The state of the giant sequoias: losses, risks, and opportunities

Research Brief • April 2026

Background

Giant sequoias are an iconic tree found only in isolated groves in California. The species is highly fire-adapted and resistant to drought and insect attack, but has exhibited signs of vulnerability in recent years, most notably wildfires. This paper provides a comprehensive, range-wide assessment of the condition of the species, including an evaluation of wildfire trends, large giant sequoia mortality, potential for local extirpation, treatment patterns, and vulnerability to future fire.

Wildfire - trends and impacts

Wildfire trends

From 2015 to 2024, 82% of giant sequoia grove area burned in wildfire, compared to 24% between 1910 and 2014. Since severity data became available in 1984, ~20% (1,846 ha) were classified as high severity, nearly all of which occurred 2015-2024 (Fig. 1). The severity in individual groves varied across the range, and some smaller groves (<10 ha) experienced at least 85% high severity, which could have long-term implications on grove persistence. Although the two largest groves experienced a much lower proportion of high severity fire, this encompassed a substantial area of large sequoia loss due to the overall grove size.

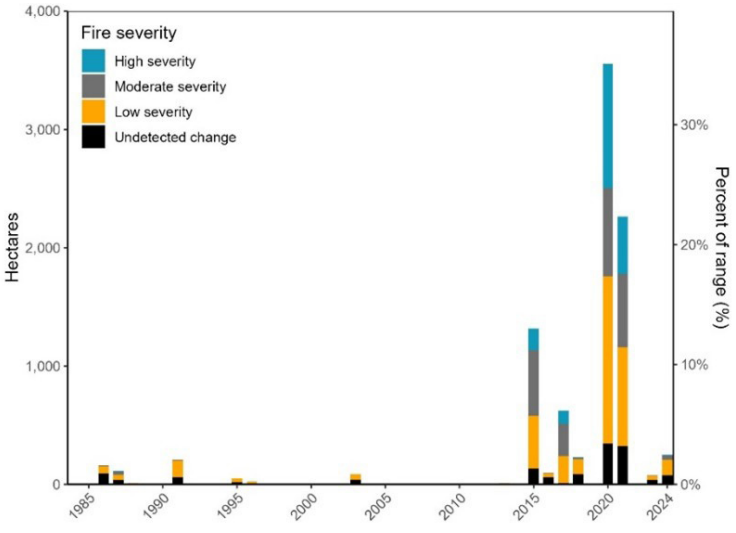

Figure 1. Area burned by fire severity, 1984-2024.

MANAGEMENT IMPLICATIONS

- Extensive areas recently burned at low/ moderate severity, which could be enhanced with additional treatments to reduce tree density if needed, and maintained with prescribed fire or managed wildfire.
- Areas with high local extirpation risk due to limited expected natural regeneration could be assessed on the ground and planted if needed, where feasible.
- Recent successes in increased rates of restoration were likely due to partnerships between land management agencies and outside entities, and should be strengthened to further increase implementation.
- Prescribed fire could be used in unburned islands of recent wildfires were effectively consumed.

Since 2015, contiguous areas of high severity have greatly exceeded historical estimate of 0.1-1 ha, with the largest contiguous patch of high severity at 266 ha. The three largest contiguous patches of high severity fire collectively spanned 554 ha—more than 5% of giant sequoia's native range.

However, far more area experienced potentially beneficial fire (low or moderate severity) – over three times the amount of high severity area burned in groves.

Large giant sequoia mortality

We conservatively estimate that 17.6% of all large giant sequoias (~12,000 individuals) have been killed by wildfire since 1984, but only 0.2% of that occurred prior to 2015. This emphasizes the stark change that has occurred in sequoia groves since 2015. The two largest fire years, 2020 and 2021, accounted for 14% mortality of all large giant sequoias.

The potential for local extirpation
Roughly 13% of the range is at some risk of local extirpation due to the loss of mature trees and limited predicted regeneration in very severe areas of recent wildfires.

Treatment trends

Treatment activity has increased since 1995 (Fig. 2), with treatment type and amount varying by jurisdiction. Considering agencies that manage the most giant sequoia area, the National Park Service has treated ~50% of the area under their management, primarily with broadcast burning, the US Forest Service has treated ~34% of their sequoia forests, primarily with mechanical thinning.

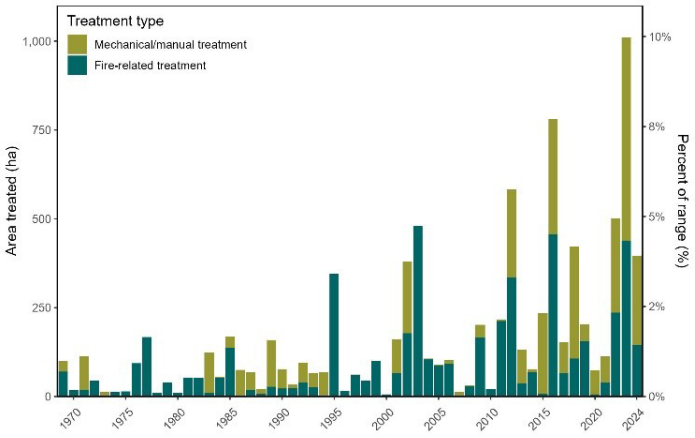

Figure 2. Area treated over time in the giant sequia range by treatment type.

The State of the Giant Sequoia: Patterns of resistance to high severity fire

To assess current conditions and the potential resistance to high severity fire, we classified the range by wildfire and treatment history as follows:

- *No resistance:* no disturbance
- *Low resistance:* Mechanical thinning only
- *Moderate resistance:* one fire-related treatment or beneficial wildfire
- *High resistance:* ≥2 treatments/beneficial wildfires within 15 years (≥1 must include fire)
- *Mature forest loss:* ≥1 high severity wildfire

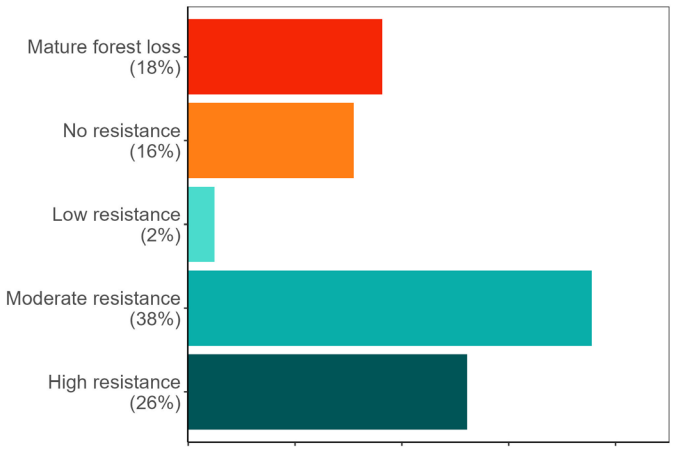

Figure 3. Proportion of the giant sequoia range by resistance class.

Roughly 18% of the range experienced mature giant sequoia forest loss. No resistance areas comprise 16% of the range and are a high priority for restoration. Moderate resistance covered the largest area (38%), which is primarily due to lower severity fire as a first entry. Follow-up treatments in these areas could leverage the work of wildfire and bolster resistance. An additional 2% had low resistance, which could benefit from subsequent burning. The remaining 26% of grove area at high resistance will require longer-term maintenance treatments to remain resistant.

Conclusions

While recent wildfires have resulted in extensive mortality and raised concerns about local extirpation, they have also done a lot of good work in giant sequoia groves. Capitalizing on this good work by enhancing and maintaining resistance through active management can help conserve the remaining giant sequoias.

Additional Information

This brief is based on the following article:
Shive, K.L., B. Baker, D. Soderberg, L.J. Hardlund, M.D. Meyer, B. Nagelson, S.M. Bisbing, A. Das, and N.L. Stephenson. 2026. The state of the giant sequoias: losses, risks and opportunities. Fire Ecology 22:30. https://doi.org/10.1186/s42408-026-00469-5

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