## Subalpine Conifer (SCN)

**General Information**

**Cover Type Overview**

**Subalpine Conifer (SCN)**

* 1,569.88 acres / 635.31 hectares
* Crosswalk to EVeg: Regional Dominance Type 1
  + Alpine Mixed Scrub
  + Mountain Hemlock
  + Subalpine Conifers
  + Whitebark Pine
* Crosswalk to EVeg: Regional Dominance Type 2
  + Any
* Crosswalk to Presettlement Fire Regime Type
  + Subalpine
* Crosswalk to LandFire Biophysical Settings
  + 0610330 Mediterranean California Subalpine Woodland
  + 0610440 Northern California Mesic Subalpine Woodland\*
  + 0610710 Sierra Nevada Alpine Dwarf-Shrubland

**Subalpine Conifer with Aspen (SCN-ASP)**

* ? acres / ? hectares
* This type is created by overlaying the NRIS TERRA Inventory of Aspen on top of the EVeg layer. Where it intersects with SCN it is assigned to SCN-ASP.

**Vegetation Description**

**Subalpine Conifer (SCN)** The subalpine landscape is comprised of a mosaic of subalpine forests/woodlands, meadows, rock outcrops, and scrub vegetation types. Subalpine forests are open stands of conifers occurring on generally sandy soils or rocky slopes at elevations above the upper montane forest stands of *Abies magnifica* and *Pinus contorta* ssp. *murrayana*. Stand densities are low. Many, but not all, species form shrubby krummholz forms of growth near their upper elevational limits (Fites-Kaufman 2007).

*Tsuga mertensiana* is often the most common tree species and mixes with *P. contorta* ssp. *murrayana*, *A. magnifica*, and *Pinus monticola*. In some areas, *P. contorta* ssp. *murrayana* dominates post-disturbances stands. *T. mertensiana* seedlings are relatively shade tolerant compared to other subalpine conifers and do well under closed canopy conditions. *P. albicaulis* presence increases in the southern portion of the project area (Fites-Kaufman 2007, LandFire 2007a).

Treeline growth of multistemmed trees and shrubby krummholz growth of conifers varies with latitude in the Sierra Nevada. Treeline in the northern Sierra Nevada is dominated by *Pinus albicaulis*, which frequently occurs with a krummholz form of growth near its upper limit. Several other species may also form krummholz growth forms, including Sierra juniper, *Tsuga mertensiana, P. contorta* ssp. *murrayana*, and rarely *Pinus jeffreyi* (Fites-Kaufman 2007).

Although typically of minor importance, a shrub understory may include *Arctostaphylos, Ribes, Phyllodoce, Vaccinium,* and *Kalmia* can occur on moist sites. Herbs present may include *Lupinus, Hieracium, Arabis, Aster,* and *Erigeron. Carex* and various grasses are also common in the sparse ground cover (Verner and Purcell 1988, LandFire 2007a).

**Subalpine Conifer with Aspen (SCN-ASP)** When *Populus tremuloides* co-occurs with LPN on the west side of the Sierran crest, it is typically found in smaller patches, often less than 2 ha (5 acres) in size. Mature stands in which *P. tremuloides* are still dominant are usually relatively open. Average canopy closures range from 60 to 100 percent in young and intermediate-aged stands and from 25 to 60 percent in mature stands. The open nature of the stands results in substantial light penetration to the ground (Verner 1998).

**Distribution**

**Subalpine Conifer (SCN)** The elevational distribution of subalpine forest communities varies with latitude. In the northern Sierra Nevada, such stands begin around 2,450 m and extend up to treeline at 2,750 to 3,100 m (9,000 to 11,000 ft). Both upper and lower limits of subalpine species distributions are driven by a variety of factors, including soil resources, water availability, and climatic limiting factors (Fites-Kaufman 2007).

Subalpine forests are characterized by a relatively short growing season with cool temperatures. With the exception of occasional summer thunderstorms, most precipitaiton falls as snow. Wet years with abundant snowfall can limit growth as these may produce late-lying snowfields that reduce the length of the growing season. Winds are often severe, particularly around exposed ridges. Such wind conditions may produce snow-free winter areas that lower soil temperatures and increase plant water stress (Fites-Kaufman 2007).

Because of the solid granite parent material, areas with deeper soil accumulation can become waterlogged for much of the year. For these reasons, the length of the growing season is a function of early season limitation due to low temperatures and snowfields, and late season limitations due to drough. Studies of the dynamics of alterations of treeline elevation over the past several millennia have reinforced the significance of complex interactions of both temperature and water availability in determining such changes (Fites-Kaufman 2007).

**Subalpine Conifer with Aspen (SCN-ASP)** Sites supporting *P. tremuloides* are associated with added soil moisture, i.e., azonal wet sites. These sites are often close to streams, lakes, and meadows. Other sites include rock reservoirs, springs and seeps. Terrain can be simple to complex. At lower elevations, topographic conditions for this type tends toward positions resulting in relatively colder, wetter conditions within the prevailing climate, e.g., ravines, north slopes, wet depressions, etc. (LandFire 2007c).

**Disturbances**

**Wildfire**

**Subalpine Conifer (SCN)** Most of the subalpine areas of the Sierra Nevada were subjected to repeated glaciation during the Pleistocene, and thus have thin and poorly developed soils with little organic matter. The small amounts of litter accumulation and open stand structure of subalpine forests mean that fire is rare (Fites-Kaufman 2007). It is, however, the major disturbance event of this type, and generally stand-replacing when it does occur, since the major tree species are highly susceptible to fire mortality (LandFire 2007a).

Estimates of wildfire return interval range from 100 to over 500 years. Van de Water and Safford (2011) found a mean fire return interval of 133 years, a median of 132 years, a mean min of 100 years and a mean max of 420 years for subalpine forest. The LandFire model for northern Sierra Nevada subalpine woodland predicts an average FRI of 321 years. Replacement FRI averages 500 years, while mixed severity FRI is 900 years, and low severity fire is not modeled (2007a). We recalculated these numbers using condition-specific information and using only high and low mortality fire categories, which resulted in an interval of 500 years for high mortality fire, 923 years for low mortality fire, and 324 years for any fire.

**Subalpine Conifer with Aspen (SCN-ASP)** Sites supporting *P. tremuloides* are maintained by stand-replacing disturbances that allow regeneration from below-ground suckers. Upland clones are impaired or eliminated by conifer ingrowth resulting in overtopping and by intensive grazing that limits the transition from seedling to sapling. If aboveground *P. tremuloides* on upland sites disappears completely (site overtaken by conifers) due to prolonged absence of disturbance, then restoration to a *P. tremuloides* condition is not a viable pathway. In a reference condition scenario, a few stands will advance toward conifer dominance, but in the current landscape scenario where fire has been reduced from reference conditions there are many more conifer-dominated mixed aspen stands (LandFire 2007c).

Van de Water and Safford (2011) found a mean fire return interval of 19 years, median of 20 years, mean min interval of 10 years and mean max of 90 years for Aspen. The LandFire model for northern Sierra Nevada aspen that is seral to conifers predicts an average FRI of 37 years. Replacement FRI averages 150 years with a range of 50-300 years, while mixed severity FRI is 250 years, and low severity fire FRI is 60 years (2007c). We recalculated these numbers using condition-specific information and using only high and low mortality fire categories, which resulted in an interval of 94 years for high mortality fire, 58 years for low mortality fire, and 36 years for any fire.

Table 1. Fire return intervals (years) and percentage of high versus low mortality fires in relation to soil type modifier and the presence of *Populus tremuloides*. Numbers for SCN were derived from BpS model 0610XXX and Van de Water and Safford (2011). Numbers for SCN -ASP were derived from BpS model 0610610 and Van de Water and Safford (2011).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variant** | **Fire Severity** | **Average** | **Min** | **Max** | **% of Fires** |
| SCN | High | 500 |  |  | 65 |
| Low | 923 |  |  | 35 |
| All Fires | 324 | 100 | 420 |  |
| SCN -ASP | High | 94 |  |  | 38 |
| Low | 58 |  |  | 62 |
| All Fires | 36 | 5 | 90 |  |

**Other Disturbance**

Other disturbances are not currently modeled, but may, depending on the condition affected and mortality levels, reset patches to early development, maintain existing stages, or shift/accelerate succession to a more open stage.

**Vegetation Condition Classes**

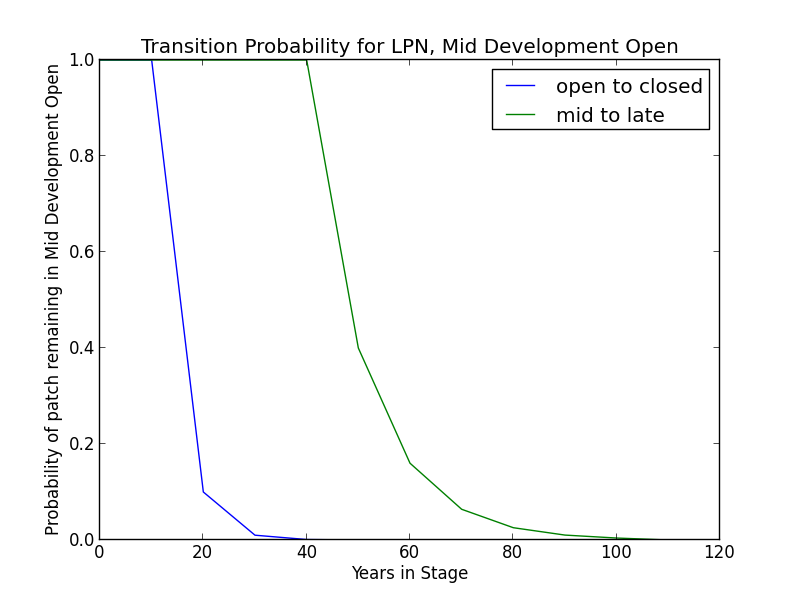
**Early Development (ED)**

**Description** The first few years following stand-replacing wildfire are characterized by bare ground, herbs, shrubs, and varying densities of tree seedlings (presumably dependent on seed sources). Dominant species include coniferous tree seedlings, resprouting grasses and shrubs, and invading herbs. Shrubs include *Ribes* spp. Herbs and grasses include *Aster*, *Pedicularis*, *Hieracium*, *Arabis*, *Erigeron*, *Carex*, *Luzula*, and *Poa* (LandFire 2007a).

**Succession Transition** In the absence of disturbance, this class will begin transitioning to mid development after 20 years. The probability of succession per time step is 0.6. Transition to either MDC or MDO can occur, although transition to MDC occurs 90% of the time. At 80 years, all stands will have succeeded.

**Wildfire Transition** High mortality wildfire (100% of fires) recycles the patch through the Early Development stage. Low mortality wildfire is not modeled for this stage.

**Mid Development - Open (MDO)**

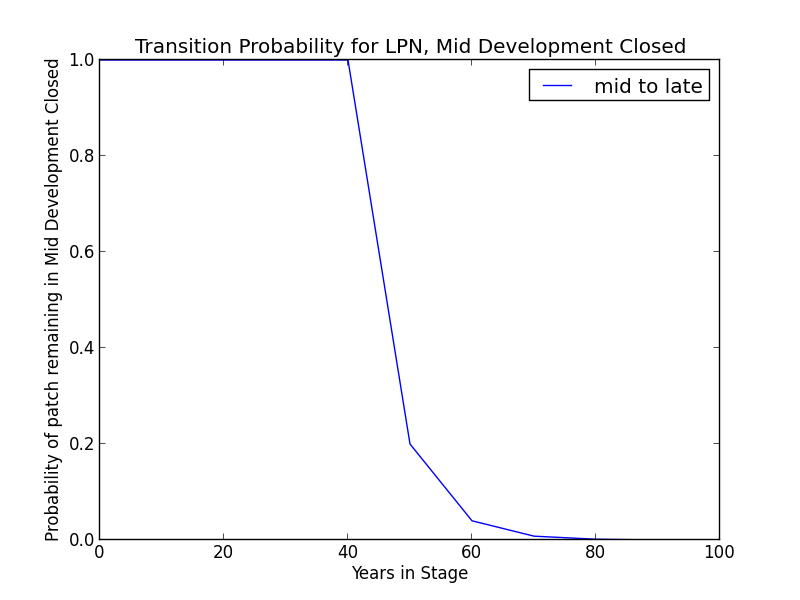


**Description** This class represents delayed tree regeneration and long-term domination by shrubs and herbs. Shrubs include *Ribes* spp. Herbs and grasses include *Aster*, *Pedicularis*, *Hieracium*, *Arabis*, *Erigeron*, *Carex*, *Luzula*, and *Poa*. Trees are represented by seedlings and saplings of *T. mertensiana, P. contorta* ssp. *murrayana*, and other species (LandFire 2007a).

**Succession Transition** This class will maintain under low mortality disturbance, but after 60 years without fire it begins transitioning to LDO with a probability of 0.5 per time step. Succession to the Late Development stages begin once the age since transition to a mid-development class for that patch is at least 60 years, even if the patch has shifted between open and closed mid development classes. After 150 years, all stands will have succeeded.

**Wildfire Transition** High mortality wildfire (60% of fires) recycles the patch through the Early Develop- ment stage. Low mortality wildfire (40%) maintains the patch in MDO.

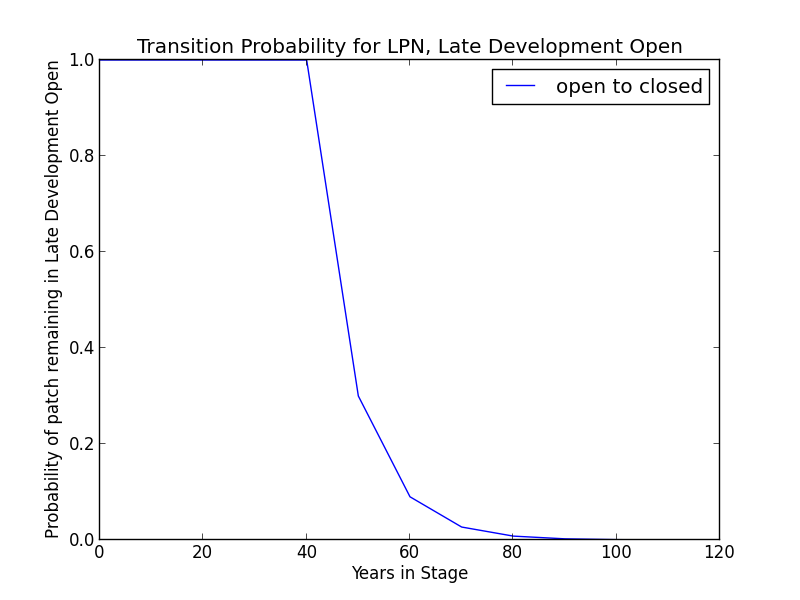
**Mid Development - Closed (MDC)**

**Description** This class represents rapid regeneration by *P. contorta* ssp. *murrayana*, with additional conifers coming in including *T. mertensiana, A. magnifica,* and *P. monticola.* Shrubs include *Ribes* spp. Herbs and grasses include *Aster*, *Pedicularis*, *Hieracium*, *Arabis*, *Erigeron*, *Carex*, *Luzula*, and *Poa*. (LandFire 2007a).

**Succession Transition** After 60 years without a wildfire-triggered transition, this class will begin transitioning to LDC. Patches moving between MDC and MDO begin transitioning after 60 years since transition to mid development. The probability of succession per time step is 0.8. After 150 years, all stands will have succeeded.

**Wildfire Transition** High mortality wildfire (66.7% of fires) recycles the patch through the Early Development stage. Low mortality wildfire (33.3%) triggers a transition to MDO.

**Late Development - Open (LDO)**

**Description** This class represents late-successional stands with large individuals (greater than 20in DBH) of *T. mertensiana* and other species, with open stand structure maintained by mixed severity fire and insect-caused tree mortality. Shrubs include *Ribes* spp. Herbs and grasses include *Aster*, *Pedicularis*, *Hieracium*, *Arabis*, *Erigeron*, *Carex*, *Luzula*, and *Poa*. (LandFire 2007a).

**Succession Transition** In absence of fire or insect mortality natural succession to LDC occurs after 80 years at a probability of 0.8 per timestep.

**Wildfire Transition** High mortality wildfire (60% of fires) recycles the patch through the Early Development stage. Low mortality wildfire (40%) maintains the patch in LDO.

**Late Development - Closed (LDC)**

**Description** This class represents late-successional stands with large individuals (greater than 20in DBH) of *T. mertensiana* and other species, advanced regeneration of *T. mertensiana* and other shade tolerant species, and typical understory species. Shrubs include *Ribes* spp. Herbs and grasses include *Aster*, *Pedicularis*, *Hieracium*, *Arabis*, *Erigeron*, *Carex*, *Luzula*, and *Poa*. (LandFire 2007a).

**Succession Transition** This class will maintain in the absence of disturbance.

**Wildfire Transition** High mortality wildfire (66.7% of fires) recycles the patch through the Early Development stage. Low mortality wildfire (33.3%) maintains the patch in LDC.

**Aspen Variant**

**Early Development – Aspen (ED–A)**

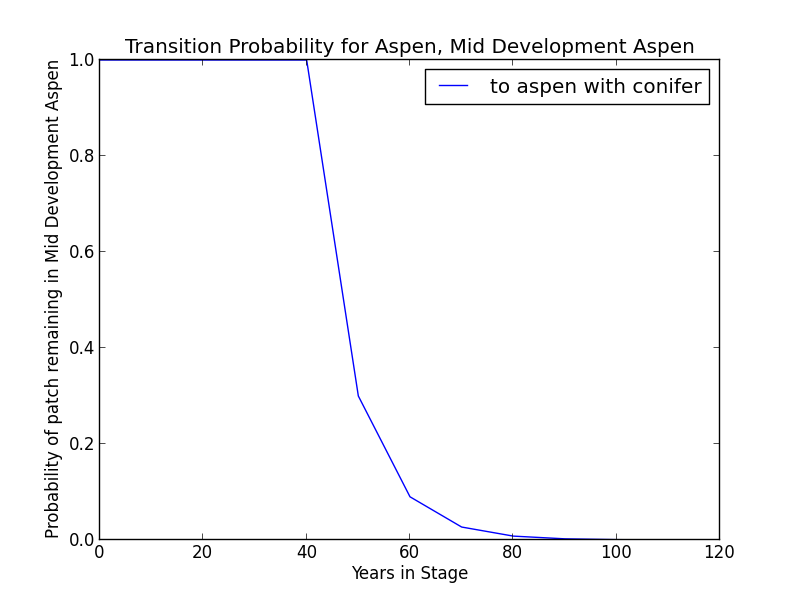
**Description** Grasses, forbs, low shrubs, and sparse to moderate cover of tree seedlings/saplings (primarily *P. tremuloides*) with an open canopy. This condition is characterized by the recruitment of a new cohort of early successional, shade-intolerant tree species into an open area created by a stand-replacing disturbance.

Following disturbance, succession proceeds rapidly from an herbaceous layer to shrubs and trees, which invade together (Verner 1988). *P. tremuloides* suckers over 6ft tall develop within about 10 years (LandFire 2007c).

**Succession Transition** Unless it burns, a patch in the early stage persists for 10 years, at which point it transitions to MD-A.

**Wildfire Transition** High mortality wildfire (100% of fires) recycles the patch through the Early Development – Aspen stage. Low mortality wildfire is not modeled for this stage.

**Mid Development – Aspen (MD–A)**

**Description** *P. tremuloides* trees 5-16” DBH. Canopy cover is highly variable, and can range from 40-100%. These patches range in age from 10 to 150 years and could maintain indefinitely. Some understory conifers, predominantly *T. mertensiana,* are encroaching, but *P. tremuloides* is still the dominant component of the stand (LandFire 2007c).

**Succession Transition** MD-A persists for at least 50 years in the absence of fire, after which stands begin transitioning to MD-AC at a rate of 0.7 per timestep. At age 100 all remaining MD-A patches transition to MD-AC.

**Wildfire** **Transition** High mortality wildfire (100% of fires) recycles the patch through the Early Development – Aspen stage. Low mortality wildfire is not modeled for this stage.

**Mid Development – Aspen with Conifer (MD–AC)**

**Description** These stands have been protected from fire for at least 100 years. *P. tremuloides* trees are predominantly 16” DBH and greater. Conifers (predominantly *T. mertensiana*) are present and overtopping the aspen. Conifers are pole to medium-sized, and conifer cover is at least 40% (LandFire 2007c).

**Succession Transition** MD-AC persists for 100 years in the absence of fire, after which stands transition to LDC.

**Wildfire Transition** High mortality wildfire (28.4% of fires) returns the patch to ED-A. Low mortality wildfire (71.6%) maintains the patch in MD- AC.

**Late Development – Closed (LDC)**

**Description** Some *P. tremuloides* continue to be present in the understory, but large *T. mertensiana* are now the dominant tree species, having overtopped the *P. tremuloides.* Smaller conifers are present in the midstory as well (LandFire 2007a).

**Succession Transition** This class will maintain in the absence of disturbance.

**Wildfire Transition** High mortality wildfire (31.2% of fires) will return the patch to Early Development - Aspen. Low mortality wildfire (68.8%) maintains the current condition.

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