

Large Legacy Tree Research in the North Yuba Landscape

The Nature Conservancy in California, April 2026

Over the past century, fire exclusion and selective logging of large pines have transformed Sierra Nevada forests. In the North Yuba watershed, forest structures are highly departed from the historical range of variability (McGarigal et al. 2020; USDA Forest Service 2023; Purvis et al., in prep). Current stands average roughly 476 trees per hectare, nearly four times the approximately 125 trees per hectare consistent with the Natural Range of Variation (NRV). Species composition has shifted markedly toward shade-tolerant conifers, and at least half of the Sierra Nevada's large trees have been lost since the 1930s alone (McIntyre et al. 2015; Kane et al. 2023).

These dense conditions, dominated by shade-tolerant conifers (white fir, Douglas-fir, and incense cedar), create compounding threats to the large, fire-adapted legacy pines that remain. During California's 2012-2016 drought, roughly 89% of the largest ponderosa pines were killed in the hardest-hit areas, with mortality strongly correlated with stand density (Fettig et al. 2019). Dense stands also create continuous fuel ladders that convert what would historically have been low-intensity surface fire into stand-replacing crown fire.

This creates a genuine management tension. The forest needs more large trees, but a lidar-based census found that where large trees occur, they tend to cluster in stands with 60-80% canopy cover, well above the 12-28% that characterized these forests historically (Kane et al. 2023; North et al. 2022). In the 2021 Schneider Springs Fire, high-severity fire affected 34% of large-tree stands with closed canopies but only 13% of those with open canopies (Meigs et al. 2025). If we do nothing, we risk losing the very trees we are trying to protect.

Research

The North Yuba Landscape Resilience Project (NYLRP) is a 275,000-acre collaborative restoration effort on the Tahoe National Forest, guided by the North Yuba Forest Partnership. Researchers from UC Davis, The Nature Conservancy, and the USFS collected field data from 120 plots and used optimization modeling to simulate mechanical thinning under five diameter limit scenarios, testing each against the Natural Range of Variation for stand density and basal area.

All scenarios restored stand density from roughly 476 to 125 trees per hectare, closely matching the NRV. The vast majority of removals are small and medium shade-tolerant conifers that can be removed under any policy. This finding underscores the urgent, shared priority across all stakeholders, which is removing large numbers of small trees across the landscape. However, no scenario could restore the full range of historical basal area because large trees have already been lost. Thinning can only remove trees, not add them.

The key difference between scenarios is species composition. Under the current 30-inch rule, shade-tolerant species still dominate 54% of post-thinning basal area, and substantially more stands remain above the 60% Stand Density Index crowding threshold (Figure 1). When the limit is raised to 40 inches for shade-tolerant conifers while continuing to protect all pines ≥ 30 inches dbh, post-thinning stands shift to pine dominance at roughly 48% of basal area (Figure 2). Research from eastern Oregon reached a similar conclusion, finding that diameter limits constrained the ability to shift composition toward fire-resilient conditions because they retained an overabundance of large shade-tolerant trees (Johnston et al. 2021).

Management Implications

Retaining all large trees regardless of species preserves more standing basal area in the near term, but locks in shade-tolerant dominance and high-competition conditions. Allowing targeted removal of some large shade-tolerant trees reduces near-term basal area slightly but shifts composition toward more fire-resistant pines and

gives surviving legacy pines more water, growing space, and a better chance of reaching very large sizes. Research shows thinning increases radial growth of retained large pines for 15 or more years and improves physiological vigor for up to two decades (Hood et al. 2018; Kolb et al. 2007). The case for shifting composition toward pines does not depend on recreating historical conditions. As the climate warms and droughts intensify, conditions will increasingly favor the functional traits pines possess, including thick bark, self-pruning branches, and drought tolerance (Safford & Stevens 2017). Treatments also directly protect large trees when fire arrives. In the Schneider Springs Fire, severity was significantly lower inside treated areas, with a "shadow effect" extending outward to protect adjacent untreated forests (Meigs et al. 2025).

The 30" Rule Doesn't Always Reduce High-Stress Conditions

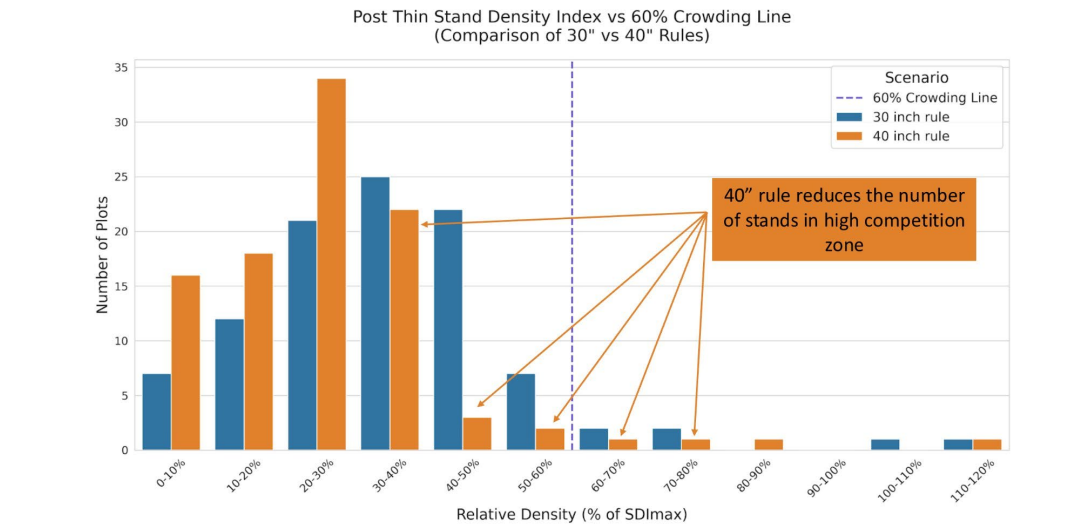


Figure 1. Post-thinning Stand Density Index compared to the 60% crowding line. The 30-inch rule (blue) leaves more stands near or above the zone of imminent mortality threshold than the 40-inch rule (orange).

The 40" Rule Restores Pine Dominance

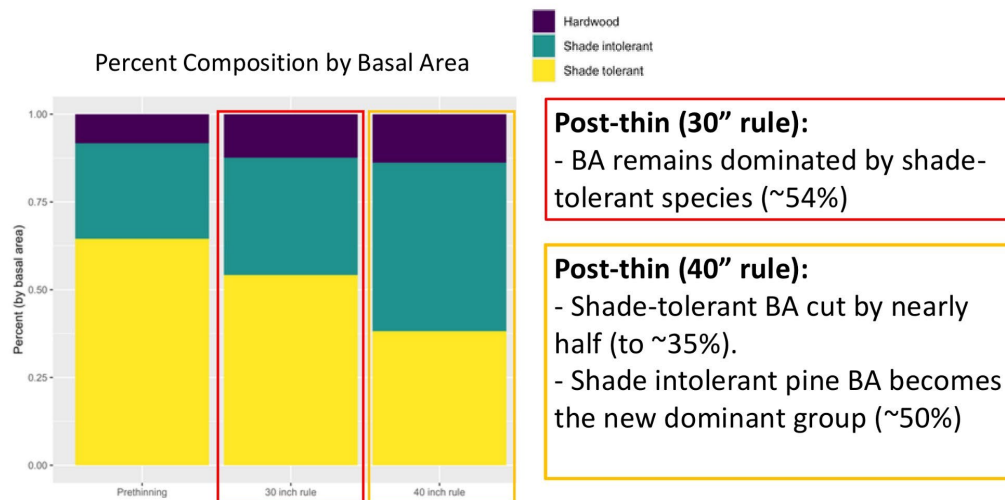


Figure 2. Species composition by basal area. Under the 30-inch rule, shade-tolerant conifers (yellow) still dominate post-thinning stands at ~54%. Under the 40-inch rule, shade-intolerant pines (teal) become dominant at ~50%

WHAT THE LARGE TREE AMENDMENT ALLOWS

The North Yuba Large Tree Amendment (TERR-NORTH YUBA-STD-01) is not a blanket authorization to cut large trees. It is narrowly defined and includes specific conditions:

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| Only shade-tolerant conifers (typically white fir, Douglas-fir, incense cedar) between 30 and 39.9 inches dbh are eligible for removal. All conifers 40 inches and larger are retained. |
| Removal must serve one of three FEIS objectives: (1) promoting growth of large shade-intolerant trees by meeting composition and density goals, (2) creating 1-3 acre openings to restore heterogeneity, or (3) reducing competition-driven mortality of large trees in homogeneous pine plantations. |
| Shade-intolerant pines (ponderosa, Jeffrey, sugar) 30 inches dbh and larger are retained, except in homogeneous plantations where 30-40 inch pines may be removed. Pines under 30 inches may be thinned, with retention prioritized for healthy individuals. |
| The amendment is not permitted in Protected Activity Centers, Inventoried Roadless Areas, or the 1,000-acre core territory around each spotted owl activity center (1.1 km / 0.7 mile radius). |
| Removed trees must generally be of low vigor (less than 30% crown ratio) and used first to meet forest plan snag and down woody material standards (SNFPA ROD #10, #11). |
| In spotted owl Home Range Core Areas, removal in highest quality habitat cannot reduce the existing CWHR canopy cover class (e.g., 5D cannot become 5M). |
| Treatment-unit-specific rationale for any 30-39.9 inch removal must be documented and offered for public comment with each draft Record of Decision. |
| The amendment applies to approximately 5,800 of 275,000 acres, with 2-8 shade-tolerant trees per acre removed depending on stand conditions. |

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