USDA Natural Resources Conservation Service

Ecological site F022AX100CA
Frigid, Sandy, Moist, Outwash Fan

Accessed: 04/23/2024

General information

Approved. An approved ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model, enough information to identify the ecological site, and full documentation for all ecosystem states contained in the state and transition model.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 022A–Sierra Nevada and Tehachapi Mountains

Major Land Resource Area 22A, Sierra Nevada Mountains, is located predominantly in California and a small section of western Nevada. The area lies completely within the Sierra Nevada Section of the Cascade-Sierra Mountains Province. The Sierra Nevada range has s gentle western slope, and a very abrupt eastern slope. The Sierra Nevada consists of hilly to steep mountains and occasional flatter mountain valleys. Elevation ranges between 1,500 and 9,000 ft throughout most of the range, but peaks often exceed 12,000 ft. The highest point in the continental US occurs in this MLRA (Mount Whitney, 14,494 ft). Most of the Sierra Nevada is dominated by granitic rock of the Mesozoic age, known as the Sierra Nevada Batholith. The northern half is flanked on the west by a metamorphic belt, which consists of highly metamorphosed sedimentary and volcanic rocks. Additionally, glacial activity of the Pleistocene has played a major role in shaping Sierra Nevada features, including cirques, arêtes, and glacial deposits and moraines. Average annual precipitation ranges from 20 to 80 inches in most of the area, with increases along elevational and south-north gradients. Soil temperature regime ranges from mesic, frigid, and cryic.

LRU “X” represents ecological sites driven by abiotic features that override the typical soils or climatic features that drive most of the other LRU zones. In the Sierra Nevada these sites are typically driven by water features associated with lotic or lentic riparian systems. Other features maybe shallow bedrock, or unique chemical development which affects the growth of typical vegetation.

Classification relationships

Forest Alliance = Pinus contorta ssp. murrayana – Lodgepole pine forest; Association = Pinus contorta ssp. murrayana. (Sawyer, John O., Keeler-Wolf, Todd, and Evens, Julie M. 2009. A Manual of California Vegetation. 2nd ed. California Native Plant Society Press. Sacramento, California.)

Ecological site concept

This site occurs on gently sloping meadows and forest edges on alluvial flats at elevations of approximately 6200 to 6500 feet. It often occurs in depressions between moraine features. Soils are very deep, with a weak fragipan at 12 to 65 inches and redox features at 10 to 20 inches. The fragipan creates a perched water table, so soils are saturated at shallow depths during the wet season, and droughty during the dry season. This limits the forest canopy to dominance by Sierra lodgepole pine (Pinus contorta var. murrayana), which is tolerant of both saturated and droughty soil conditions. The understory is moist meadow vegetation with willows, grasses and sedges. Lemmon's willow (Salix lemmonnii) is the most common shrub on this site.

Associated sites

F022AF002CA	**Frigid, Sandy, Or Loamy Outwash** Occurs on adjacent gently sloping outwash, moraines and outwash fans with moderatley deep to very deep soils of mixed origin. Vegetation is an open Jeffrey pine (Pinus jeffreyi) forest.
F022AF003CA	**Frigid, Loamy, Fragipan, Outwash** Occurs on adjacent gently sloping glacial outwash with very deep soils with a weak fragipan that causes a seasonally perched water table. Vegetation is a dense Sierra lodgepole pine (Pinus contorta var. murrayana) forest with a sparse grass understory.
R022AX102CA	**Frigid E-C Meadow System** Occurs on nearby low gradient Rosgen C to E type channels with broad gently sloped floodplains. Vegetation is a wet to dry meadow complex, with Lemmon's (Salix lemmonni) and Geyer willow (Salix geyeriana), sedges, grasses and forbs.

Similar sites

F022AF001CA	**Frigid Sandy Outwash Plain Gentle Slopes** Occurs on undulating outwash soils that are deep to a duripan. The depth to the duripan is variable due to undulating topography, which creates a mosaic of saturated and very droughty soils. The vegetation is a patchy Sierra lodgepole pine (Pinus contorta var. murrayana) forest, with western juniper (Juniperus grandis) scattered in shallower dry areas. Willows are absent, and only patches of grasses occur in the understory.
F022AF003CA	**Frigid, Loamy, Fragipan, Outwash** Occurs on very deep soils from outwash and alluvium from mixed sources. Soils have a weak fragipan that causes a perched water table during wet seasons and droughty conditions during dry seasons. The vegetation is dense Sierra lodegepole pine (Pinus contorta var. murrayana) forest with sparse grasses in the understory.

Table 1. Dominant plant species

Tree	(1) *Pinus contorta var. murrayana*
Shrub	(1) *Salix lemmonii*
Herbaceous	Not specified

Physiographic features

This ecological site is found on level to gently sloping meadows and forest edges on outwash and lake terraces and valley flats. It is primarily located along the southern shore of Lake Tahoe, near lake level, with elevations ranging from 6,220 to 6,500 feet.

Table 2. Representative physiographic features

Landforms	(1) Outwash terrace (2) Lake terrace (3) Valley flat
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to rare
Ponding duration	Brief (2 to 7 days)
Ponding frequency	None to frequent
Elevation	6,220–6,500 ft
Slope	0–9%
Water table depth	12–72 in
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation is 23 to 49 inches, mostly in the form of snow in the winter months (November to April). The average annual air temperature ranges from 41 to 46 degrees Fahrenheit. The frost-free (>32F) season is 20 to 90 days and the freeze-free (>28F) season is 55 to 120 days, with a median of 80 days.

Table 3. Representative climatic features

Frost-free period (average)	55 days
Freeze-free period (average)	87 days
Precipitation total (average)	36 in

Influencing water features

This site borders wetland areas, including wet meadows and marshes. The soil meets the hydric soil criteria for 2b3(http://soils.usda.gov/use/hydric/criteria.html). During the growing season, the water table can range from 12 to 24 inches. The area can be briefly flooded and ponded during times of rapid spring snowmelt.

Soil features

The soils associated with this ecological site are very deep and developed from granitic alluvium. These soils are poorly to moderately well drained with slow to moderately rapid permeability. The soil moisture regime is xeric and the soil temperature regime is frigid. Surface textures are loamy coarse sand and sandy loam. Partially decomposed organic matter overlies the mineral horizons (Oi horizon). Subsurface textures are loamy coarse sand, clay loam, fine sandy loam, sandy loam, sandy clay loam, and clay. Lower horizons have fine textures that may be buried lake sediments. Mottles from the seasonally high water table are present below 14 inches. The soils that are correlated to this ecological site are the Marla soils (Sandy, mixed, frigid Aquic Dystroxerepts) and the Ubaj soils (Fine-loamy, mixed, superactive, frigid Ultic Haploxeralfs).

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

7471 ; Marla loamy coarse sand, 0 to 5 percent slopes ; Marla ; ; 80; Ubaj ; 4
7541 ; Ubaj sandy loam, 0 to 9 percent slopes ; Ubaj ; ; 80; Marla ; 2
7011 ; Beaches ; Marla ; ; 5
7444 ; Christopher-Gefo complex, 0 to 5 percent slopes ; Marla ; ; 5; Ubaj ; ; 5
9011 ; Oxyaquic Cryorthents-Aquic Xerorthents-Tahoe complex, 0 to 15 percent slopes ; Marla ; ; 5
7431 ; Celio loamy coarse sand, 0 to 5 percent slopes ; Marla ; ; 4
7441 ; Christopher loamy coarse sand, 0 to 9 percent slopes ; Marla ; ; 2
7442 ; Christopher loamy coarse sand, 9 to 30 percent slopes ; Marla ; ; 2
7443 ; Christopher gravelly loamy coarse sand, 9 to 30 percent slopes ; Marla ; ; 2

7451 ; Gefo gravelly loamy coarse sand, 2 to 9 percent slopes ; Marla ; ; 2
7452 ; Gefo gravelly loamy coarse sand, 9 to 30 percent slopes ; Marla ; ; 2
7461 ; Jabu coarse sandy loam, 0 to 9 percent slopes ; Marla ; ; 2
7462 ; Jabu coarse sandy loam, 9 to 30 percent slopes ; Marla ; ; 2
7491 ; Oneidas coarse sandy loam, 0 to 5 percent slopes ; Marla ; ; 2
7492 ; Oneidas coarse sandy loam, 5 to 15 percent slopes ; Marla ; ; 2
7051 ; Oxyaquic Xerorthents-Water association, 0 to 5 percent slopes ; Marla ; ; 1
7411 ; Cagwin-Rock outcrop complex, 5 to 15 percent slopes, extremely stony ; Marla ; ; 1
7412 ; Cagwin-Rock outcrop complex, 15 to 30 percent slopes, extremely stony ; Marla ; ; 1
7413 ; Cagwin Rock outcrop complex, 30 to 50 percent slopes, extremely stony ; Marla ; ; 1
7414 ; Cagwin-Rock outcrop complex, 50 to 70 percent slopes, extremely stony ; Marla ; ; 1
7421 ; Cassenai gravelly loamy coarse sand, 5 to 15 percent slopes, very stony ; Marla ; ; 1
7425 ; Cassenai cobbly loamy coarse sand, moist, 5 to 15 percent slopes, very bouldery ; Marla ; ; 1
7426 ; Cassenai cobbly loamy coarse sand, moist, 15 to 30 percent slopes, very bouldery ; Marla ; ; 1

Table 4. Representative soil features

Parent material	(1) Alluvium–granite
Surface texture	(1) Loamy coarse sand
Family particle size	(1) Sandy
Drainage class	Poorly drained
Permeability class	Slow to moderately rapid
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	4–6.9 in
Soil reaction (1:1 water) (0-40in)	5.1–7.3
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This ecological site consists primarily of a forest of Sierra lodgepole pine. It is more common in the southern portion of the Lake Tahoe Basin, especially within the Upper Truckee River and Trout Creek drainages. It is currently found in narrow strips between wet meadow areas, and in drier white fir-Jeffery pine forest. The moist meadow vegetation can be found in the understory. Some wetland plants are also found in this area due to the seasonally high water table of 12 inches.

The presumed historic most successionally advanced community phase is identified as Sierra lodgepole pine/Lemmon’s willow (*Salix lemmonii*). This phase likely consisted of multi-aged stands with areas of large older open Sierra lodgepole pines with intermixed small areas of dense young seedlings. White fir (*Abies concolor*), Jeffrey pine (*Pinus jeffreyi*) and incense cedar (*Calocedrus decurrens*) were occasionally present.

Sierra lodgepole pine can tolerate harsher conditions than many other conifers—especially cold, light, heat, drought, saturation, and hardpan soils (Kocher, 2005; Lotan and Critchfield, 1990). On these montane sites, lodgepole pine grows in the cold air drainages (Agee, 1994). They are moderately tolerant to shade and competition. The thin bark and shallow root systems of lodgepole pine makes it susceptible to fire and windfall (Lotan and Critchfield, 1990). Prolonged drought and flooding can kill the trees or make them vulnerable to disease and pest outbreaks.

Fire can play an important role in thinning and renewing Sierra lodgepole forests. Studies on fire frequency in Sierra lodgepole pine forests vary from 20 to 200 years, depending on location, elevation, and precipitation (Cope, 1993; Murphy and Knopp, 2000). This area has moderate precipitation, is at mid-elevations, and has seasonal wetness. The fire interval for moderate or severe fires was likely between 70 to 100 years, and was heavily correlated with mountain pine beetle infestations and the decline of the overstory trees. Sierra lodgepole pine is the only non-serotinous lodgepole pine. Therefore it does not need fire to open its cones to release seeds. In addition to a natural fire regime, it is believed the Washoe Tribe used fire to preserve meadow environments and to keep the forests open (Murphy and Knopp, 2000).

Human disturbance regimes have altered the historic community phase and its natural cycles. Much of the lodgepole pine forest terrain was clear-cut during the Comstock era from the mid-1870s to the mid-1890s although small scale logging occurred in sections from 1911 to the 1970s (Murphy and Knopp, 2000). Intense sheep and cattle grazing began as early as 1850, especially in the meadows. In 1924, fire exclusion became national policy (Murphy and Knopp, 2000), which led to an increase in forest density as well as the buildup of fuel in both the overstory and the understory. These disturbances and fire exclusion created lodgepole pine forests which are generally young, overcrowded, and do not necessarily resemble the historic forest.

The reference state consists of the most successionally advanced community phase (numbered 1.1) as well as other community phases that result from natural and human disturbances. Community phase 1.1 is deemed the phase representative of the most successionally advanced pre-European plant/animal community including periodic natural surface fires that influenced its composition and production. Because this phase is determined from the oldest modern day remnant forests and/or historic literature, some speculation is necessarily involved in describing it.

All tabular data listed for a specific community phase within this ecological site description represent a summary of one or more field data collection plots taken in communities within the community phase. Although such data are valuable in understanding the phase (kinds and amounts of ground and surface materials, canopy characteristics, community phase overstory and understory species, production and composition, and growth), it typically does not represent the absolute range of characteristics nor an exhaustive listing of species for all the dynamic communities within each specific community phase.

State and transition model

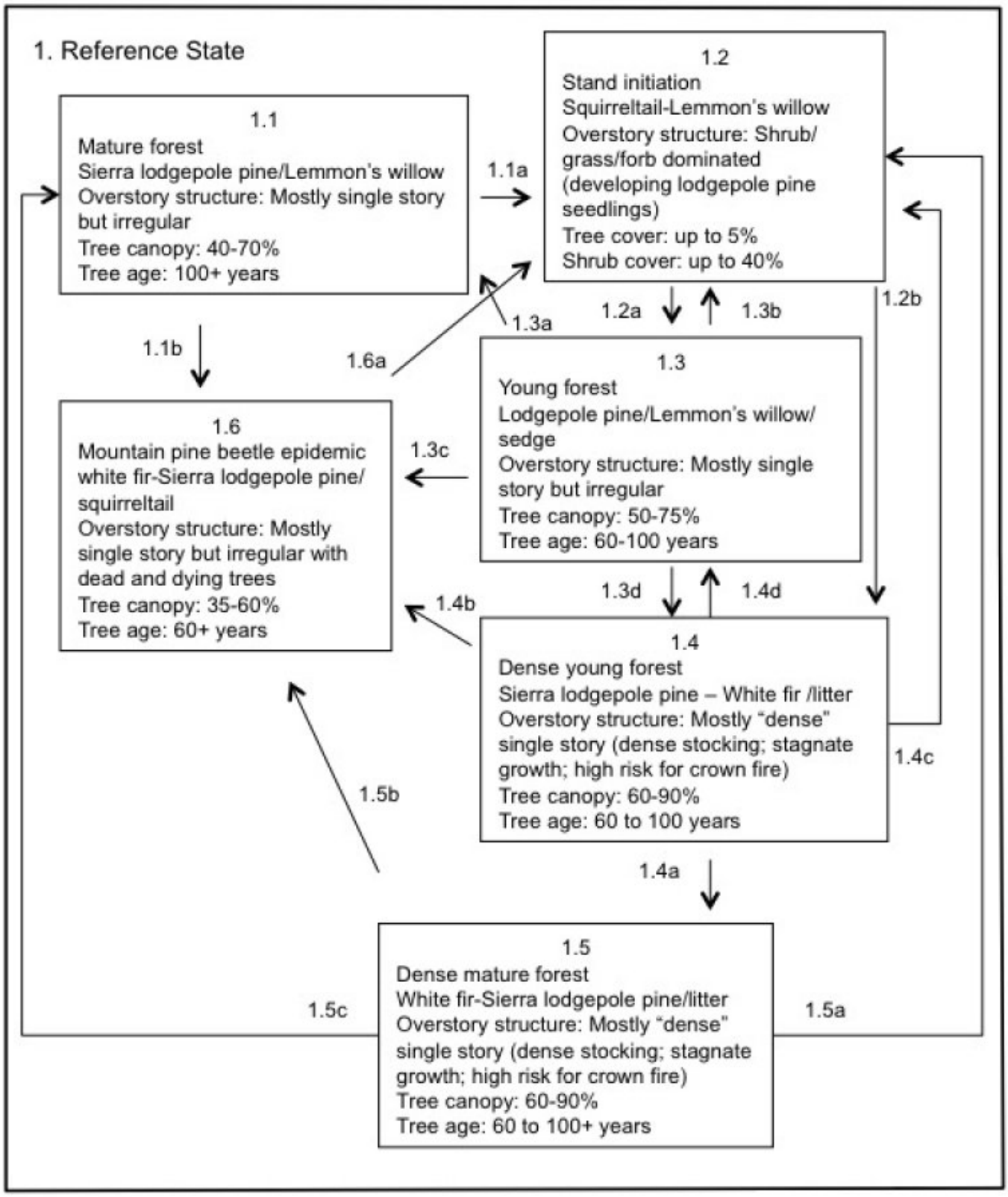

Figure 6. F022AX100CA

State 1
Reference

Community 1.1
Mature forest

Figure 7. Community Phase 1.1

The historic most successionally advanced community phase was presumed to be open old-growth stands of predominantly Sierra lodgepole pine occasional scattered white fir, Jeffrey pine and incense cedar, with establishment of secondary conifers limited by frost and high water table levels. The age for this community is estimated to have ranged from 100 to more than 200 years between disturbances. Stand-replacing fires would have initially established an even-aged forest. However, minor disturbances, such as windfall and insect infestation would have eventually led to openings, tree regeneration, and a mosaic of developing small stands forming an overall multi-aged forest. The understory cover was probably moderate in the openings with Lemmon's willow, grasses, and sedges making up the majority of species.

Forest overstory. The overstory in this multi-aged forest is open, rarely exceeding 65 percent canopy cover. Mature Sierra lodgepole pine dominates with a cover ranging from 35 to 65 percent, with an average of 45 percent. White fir, Jeffrey pine, and incense cedar are occasionally present with low cover.

Forest understory. The understory of these sites consists of primarily grasses and willows and species composition is variable. The open canopy allows a high diversity of herbaceous species and graminoids.

Community 1.2
Stand initiation

This community may be dominated for a short time by Lemmon's willow, grasses and forbs. Lemmon's willow can resprout from the rootcrown or stembase after a fire. Several species of grasses and forbs, including bentgrasses and bromes, may regenerate from seed. Willow and grasses can have a potentially high cover. Remnant overstory lodgepole pines may be present in limited numbers. Sierra lodgepole pine will regenerate from wind dispersed seed. The seeds will readily germinate in the spring in the mineral soil exposed by fire or scarification but require moist soil and full sun to establish in the first season. The seedlings develop into pole sized trees, with up to 40 percent canopy cover.

Forest overstory. If there is ample moisture and sunlight, Sierra lodgepole pine seedlings will germinate in thick patches in the spring following a fire or clear-cut.

Forest understory. Native grases and lemmon's willow can have high cover in this area.

Community 1.3
Young forest

This phase is dominated by an overstory of young Sierra lodgepole pine forest. White fir may germinate during this time in the shade of the young lodgepole pine and small shrubs. The estimated duration for this phase is up to approximately 60 years. Canopy increases with age and growth slows near the upper age of the phase.

Community 1.4
Dense young forest

The dense phase of the young forest develops in the absence of canopy disturbance. Periods without fire, windthrow, or pest ourbreaks maintain a closed overstory canopy. White fir and incense cedar seedlings are more shade tolerant than lodgepole pine seedlings, which allows them to continue to reproduce in the understory of the lodgepole pine canopy. The density of white fir increases over time and creates competition with lodgepole pine for sunlight and water. This stress makes the forest more susceptible to death from pests and drought, which in turn increases the fuel loads and potential for severe fires. It appears that this site is not a conducive environment for the optimal growth of white fir. This is primarily due to the properties of the soil, the high water table, and the high frequency of frost. However, in some areas within this site, white fir is present and reproducing well.

Community 1.5
Dense mature forest

The mature dense forest will develop with the continued exclusion of fire, allowing white fir to reach the upper canopy and gain dominance over lodgepole pine. Competition for water and sunlight will cause the health and vigor of Sierra lodgepole pine to decline. An estimated age for this community phase ranges from 60 to more than 200 years. However, drought, pest attacks and water table fluctuations are disturbances likely to decimate this phase.

Community 1.6
Mountain pine beetle epidemic

Standing dead Sierra lodgepole pine forests can result following disease or pest outbreaks, sometimes in combination with prolonged drought or flooding. Large patches of forest remain standing dead for many years until fire or manual treatment remove the dead trees and surface fuels. If surface fuels are not too high, grasses and forbs may grow in the understory and in openings.

Pathway 1.1a
Community 1.1 to 1.2

In the event of a severe canopy fire, or a clear-cut with or without a prescribed burn, phase 1.1 would quickly develop into phase 1.2, the stand initiation phase. Sierra lodgepole pine is susceptible to death from fire at any age because of their thin bark and shallow root systems (Kocher, 2005).

Pathway 1.1c
Community 1.1 to 1.4

This pathway occurs with fire suppression.

Pathway 1.1b
Community 1.1 to 1.5

Plant community phase 1.1 may develop into phase 1.6 with the infestation of pests. The primary threat to Sierra lodgepole pines from pest invasion is from the mountain pine beetle (Dendroctonus ponderosae). Infestations can

lead to a high mortality rate, sometimes leaving a stand of dead trees, and causing high fuel loads. Natural outbreaks of variable severity tend to occur every 20 to 40 years (Cope, 1993).

Pathway 1.2a
Community 1.2 to 1.3

Phase 1.2 will naturally move to phase 1.3 if given time without major disturbances. This pathway is facilitated with a natural fire regime and small scale canopy disturbances. An open multi-age forest develops (Community Phase 1.3). Reports vary on the natural fire return interval, but this pathway assumes that surface fires are relatively frequent with 20 to 40-year cycles (Cope 1993). Manual thinning with prescribed burns can imitate the natural cycle and lead to the same relatively open community.

Pathway 1.2b
Community 1.2 to 1.4

This pathway occurs with fire suppression that prevents thinning necessary for the natural patchy structure of this ecological site. Lack of ground fire allows white fir and incense cedar to establish and gain maturity in the understory.

Pathway 1.3a
Community 1.3 to 1.1

The natural shift for this phase is to grow and develop into community phase 1.1. This pathway evolved with a historic fire regime of occasional surface and moderately severe fires, with occasional pest outbreaks that can lead to partial tree death. Manual thinning or prescribed burning can be implemented to replace the natural disturbances that kept this forest relatively open.

Pathway 1.3b
Community 1.3 to 1.2

In the event of a canopy fire, this phase would quickly return to phase 1.2

Pathway 1.3c
Community 1.3 to 1.4

This pathway occurs with fire suppression that prevents thinning necessary for the natural patchy structure of this ecological site. Lack of ground fire allows white fir and incense cedar to continue to establish and gain maturity in the understory.

Pathway 1.3d
Community 1.3 to 1.6

This phase can transition to phase 1.6 with the infestation of pests. The primary threat to Sierra lodgepole pines from pest invasion is from the mountain pine beetle (Dendroctonus ponderosae). Infestations can lead to a high mortality rate, leaving a forest of standing dead trees, and causing high fuel loads. Natural outbreaks of variable severity tend to occur every 20 to 40 years (Cope, 1993).

Pathway 1.4c
Community 1.4 to 1.2

In the event of a severe canopy fire or clear-cut/scarification, phase 1.2 would develop.

Pathway 1.4a
Community 1.4 to 1.5

With continued fire suppression, this phase will transition to a dense mature forest.

Pathway 1.4b
Community 1.4 to 1.6

This phase can transition to phase 1.6 with the infestation of pests. The primary threat to Sierra lodgepole pines from pest invasion is from the mountain pine beetle (Dendroctonus ponderosae). Infestations can lead to a high mortality rate; leaving a forest of standing dead trees, and causing high fuel loads. Natural outbreaks of variable severity tend to occur every 20 to 40 years (Cope, 1993).

Pathway 1.5c
Community 1.5 to 1.1

A naturally occurring moderate or surface fire in this forest is unlikely due to the high fuel load. Considerable management effort would be needed to create the open forest conditions that should exist in this forest with a natural fire regime. Manual treatment or prescribed burns could thin out dense Sierra lodgepole pine, white fir and incense cedar. This would shift this forest back to its natural state of open, patchily distributed Sierra lodgepole pine forest (Community phase 1.1).

Pathway 1.5a
Community 1.5 to 1.2

Ladder fuels and the density of fuels formed from the dead and dying white fir in the mid and lower canopies create conditions suitable for a high intensity canopy fire, which would initiate regeneration similar to that seen in phase 1.2. Because of the likely proximity of a white fir seed source, further treatments would be needed to promote the predominance and reestablishment of Sierra lodgepole pines.

Pathway 1.5b
Community 1.5 to 1.6

A high mortality pest attack on white fir and lodgepole pine, drought or above normal water tables could create a dead and dying forest with conditions and fuel loadings similar or heavier than phase 1.6.

Pathway 1.6a
Community 1.6 to 1.2

After a prolonged period, this phase will progress to phase 1.2. Severe fire will accelerate this succession. Fire is the natural disturbance at this point in the Sierra lodgepole pine cycle and will allow for the regeneration of the open lodgepole pine forest seen in phase 1.3. Mechanical removal of the dead trees with partial scarification of the surface or a prescribed burn in the understory can also induce stand regeneration.

Additional community tables

Table 5. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
Sierra lodgepole pine	PICOM	*Pinus contorta var. murrayana*	Native	–	27–50	–	–
white fir	ABCO	*Abies concolor*	Native	–	5–10	–	–
Jeffrey pine	PIJE	*Pinus jeffreyi*	Native	–	3–5	–	–
incense cedar	CADE27	*Calocedrus decurrens*	Native	–	0–2	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
bentgrass	AGROS2	*Agrostis*	Native	–	3–7
California brome	BRCA5	*Bromus carinatus*	Native	–	1–3
sedge	CAREX	*Carex*	Native	–	0–2
Forb/Herb					
Torrey's blue eyed Mary	COTO	*Collinsia torreyi*	Native	–	–
cryptantha	CRYPT	*Cryptantha*	Native	–	–
ragwort	SENEC	*Senecio*	Native	–	–
checkerbloom	SIDAL	*Sidalcea*	Native	–	–
mayflower	MAIAN	*Maianthemum*	Native	–	–
yampah	PERID	*Perideridia*	Native	–	–
Shrub/Subshrub					
Lemmon's willow	SALE	*Salix lemmonii*	Native	–	3–7
currant	RIBES	*Ribes*	Native	–	0–2
Virginia rose	ROVIV2	*Rosa virginiana var. virginiana*	Native	–	–
Tree					
Sierra lodgepole pine	PICOM	*Pinus contorta var. murrayana*	Native	–	3–7
white fir	ABCO	*Abies concolor*	Native	–	3–7
incense cedar	CADE27	*Calocedrus decurrens*	Native	–	–

Animal community

These forests provide cover at the edges of meadows and riparian corridors. There are many mammals including bear, deer, and squirrels, as well as almost 50 bird species that use Sierra lodgepole pine forests for food, cover, and habitat. Dead or dying trees provide nesting sites for cavity-nesting birds. The fallen branches from these trees also provide sites for ground-nesting birds and mammals. The seeds are a food source for squirrel, chipmunk, birds, and mice (Cope, 1993).

Recreational uses

This site is primarily used for hiking trails along streams and meadows.

Wood products

The wood is suited for common lumber grades and has potential for structural particle board. It can also be used for light framing materials, interior paneling, exterior trim, posts, railroad ties, pulp, and paper. The uniform size of Sierra lodgepole pine makes harvesting efficient (Cope, 1993). In this area, the pole-sized trees may be useful as fence material, but this open lodgepole community would not be very productive for commercial harvest.

Other products

All willows produce salacin, which is closely related chemically to aspirin. Native Americans used various preparations from willows to treat toothache, stomachache, diarrhea, dysentery, and dandruff. Native Americans also used flexible willow stems for making baskets, bows, arrows, scoops, fish traps, and other items (Uchytil, 1989).

Other information

Site index documentation:

Alexander (1966), Schumacher (1926), and Meyer (1961) were used to determine forest site productivity for lodgepole pine, white fir and Jeffrey pine, respectively. Low to High values of Site index and CMAI (culmination of mean annual increment) give an indication of the range of inherent productivity of this ecological site. Site index relates to height of dominant trees over a set period of time and CMAI relates to the average annual growth of wood fiber in the boles/trunks of trees. Site index and CMAI listed in the Forest Site Productivity section are in units of feet and cubic feet/acre/year, respectively. Both site index and CMAI are estimates; on-site investigation is recommended for specific forest management units for each soil classified to this ecological site. The historical and actual basal area of trees within a growing stand will greatly influence CMAI.

Trees appropriate for site index measurement typically occur in stands of community phases 1.4 and 1.6. Site trees are selected according to guidance in the cited publications. Please refer to the Tahoe Basin Area Soil Survey for detailed site index information by soil component.

Table 7. Representative site productivity

Common Name	Symbol	Site Index Low	Site Index High	CMAI Low	CMAI High	Age Of CMAI	Site Index Curve Code	Site Index Curve Basis	Citation
white fir	*ABCO*	55	55	109	109	70	030	–	
Sierra lodgepole pine	*PICOM*	80	80	88	88	100	520	–	
Jeffrey pine	*PIJE*	80	80	69	69	40	600	–	

Inventory data references

The following NRCS plots were used to describe this ecological site.

Co03013
Ev0201
lo03310
101
106
107
108

Other references

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Contributors

Alice Miller
Josie Crawford, Marchel Munnecke
Lyn Townsend
Marchel 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):**

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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:**