and white bark pine to survive in this cold environment. They have maximum photosynthetic rates at colder temperatures than lower elevation trees, and close stomata to reduce water loss during dormant periods. The tips of mountain hemlock are very flexible, an attribute that reduces snow build-up and stem breakage. Snow burial can be helpful in protecting trees from strong winter winds, desiccation from warm winter winds and sunny winter days, extreme cold, and repeated freezing and thawing (Arno and Hammerly, 1984). Snow burial can, however, be detrimental as well. In some areas, those portions of the trees exposed above the snow can die back, leaving short multi-stemmed trees. Snow creep can create pistol-butted trees, and avalanches can destroy swaths of forest.

Timberline trees are able to withstand extremely cold winter conditions when they are dormant but need at least a 2 to 3-month frost free growing period in the summer. During this short growing season, usually in July and August, new mountain hemlock and whitebark pine growth is susceptible to frost. The new shoots are soft and succulent and need time to "ripen" (Arno and Hammerly, 1984). The duration of the growing season is crucial for seedling establishment. As elevations increase, temperatures drop and the growing season is shortened. Growing season length is one of the limiting factors to determine treeline. Another is wind. Wind induced treelines can be caused by drought conditions, due to increased evapotranspiration (Tomback, et al. 2001).

Whitebark pine is a long-lived timberline tree species that grows 40 to 60 feet tall in favorable conditions. At upper treeline limits and on exposed ridges it is reduced to its Krummholz or low shrub form. In its upright form it develops multiple branches along the upper stem and creates a broad canopy, rather than the tapered canopy of many conifers. Needles are formed in bundles of 5 that vary in length from 1.5 to 7 inches. The female cones are 1.6 to 3 inches in length. The cones are indehiscent, meaning they do not open at maturity. They heavily rely on the Clark’s Nutcracker (Howard, 2002) as these birds often cache the seeds in open areas that are suitable for young seedlings. If the seeds are not completely consumed, they give rise to dense clusters of genetically similar whitebark pine. These clusters appear to be one tree with many stems but are actually individual trees (Arno and Raymond 1990, Tomback et al. 2001).

White bark pine germination and seedling survival is best in canopy openings, such as those created by small fires. This is especially important in areas where whitebark pine develops dense canopies, as in the northern Cascades and the Rocky Mountains (Arno and Raymond, 1990, Howard, Janet L. 2002, Tomback et al. 2001). In Lassen Volcanic National Park, whitebark pine is usually found on exposed ridges and mountain slopes near timberline. It grows naturally into an open canopy with low levels of litter and woody debris accumulations. The understory is primarily bare soil, composed of loose single-grain gravels or coarse sand. Lightning is the primary cause of natural fires in this area, but the discontinuity of forest fuels will usually not allow it to spread far or burn very hot (Arno and Raymond, 1990, Howard, Janet L. 2002).

Whitebark pine forests are diminishing rapidly across the western United States. This is caused by fire exclusion and climate change, as well as impacts by the introduction of white pine blister rust (Cronartium ribicola) and from the native mountain pine beetle (Dendroctonus ponderosae) (Cox, 2000, Howard, Janet L. 2002, Tomback et al. 2001). In 2005, the National Park Service surveyed for white pine blister rust infestation in Lassen Volcanic National Park. There was a 2 percent infection rate in 1 of the 2 plots within the whitebark pine forest (personal communication, LVNP). The sites have not been resurveyed since. Conditions for the white pine blister rust require sufficient moisture during early summer to allow an alternate host to be infected, usually local currents and gooseberries (Ribes ssp.), and continuing moisture throughout summer to maintain the leaf moisture (Arno and Raymond, 1990). Alternate hosts are often found in lower elevation forests and wind can carry the fragile spores short distances up slope.

Predictions about climate change due to global warming suggest that the whitebark pine communities may be threatened by rising temperatures and precipitation changes. These changes may cause lower elevation tree species to extend their elevation range and encroach into the whitebark pine community (Cox, 2000). These invading trees, which may include California red fir (*Abies magnifica*), mountain hemlock (*Tsuga mertensiana*) and Sierra lodgepole pine (*Pinus contorta* var. murrayana) could over-top the whitebark pine and replace it successionally (Cox, 2000).

The fire return intervals for whitebark pine and mountain hemlock forests in this area are poorly documented. Fire occurrence for mountain hemlock may range from 400 to 800 years (Tesky, 1992); for white bark pine, the range is from 50 to over 300 years (Tomback et al. 2001). There were 9 fires documented in the mountain hemlock zone of Lassen Volcanic National Park between 1933 and 1977, resulting in a single tree being burned (Taylor, 1995). Lightning strikes are very common in this area, but the fuel loads and their capacity to carry fire is low. Even if fire started to spread, these forests are often dissected by unvegetated slopes, wind exposed ridges and rock outcrops.

Mountain hemlock is a slow-growing native conifer. On this site it is generally less than 45 feet tall with branches covering the entire stem. Low-lying branches may root by layering. Trees produce single needles that tightly overlap all surface area of the twigs. The needles generally curve upward. The species exhibit shallow wide-spreading root systems. It is shade tolerant and will reproduce in the understory (Tesky, 1992). Reestablishment of mountain hemlock after a fire or other disturbance is often slow, and in some areas growth never regains its tree-like stature (Arno and Hammerly, 1984).

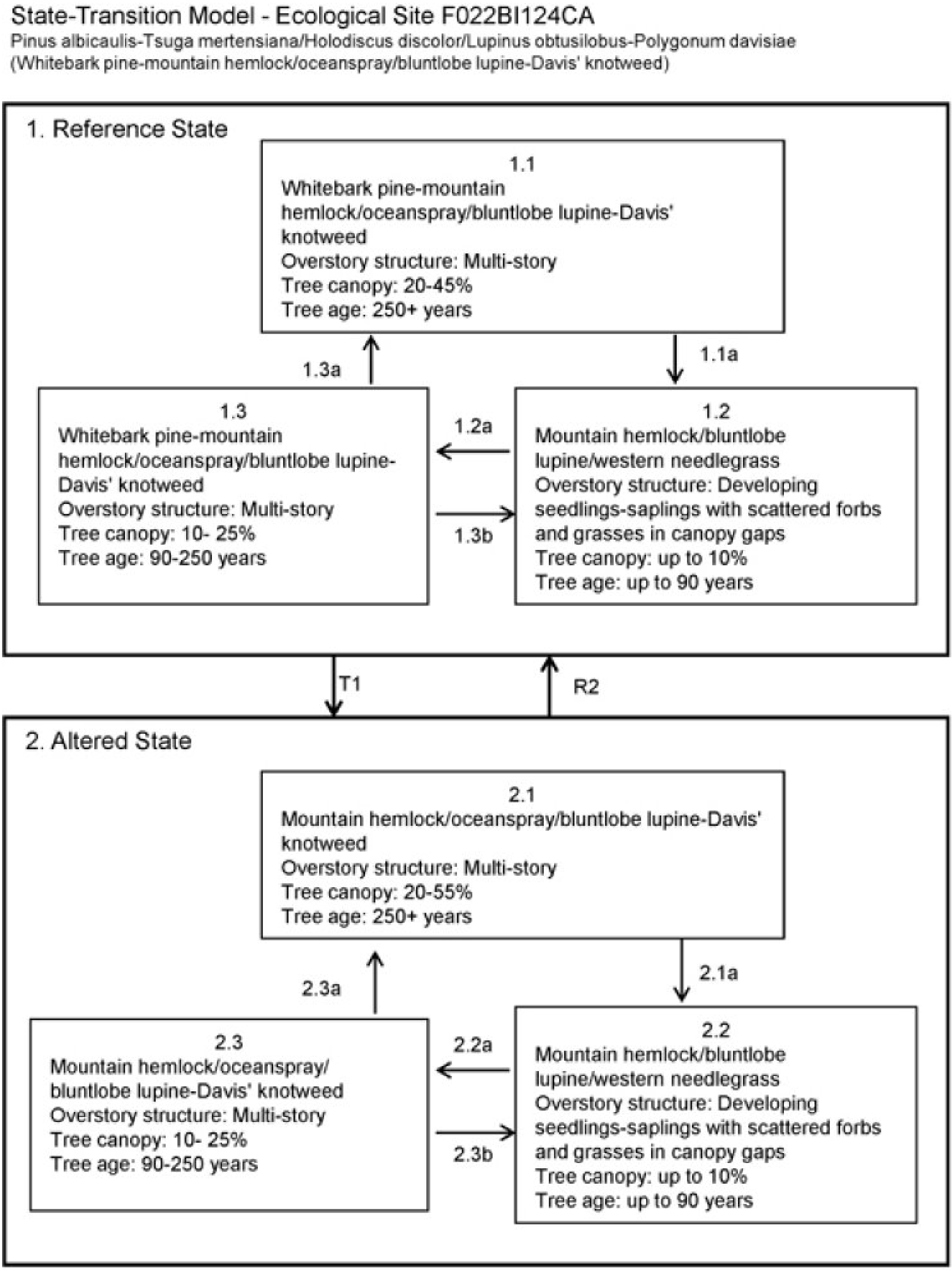
Mountain hemlock is not generally as susceptible to forest pathogens as the lower elevation conifers, but trees over 80 years old are very susceptible to laminated root rot (Phellinus weirii). Laminated root rot can rapidly spread by root contact and kill acres of forests (Tesky, 1992). Other common fungal and parasitic pests of mountain hemlock include several heart rots, of which Indian paint fungus (Echinodontium tinctorum) is the most common and damaging, various needle diseases, snow mold (Herpotrichia nigra), and dwarf-mistletoe (*Arceuthobium tsugense*) (Tesky, 1992).

Other pests that affect whitebark pine include aphids (Essigella gillettei), mealybugs (Puto cupressi and P. pricei), lodgepole needletier (Argyrotaenia tabulana), Monterey pine Ips (Ips mexicanus), other bark beetles (Pityogenes carinulatus and P. fossifrons), and ponderosa pine cone beetle (Conophthorus ponderosae). Other diseases that infect whitebark pine include stem infections from (Atropellis pinicola), (A. piniphila), (Lachnellula pini), (Dasyscypha pini) and (Gremmeniella abietina), all of which form cankers. Wood rots are caused by (Phellinus pini), (Heterobasidion annosum), (Phaeolus schweinitzii), and (Poria subacida). Needle cast fungi include (Lophodermium nitens), (L. pinastri), (Bifusella linearis), and (B. saccata). The snow mold (Neopeckia coulteri) occasionally forms on leaves when they are buried by snow for long periods. Several species of dwarf mistletoes (Arceuthobium spp.) can infest whitebark pine and cause localized mortality. The limber pine dwarf mistletoe (*A. cyanocarpum*), lodgepole pine dwarf mistletoe (*A. americanum*), and hemlock dwarf mistletoe (*A. tsugense*) can damage whitebark pine.

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
Whitebark pine-mountain hemlock/oceanspray/bluntlobe lupine-Davis knotweed

This timberline forest is composed of whitebark pine and mountain hemlock. It is patchy in distribution because of its exposure to high wind, avalanche, and intense solar radiation. Whitebark pine is almost solely dominant along a thin band at the upper elevations of this site, the mountain hemlock increasing in cover as elevation decreases. Within the areas suitable for forest development, small canopy gaps are crucial for continual regeneration of white bark pine. This forest has evolved with small-scale disturbances that cause mortality ranging from a single to several trees. Lightning is the most common agent for natural canopy disturbance in this area. Older trees can become stressed from climatic factors which renders them more susceptible to death from pests and drought. The presence of mountain hemlock will increase in some areas because it is shade tolerant and will continue to reproduce in the understory. It is long-lived and after extended periods without disturbance (>400 years), mountain hemlock may slowly replace whitebark pine. There are locations, however, where this site is too extreme for mountain hemlock and whitebark pine will persist.

Forest overstory. Whitebark pine is dominant or equal in cover to mountain hemlock. Total canopy cover ranges from 20 to 45 percent. Trees are generally less than 35 feet tall and often multi-stemmed. Trees are multi-stemmed due to continual regeneration and long lifespan. Regeneration is evident.

Forest understory. The understory is generally sparse, but the cover of bluntlobe lupine (Lupinus obtusilobus) can be high in some areas. Other common plants are western needlegrass (Achnatherum occidentale), pioneer rockcress (Arabis platysperma), squirreltail (Elymus elymoides), marumleaf buckwheat (Eriogonum marifolium), oceanspray (Holodiscus discolor), and Davis' knotweed (Polygonum davisiae).

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Forb	–	101	180
Shrub/Vine	–	73	143
Tree	3	18	27
Grass/Grasslike	–	12	25
Total	**3**	**204**	**375**

Community 1.2
Mountain hemlock/bluntlobe lupine/western needlegrass

The cones of whitebark pine are indehiscent and rely heavily on the Clark's nutcracker (a bird) to release and cache the heavy wingless seeds into the soil. The birds prefer to cache the seeds on open slopes created after fire. The seeds that are not consumed will eventually germinate. The birds will continue to cache seeds from nearby trees for decades, as long as the site remains open. Whitebark pine seed have a delayed germination and need suitable conditions for survival. It may be several years before a good seedling establishment. Young seedlings do well in partial shade to open sunlight. They quickly develop deep roots. Stem growth is slower and may take several decades to reach 10 feet in height. Mountain hemlock will germinate from winged wind-dispersed seeds after fire, but seedling survival is best under shade. Seedlings that survive grow slowly.

Community 1.3
Whitebark pine-mountain hemlock/oceanspray/bluntlobe lupine-Davis knotweed

This forest slowly develops over time with occasional small scale disturbances. It is a relatively young patch of forest dominated by whitebark pine. Mountain hemlock establishes slowly in the understory and at the lower elevations of this site.

Pathway 1.1a
Community 1.1 to 1.2

Natural disturbances such as fire, disease, avalanche, or rock fall create the small and moderate-sized canopy openings needed for white bark pine regeneration (Community Phase 1.2).

Pathway 1.2a
Community 1.2 to 1.3

With time, growth, and small scale disturbances, a multi-aged whitebark pine-mountain hemlock forest develops (Community Phase 1.3).

Pathway 1.3a
Community 1.3 to 1.1

With time and growth, the mature whitebark pine-mountain hemlock forest develops (Community Phase 1.1).

Pathway 1.3b
Community 1.3 to 1.2

This pathway is created after canopy disturbances, which allow for regeneration (Community Phase 1.2).

State 2
Altered

Community 2.1
Mountain hemlock/oceanspray/bluntlobe lupine-Davis knotweed

This forest is dominated by mountain hemlock (*Tsuga mertensiana*). There may be 1 to 2 percent cover of blister rust-resistant whitebark pine. This forest can maintain for centuries without major disturbance, however it benefits from small scale disturbances. A mature forest may be from 200 to 400 years old but trees can live for 800 years. Mountain hemlock will regenerate in shady understories and in small canopy openings. Growth and development is slow.

Community 2.2
Mountain hemlock/bluntlobe lupine/western needlegrass

Small-scale disturbances from windthrow, disease, single tree mortalities from lightning strikes, snow creep, and small avalanches are possible in this ecological site. Mountain hemlock has a shallow root system and is susceptible to windthrow. These disturbances create small gaps which reduce competition and enhance mountain hemlock regeneration. Canopy fires are uncommon in this mountain hemlock community phase but may occur if there are sufficient fuels and the right climatic conditions for fire to spread. Mountain hemlock is able to reproduce by layering and by seed. Trees that reproduce by layering create a circle of young trees around the original tree. Mountain hemlock seedlings prefer partial shade. Seeds are winged and wind dispersed. Trees produce cones in 3-year intervals with almost no cone production between intervals. For the seeds to establish, a good seed crop is needed with favorable temperature and moisture conditions. Mountain hemlock establishes well during years of lower than normal April snowpack depths, which provides a longer snow-free growing season (Taylor, 1995). Adequate summer moisture is also important. Growth of the seedlings is very slow at first. In a study of mountain hemlock recruitment in Lassen Volcanic Park, 30 cm tall seedlings were 29 years old (Taylor, 1995). Lupines, grasses, and other forbs are present.

Community 2.3
Mountain hemlock/oceanspray/ bluntlobe lupine-Davis knotweed

Even under favorable conditions this community may require over 100 years for the slow growing hemlocks to slowly regain a forest structure. In one study of mountain hemlock after a laminated root rot die-off, the regrowth of the forest was very slow. Due to the slow and continual recruitment of mountain hemlock, an unevenly aged forest will develop (Boone et. al. 1988). If disturbances such as fire, clear-cutting or disease create large canopy openings, the trees may have difficulty reestablishing as a forest site. The lack of a nearby seed source, exposure to severe winds, or the lack of protective shade may reduce a formerly forested site to a more open Krummholz statured forest.

Pathway 2.1a
Community 2.1 to 2.2

Fire, disease, windthrow, avalanche, and/or winter desiccation create small canopy gaps for regeneration (Community Phase 2.2).

Pathway 2.2a
Community 2.2 to 2.3

With time and growth, mountain hemlock increases in basal area, height and cover.

Pathway 2.3a
Community 2.3 to 2.1

With time and growth, mountain hemlock increases in basal area, height and cover.

Pathway 2.3b
Community 2.3 to 2.2

Fire, disease, windthrow, avalanche, and/or winter desiccation create small canopy gaps for regeneration.

Transition T1
State 1 to 2

Transition to State 2 is triggered by a high mortality of white bark pine from white pine blister rust. White bark pine die slowly from white pine blister rust. The upper branches where cones are produced often succumb first; therefore regeneration is reduced long before the trees actually die. Trees weakened by white pine blister rust are more susceptible to mountain pine beetle infestations, and mortality may be high. Climate change may intensify this situation if precipitation and temperature increase. This transition may not be an immediate threat in this area, but whitebark pine has declined in much of its range due to a combination of white pine blister rust, mountain pine beetle infestations and fire suppression.

Transition R2
State 2 to 1

Restoration efforts need to be focused on re-introducing blister rust-resistant white bark pine. Seeds may need to be collected from other areas or from resistant trees nearby. Canopy openings will be needed to eliminate shade and competition from mountain hemlock.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Tree					
0	**Tree (understory only)**			3–27	
	mountain hemlock	TSME	*Tsuga mertensiana*	0–17	0–3
	whitebark pine	PIAL	*Pinus albicaulis*	3–10	1–3
Shrub/Vine					
0	**Shrub**			0–143	
	oceanspray	HODI	*Holodiscus discolor*	0–135	0–8
	marumleaf buckwheat	ERMA4	*Eriogonum marifolium*	0–6	0–4
	pinemat manzanita	ARNE	*Arctostaphylos nevadensis*	0–3	0–1
Grass/Grasslike					
0	**Grass/Grasslike**			0–25	
	squirreltail	ELEL5	*Elymus elymoides*	0–13	0–2
	western needlegrass	ACOC3	*Achnatherum occidentale*	0–11	0–2
Forb					
0	**Forb**			0–180	
	bluntlobe lupine	LUOB	*Lupinus obtusilobus*	0–175	0–12
	Davis' knotweed	PODA	*Polygonum davisiae*	0–4	0–4
	pioneer rockcress	ARPL	*Arabis platysperma*	0–1	0–1

Table 7. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)	Diameter (Cm)	Basal Area (Square M/Hectare)
Tree							
whitebark pine	PIAL	*Pinus albicaulis*	Native	–	15–35	–	–
mountain hemlock	TSME	*Tsuga mertensiana*	Native	–	5–10	–	–

Table 8. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
western needlegrass	ACOC3	*Achnatherum occidentale*	Native	–	0–2
squirreltail	ELEL5	*Elymus elymoides*	Native	–	0–2
Forb/Herb					
bluntlobe lupine	LUOB	*Lupinus obtusilobus*	Native	–	0–12
Davis' knotweed	PODA	*Polygonum davisiae*	Native	–	0–4
pioneer rockcress	ARPL	*Arabis platysperma*	Native	–	0–1
Shrub/Subshrub					
oceanspray	HODI	*Holodiscus discolor*	Native	–	0–8
marumleaf buckwheat	ERMA4	*Eriogonum marifolium*	Native	–	0–4
pinemat manzanita	ARNE	*Arctostaphylos nevadensis*	Native	–	0–1
Tree					
whitebark pine	PIAL	*Pinus albicaulis*	Native	–	1–3
mountain hemlock	TSME	*Tsuga mertensiana*	Native	–	0–3

Animal community

The seeds of whitebark pine are a nutritional food source for bears, rodents and birds. Whitebark pine and mountain hemlock provide cover and nesting sites for wildlife species. Bears have been reported to raid squirrel middens for whitebark seeds. Northern flickers and mountain bluebirds are cavity nesters that use whitebark pine trees (Howard, 2002). Various other birds eat mountain hemlock seeds. In some areas the understory provides decent forage (Tesky, 1992).

Recreational uses

This site is located on or near alpine peaks and ridges. The area is often steep but provides scenic views. Trails may need special planning to avoid erosion.

Wood products

Whitebark pine and mountain hemlock are rarely harvested for commercial uses because of inaccessibility. If harvested, mountain hemlock is usually sold with western hemlock. The wood is moderately strong and used as small lumber, pulp, interior finish, cabinetry, crates, flooring and ceilings (Tesky, 1992).

Whitebark pine is not generally harvested, and trees on this site are generally twisted and gnarled, making them unsuitable for most timber uses.

Other products

Mountain hemlock is sometimes planted as an ornamental tree.

Other information

Re-vegetation/Restoration of white pine blister rust infected areas to prevent transition to State 2:

The following restoration procedures are outlined in the U.S. Forest Service Fire Effects Information System:

1. Assess the local extent, successional status, and vigor of whitebark pine to determine if cone crops will dwindle in the future.

2. Inventory stands to document tree age, stand structure, cone production potential, and projected time of successional replacement.

3. Apply and evaluate management-ignited and wild-land for resource benefit fires designed to kill late-successional species and favor whitebark pine.

4. Conduct seed trials with white pine blister rust-resistant stock in areas where natural whitebark pine seed sources have disappeared.

Information and data for forest site productivity was not collected for tree species on this site.

Inventory data references

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

789173-type location
789292

Type locality

Location 1: Shasta County, CA	
Township/Range/Section	T30 N R4 E S11

UTM zone	N
UTM northing	4481351
UTM easting	626356
General legal description	The type locality is about 0.2 miles west-southwest from the southernmost corner of the Lassen Peak Trail parking lot.

Other references

Arno, Stephen F. and Hammerly, Ramona p. 1984. Timberline, Mountain and Artic Forest Frontiers. The Mountaneers, Seattle, WA.

Arno, Stephen F.; Hoff, Raymond J. *Pinus albicaulis*, Whitebark Pine. In: Silvics Of North America Volume 1. Conifers. U.S. Department of Agriculture, Forest Service, Agricultural Handbook 654.

Barnes, George H. 1962. Yield of even-aged stands of western hemlock. USDA, Forest Service. Pacific Northwest Forest and Range Experiment Station Technical Bulletin 1273.

Boone, Richard D.; Sollins, Phillip; and Cromack, Kermit Jr, 1988. Stand and Soil Changes Along A Mountain Hemlock Death and Regrowth Sequence. Ecology, Vol. 69, No. 3 (Jun., 1988), pp. 714-722.

Cox, Sam (2000). Management of Whitebark Pine (*Pinus albicaulis*) in North American Forest and National Parks. Colorado State University

Howard, Janet L. 2002. *Pinus albicaulis*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2004, May 18].

Means, Joseph E. *Tsuga mertensiana* (Bong.) Carr. Mountain Hemlock. In. Burns, Russell M; Honkala, Barbara H.; [Technical coordinators] 1990. Silvics of North America: Volume 1. Conifers. United States Department of Agriculture (USDA), Forest Service, Agriculture Handbook 54.

Parker, Albert J. 1991. Forest/Environment Relationships in Lassen Volcanic National Park, California, U.S.A. Journal of Biogeography, Vol. 18, No. 5, Sept., 1991. pp. 543-552.

Taylor, Alan H. 1995. Forest Expansion and Climate Change in the Mountain Hemlock (*Tsuga mertensiana*) Zone, Lassen Volcanic National Park, California, U.S.A. Artic and Alpine Research, Vol. 27, No. 3, 1995, pp. 207-216.

Tomback, Diana F., Arno, S. F., and Keane, R. E. 2001. Whitebark Pine Communities: Ecology & Restoration. Washington, D.C. Island Press.

Tesky, Julie L. 1992. *Tsuga mertensiana*. In: Fire Effects Information System, [Online].
U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2008, June 16].

Contributors

Lyn Townsend
Marchel M. Munnecke

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:**
