Conifer Habitats

Climate Change Vulnerability, Adaptation Strategies, and Management Implications in Southern California National Forests


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Habitat Description

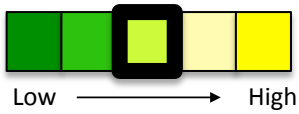
In southern California, conifer habitats occur across a wide elevational gradient, ranging from closed-cone pine and cypress stands on coastal bluffs to pine stands on high-elevation mountaintops. The spatial arrangement of conifer habitats is dynamic, and strongly influenced by climatic gradients, topography, latitude, distance from the coast and/or desert, disturbances, and understory composition. These habitats are dominated by coniferous species, although hardwoods may also be present in some habitat types.

Habitat Vulnerability

Sensitivity & Exposure

Conifer and mixed conifer habitats are sensitive to decreases in water availability, and moisture-stressed trees are more vulnerable to additional stressors, including insect outbreaks, disease, and pollution. Dead or dying trees can exacerbate wildfire by providing additional fuel, and wildfire may accelerate shifts in species composition by extirpating local populations, promoting fire-tolerant species or habitat types, and creating conditions suitable for invasive species. Conifer habitats are also sensitive to non-climate stressors (e.g., air pollution) that can exacerbate the impacts of climate change.

Moderate Vulnerability



Drivers of Conifer Habitats

- Climate sensitivities: Drought, precipitation, snowpack depth, and soil moisture
- Disturbance regimes: Wildfire, insects, wind
- Non-climate sensitivities: Fire suppression practices, land use conversion

Projected Climate and Climate-Driven Changes	Potential Impacts on Conifer Habitats
Changes in precipitation, decreased soil moisture, & increased drought *Variable annual precipitation volume and timing; longer, more severe droughts twice as likely to occur*	• Decreased growth and seedling survival • Increased competition for water, especially in dense stands • Reduced forest extent and/or shifts in species composition • Widespread tree mortality exacerbated by other stressors
Increasing air temperature/extreme heat *+2.5 to +9°C by 2100; heat waves will occur more frequently at higher temperatures and last longer*	• Longer growing seasons and changes in phenology • Increased growth in high-elevation sites • Increases in heat-tolerant species such as ponderosa pine
Earlier timing of snowmelt/runoff *Snowmelt and peak runoff occurring 1-3 weeks earlier*	• Increased dependency on spring precipitation events • Reduced soil moisture during summer months • Earlier start to growing season where snowmelt typically limits length of season
Altered wildfire regimes *Increased fire size, frequency, and severity*	• Shifts in species composition and reduced forest extent • Stand extirpation where fire severity and/or frequency does not allow regeneration requirements to be met

Adaptive Capacity

Factors that enhance adaptive capacity:

+ Widespread habitat type with many large forest areas are already preserved
+ Diverse spatial distribution and species composition
+ Supports rare and/or endemic species (e.g., Laguna Mountains skipper)
+ Provides many ecosystem services: water supply, recreation, flood and erosion protection

Factors that undermine adaptive capacity:

- Anthropogenic disturbance is high, especially in coastal regions
- Low connectivity between high-elevation sites
- Slow rate of forest regeneration after disturbance
- Some endemic species have patchy distribution and low genetic diversity, making them vulnerable to extirpation (e.g., Torrey pine)

Adaptation Strategies for Conifer Habitats

Photo by Tom Mendelhall (Public Domain)

What kinds of adaptation options are there?

Enhance Resistance ➔ Prevent climate change from affecting a resource

Promote Resilience ➔ Help resources weather climate change impacts by avoiding the effects of or recovering from changes

Facilitate Transition ➔ Accommodate change and/or enable resources to adaptively respond to variable conditions

Increase Knowledge ➔ Gather information about climate impacts and/or management effectiveness in addressing climate change challenges

Engage Collaboration ➔ Coordinate efforts and capacity across landscapes and agencies

Adaptation Category	Adaptation Strategy	Specific Management Actions*
Enhance Resistance	Prevent stand-replacing wildfire	• Focus thinning activities in areas where fire is most likely to carry up from neighboring habitats (e.g., chaparral or oak woodland) • Increase fire permit restrictions for recreation users
	Ensure survival of seedlings after habitat restoration efforts	• Create barriers (e.g., tree tubes, K-rails) between habitat restoration areas and key human ignition sources
Promote Resilience	Facilitate regeneration of montane conifer forest	• Thin overly dense stands and/or those that are mostly single-species and uniform in age, in order to reduce competition • Use nurse plants to facilitate regeneration of conifer species
	Protect and facilitate regeneration of black oaks	• Avoid prescribed burns in areas of oak regeneration if burn conditions would be too hot for seedling survival • Plant acorns from varied genetic stocks
Facilitate Transition	Develop seed collections to increase genetic diversity	• Collect seed from trees in lower-elevation bands • Increase species and genetic diversity within seed collections
	Maintain biodiversity of shifting plant communities	• Facilitate migration of co-adapted species, focusing on species where one species within an association is limiting the migration of all
Increase Knowledge	Monitor groundwater extraction both inside and outside the forest	• Monitor groundwater extraction to quantify changes to the water table, focusing on transition zones and mesic areas where the greatest opportunities for improvement exist
Engage Collaboration	Work across jurisdictions	• Coordinate management actions across land management designations to meet mutual goals

*Actions presented are those evaluated as having higher effectiveness and/or feasibility.

Management Implications

This information can be used in a variety of ways:

- ✔ Forest Plan Revisions
- ✔ U.S. Forest Service Climate Change Performance Scorecard: Element 6 - "Assessing Vulnerability" and Element 7 - "Adaptation Actions"
- ✔ Bureau of Land Management Resource Management Plan Revisions

Resilient management requires implementing a variety of adaptation options

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Further information and citations can be found in source reports, *Climate Change Vulnerability Assessment for Focal Habitats of Southern California* and *Climate Change Adaptation Strategies for Focal Habitats of Southern California*, available online at the EcoAdapt Library: http://ecoadapt.org/library.