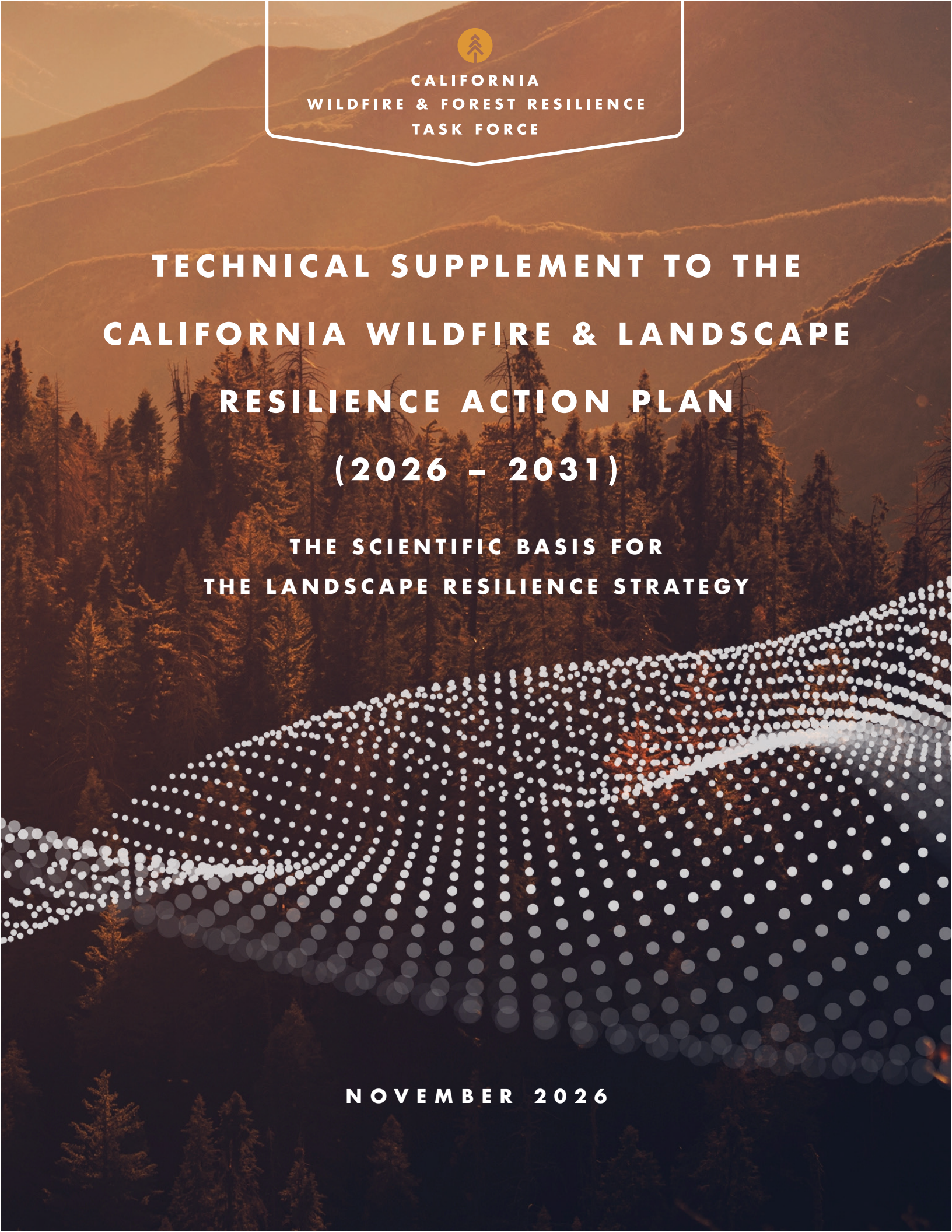
CALIFORNIA
WILDFIRE & FOREST RESILIENCE
TASK FORCE

TECHNICAL SUPPLEMENT TO THE CALIFORNIA WILDFIRE & LANDSCAPE RESILIENCE ACTION PLAN (2026 – 2031)

THE SCIENTIFIC BASIS FOR THE LANDSCAPE RESILIENCE STRATEGY



NOVEMBER 2026

THE SCIENTIFIC BASIS FOR THE LANDSCAPE RESILIENCE STRATEGY

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Overview

The Wildfire and Landscape Resilience Action Plan provides a new framework for collective action in response to the wildfire crisis. This framework includes four linked efforts: a Landscape Resilience Strategy, a Community Wildfire Preparedness Strategy, Mobilizing Regional Action, and Cross-cutting Initiatives. This technical supplement to the Action Plan focuses on the first of those linked efforts; it describes the key information sources, assumptions, methodology, and anticipated benefits of the Landscape Resilience Strategy (Strategy).

Purpose and Scope

The Strategy is a prioritized, science-based assessment of wildfire resilience and vegetation treatment needs to inform planning, collaboration, and investment across California's diverse landscapes. The Strategy has three primary goals:

- Reduce wildfire hazards to communities and landscapes
- Restore health and resilience in forests, woodlands, and shrublands*
- Promote long-term beneficial fire in forests and natural fire frequencies in shrublands

To meet these goals, the Strategy focuses on increasing proactive, targeted treatments to reduce human disturbances that impact shrublands and to set the stage for using fire as the primary mechanism for restoring and maintaining forested landscapes. The Strategy leverages statewide assessments and analyses of physical conditions like wildfire hazard and vegetation health to determine treatment priorities. However, addressing the challenges ultimately requires local solutions. For this reason, the Strategy does not prescribe site-specific treatments; rather, it provides a statewide estimate of vegetation treatment priorities. Regional and local partners will refine these estimates based on local ecological conditions, management capacities, available resources, and objectives; develop corresponding projects; and group these into a regional priority or five-year plan. These plans are expected to account for crucial considerations that are best assessed at regional or local scales, such as:

- The distribution and condition of sensitive areas, such as old-growth stands, meadows, and riparian zones.
- The history of disturbance that influences management decisions about maintaining previously treated acres, leveraging footprints of past fires, and halting the invasive grass-fire cycle.

* While the Strategy recognizes the need to also restore health and resilience to grasslands, limited data prevented the inclusion of treatment priorities and quantities for them.

- The patterns of weather, ignitions, nearby wildland health, home hardening, and defensible space that affect the risk and potential for fires that start in wildlands to reach nearby communities, and the risk of ignitions that start in communities to spread into wildlands.

Approach and Sources

The Landscape Resilience Strategy leveraged multiple bodies of knowledge to recommend priority vegetation treatments and quantities across the state. These included extensive scientific research, interagency modeling results, and consultations with experts from government, academia, and industry. Sources include the 2025 Effects of Forest Management & Wood Utilization on Carbon Sequestration & Storage in California report by CAL FIRE, American Forests, and the USDA Forest Service (2025 American Forests Report), which was foundational to the Strategy's prioritization and treatment approaches in forested areas. Additional sources include the California Air Resources Board (CARB) Scoping Plan, Task Force modeling results, and regional plans from partners.

Key Data and Modeling Efforts

2025 American Forests Report

Several concepts and findings from the 2025 American Forests Report underpin the Landscape Resilience Strategy. The report forecasted California's current pace of treatments into a future under climate change (a "business-as-usual" scenario) and found that acres of high-severity wildfire will more than double. Because of increased high-severity wildfire and subsequent post-fire regeneration failure, their findings estimated a loss of 48% (15 million acres) of California's forested area by 2071. The 2025 American Forests Report then modeled a portfolio of forest management and wood utilization scenarios to inform the role that forests and forest management can play in climate change resilience and in mitigating forest loss predicted under the business-as-usual scenario. The results of the study suggest that combining a proactive 10-year pulse of increased treatments across 7.3 million acres of forest at high wildfire hazard, with reforestation of burned areas unlikely to regenerate naturally, and extensive innovative utilization of woody forest byproducts, is likely to reduce carbon emissions and prevent the loss of over 12 million acres of forests over the next half-century when compared to the "business-as-usual" scenario.

CARB 2022 Scoping Plan

The Landscape Resilience Strategy also builds upon key findings in the CARB 2022 Scoping Plan (Scoping Plan) that underscore the importance of ramping up management activity in California's natural and working lands, including forests, shrublands, and grasslands, to reduce future greenhouse gas emissions, wildfire risk, and air pollution. Specifically, modeling in the Scoping Plan indicates that proactive

vegetation management can not only reduce climate change-related landscape carbon losses, but also meaningfully reduce wildfire-related healthcare expenditures. The Scoping Plan also indicates that using woody biomass removed from vegetation management treatments can stimulate rural industries and create jobs.

Task Force Scenario Modeling

The Landscape Resilience Strategy also leverages findings from a comprehensive statewide modeling effort directed by the Task Force and conducted by the Spatial Informatics Group (SIG). This modeling closely reflected the priorities used in both the 2025 American Forests Report and the USDA Forest Service Wildfire Risk analysis, and built further on the former by exploring additional management scenarios.

The modeling effort evaluated five independent management scenarios, each compared against a no-treatment reference. Treatments were simulated over 2024 – 2044 in five-year time steps. Treatment acres in the scenarios were footprint acres and often included two treatment activities per footprint acre. Outcomes were evaluated after 10 years and 20 years of treatment.

- **The *Wildfire Mitigation* scenario** simulated 650,000 acres per year of treated footprints in high and very high wildfire hazard areas.
- **The *Ignition Reduction* scenario** retained the treated footprint of the *Wildfire Mitigation* scenario and simulated treating an additional 400,000 footprint acres along road corridors and in the WUI. These additional acres included treatments in all classes of wildfire hazard potential.
- **The *Broader Landscape* scenario** retained the treated footprint of the *Wildfire Mitigation* scenario and simulated treating an additional 675,000 acres per year. These additional acres included treatments in lower wildfire hazard areas.
- **The *Sensitive Areas* scenario** retained the treated footprint of the *Broader Landscape* scenario and simulated treating an additional 500,000 acres per year in sensitive and wilderness areas, using prescribed fire in low to moderate wildfire hazard wilderness and sensitive areas forests, and mechanical thinning followed by prescribed fire in high to very high wildfire hazard sensitive forests.
- **The *Prescribed Fire* scenario** also retained the treated footprint of the *Broader Landscape* scenario and expanded to treat an additional 360,000 acres per year of sensitive and wilderness areas at low to moderate wildfire hazard potential.

The scenarios and modeling structure were designed to inform five policy questions about treatment prioritization and implementation, and to compare the relative benefits and trade-offs of the simulated management strategies. The results of the scenario modeling align with the 2025 American Forests Report findings that prioritizing

treatments in areas with high wildfire hazard is likely to yield the greatest hazard reduction benefits. Additional findings related to each policy question include:

1) What are the benefits of implementing wildfire mitigation treatments in high-hazard areas relative to no treatment? *Scenario modeling suggests that, compared to no treatment, prioritizing treatments in the highest wildfire-hazard areas meaningfully and beneficially changes forest wildfire behavior and improves forest health.*
2) What are the benefits of focusing on ignition reduction by increasing treatments along road corridors and in the WUI? *Scenario modeling suggests that treating all areas along road corridors and in the WUI yields modest reductions in wildfire hazard near communities. Spatially narrow, linear treatments like ignition reduction may require finer-resolution analyses to evaluate their potential impacts on local burn probability and fire behavior.*
3) What are the benefits of scaling up effort to include lower-hazard areas across the broader landscape? *Scenario modeling suggests that scaling up to include lower-hazard areas across the broader landscape moderately and beneficially modifies forest wildfire behavior and meaningfully improves forest health.*
4) What are the benefits of further scaling up effort to treat sensitive habitat areas? *Scenario modeling suggests that increasing effort to include sensitive habitat and wilderness areas moderately modifies forest wildfire behavior and meaningfully improves forest health.*
5) What are the benefits of scaling up effort to implement prescribed fire more broadly and in sensitive and wilderness areas? *The scenario modeling suggests that implementing a light-touch prescribed fire prescription more broadly across the landscape results in modest improvements in wildfire behavior and forest health.*

State and Federal Frameworks

California Expanding Nature-Based Solutions

The importance and role of healthy, resilient lands that limit future greenhouse gas emissions, increase resilience to climate impacts, and result in stable, durable carbon stocks are a cornerstone of the State's effort to expand nature-based solutions. The Strategy focuses on immediate priority actions that advance the portions of the Natural and Working Lands Climate Smart Strategy and the Nature-Based Solutions Climate Targets related to forests and shrublands. The Strategy and the Nature-Based Solutions also align on the treatment priorities for shared vegetation types. For instance, both strategies emphasize thinning, prescribed fire, restoration, and roadside ignition reduction to increase landscape resilience.

USFS Forest Health and Fuels Reduction Emergency Situation Determination and Active Forest Management Strategies

Risk-based, outcome-driven frameworks are a shared foundation of both the Landscape Resilience Strategy and the wildfire and forest health research and priorities identified by the USDA Forest Service. Methodologically, the Strategy leverages tools pioneered by the USDA Forest Service to identify priority treatment areas, including Wildfire Hazard Potential (WHP) and forest density indices. The USDA Forest Service has considered both high wildfire risk and substantially increased tree mortality to identify and designate Forest Health and Fuels Emergency Situation Determination (FHF) lands[1]. In California, the Forest Service has similarly prioritized forest health treatments based on stand density in mixed-conifer forests[2]. This alignment between the Strategy and existing federal approaches ensures that partner investments are compatible and likely to focus on the same high-priority landscapes.

Landscape Resilience Strategy Treatment Concepts

The Landscape Resilience Strategy proposes treatment priorities for the next ten years based on **three core concepts:**

- *Treat the Worst First*, including areas near valued features, such as communities, and areas with high hazard.
- *Set the Stage for Beneficial Fire* by expanding prescribed and cultural burning today and promoting long-term beneficial fire regimes.
- *Restore Post-fire Landscapes* to avoid permanent loss of desirable forest and shrub cover.

The Strategy focuses on proactive vegetation management to further mitigate the compounding and intensifying impacts of heat, drought, and wildfires on landscapes, watersheds, and people.[3] Addressing these priorities over the next ten years will increase landscape resilience and unlock additional management options, including greater use of wildfire managed for resource benefit.

The following sections present these core concepts, their scientific basis, and associated treatment priorities.

Treat the Worst First

Treating the worst first means prioritizing treatments in areas with the greatest wildfire hazard and near communities, critical infrastructure, and ecologically important wildlands. Wildfire resilience treatments in high-hazard areas near highly valued features are likely to have the greatest positive impact. Focusing treatments near communities and critical infrastructure can reduce burn probabilities and flame lengths, improving first responders' ability to suppress unwanted wildfires. When vegetation conditions in

and around communities are safer, the likelihood that ignitions near a community spread into the wildlands decreases, and beneficial fire treatments become more feasible in WUI-adjacent wildlands.

Treatment priorities associated with this core concept include: (1) conduct thinning in high-hazard forested WUI areas; (2) establish or maintain strategic fuel breaks; and (3) conduct thinning followed by prescribed burning in forested wildlands at high risk due to both wildfire hazard and high tree densities.

Scientific Basis for Conducting Thinning in High-Hazard Forested WUI Areas

Proximity to the WUI is a major factor influencing wildfire damage in California.[4] Consequently, reducing fuels in high wildfire hazard areas around communities to decrease potential wildfire intensity and burn probability is a priority in forested landscapes.[5,6] The WUI is generally classified by zones as Interface, Intermix, or Influence, in order of decreasing structure density and distance between structures. Because wildfire poses a risk to life and property within the Interface and Intermix, acres prioritized for treatment are expanded from high and very high hazard to include moderate-hazard acres.

The Landscape Resilience Strategy assumes that mechanical or hand thinning with pile burning will be the primary treatment type in and around forested WUI communities with elevated wildfire hazard potential. However, Prescribed Burn Associations and other local initiatives are actively working to increase the use of beneficial fire within the WUI, a trend that is expected to continue.

Scientific Basis for Establishing and Maintaining Strategic Fuel Breaks

Fuel breaks are key suppression assets that augment the actions described in the Action Plan's Community Wildfire Preparedness Strategy, including structure hardening, defensible space treatments, and ignition reduction. The Landscape Resilience Strategy encourages using shaded fuel breaks in forests and woodlands, which are designed to retain the overstory canopy. Shaded fuel breaks are proven effective at moderating wildfire behavior. They can also protect utility corridors, such as in the Liberty Utilities Powerline Resilience Corridor Project in the Lake Tahoe Basin. Fuel breaks strategically placed along roads give crews and aircraft opportunities to suppress or manage fires and protect key evacuation routes.

Fuel breaks in shrublands are similarly valuable for suppression and fire response operations, but only if they are maintained and located in accessible areas. Fuel break development and maintenance efforts in shrublands must be complemented by ignition reduction and community protection measures. Fuel break treatments in shrublands must be carefully located, designed, and maintained to minimize their threat to ecological integrity, as fuel breaks can promote the spread of invasive grasses.[7,8]

Scientific Basis for Conducting Thin and Burn Treatments in High-Risk Forested Wildlands
Many forests and woodlands across the state currently have fire regimes that differ from historical conditions, typically meaning a wildfire deficit. Wildfire deficits in forests can lead to dense stands with high mortality risk and elevated Wildfire Hazard Potential (WHP). Thinning followed by prescribed burning can proactively reduce fire severity and forest loss from both threats[9].

Within sensitive forest areas, vegetation heterogeneity and dense canopy cover are critical habitat elements for many native species. Treatments to reduce WHP in sensitive areas would include minimal-to-no modification of canopy trees by focusing on surface and ladder fuels. To further protect heterogeneity and ensure habitat continuity, the Strategy recommends no treatment in 25% of the sensitive forested areas with the densest canopies.

Set the Stage for Beneficial Fire

Setting the stage for beneficial fire means taking strategic short-term action to reduce landscape fire hazard and help realize the longer-term goal of restoring appropriate wildfire intensities and intervals to California's fire-adapted landscapes. As described above, the treatment priorities associated with Treating the Worst First will help set the stage for beneficial fire by addressing the highest hazard acres across California's forests and by increasing suppression capabilities across the WUI. To further expand the proportion of healthy forests across landscapes and increase opportunities for large-scale beneficial fire, the Landscape Resilience Strategy also includes prescribed and cultural burning as an initial treatment to promote forest and woodland health in areas of lower wildfire hazard.

Combined with the proposed treatment strategies in Treat the Worst First, the Strategy would increase acres burned in prescribed and cultural fire to between 500,000–750,000 acres a year, a significant increase from current levels. In many forests, when treatments are strategically placed and increase the proportion of healthy forests to 25 – 40% of the landscape, unplanned wildfires are more likely to produce ecologically beneficial outcomes.[10,11,12]

Scientific Basis for Conducting Prescribed Burns in Lower Wildfire Hazard but Highly Dense Forests and Woodlands
The Strategy suggests using prescribed fire as a primary treatment in areas with lower wildfire hazard, where appropriate. 4 million acres of forests and woodlands across the state have lower wildfire hazard potential but are in poor health, presenting an opportunity to restore prescribed and cultural fire at a lower cost. Treating forest stands at high risk of mortality can increase drought resistance, avoid future higher treatment costs as fuel loads increase, and preserve treatment options. Including this as a treatment priority allows the Landscape Resilience Strategy to proactively act on the

2025 American Forests Report's findings that insect- and drought-related tree mortality will likely increase in the coming decades, contributing to projections of increased fire severity.[13]

In Northern California and the Sierra Nevada, priority areas include forests and woodlands with low-to-moderate wildfire hazard and with unhealthy tree densities. Priorities in Central and Southern California forests for prescribed fire treatments are the same as in Northern California and the Sierra Nevada. In Central and Southern California woodlands threatened by Gold-Spotted Oak Borer, prescribed and cultural burning may be important tools for promoting resilience; therefore, the prescribed fire priority for oak woodlands in Central and Southern California is expanded to include woodlands with low-to-moderate wildfire hazard at any stand density index. Per the 2025 American Forests Report and other supporting studies, treatments to restore forest health in areas at high risk of mortality are particularly beneficial when they help prevent tree die-off and the accumulation of large, fire-prone pools of dead trees.[14] The Strategy prioritizes treating across 40% of these highly dense areas, since research has suggested that such a proportion may be sufficient to promote beneficial outcomes when wildfires occur.[15]

Restore Post-fire Landscapes

Restoring post-fire landscapes must be a priority to avoid the permanent type conversion of millions of acres of critical habitat across the state, including burned forests into shrublands and burned native shrublands into invasive grasses. The treatment priorities within this core concept are to (1) reforest conifer forestlands that experienced large high-severity patches and (2) restore shrublands and woodlands that have experienced too much fire.

Scientific Basis for Conifer Post-fire Reforestation

Implementing reforestation treatments in conifer forests that experienced high severity fire in large patches can promote future healthy forest cover. Treatments that occur no more than 3 to 5 years after a severe fire are most likely to minimize the accumulation of downed woody fuels and the establishment of large continuous shrub patches, both of which are prone to high-severity reburns. Reducing the reforestation backlog and keeping up with new post-fire restoration needs are priorities for both state and federal agencies, as reflected in the reforestation provisions of the 2022 REPLANT Act and the 2024 CNRA Nature-Based Solutions Climate Targets.

California's Reforestation Strategy identifies recent large patches of high severity burned area and forecasts near-term large patch high severity fire across many conifer forests statewide that likely require targeted fuel treatments and active reforestation. More than 90% of these areas are in the northern half of the state, particularly in the Sierra Nevada.

Scientific Basis for Shrubland and Woodland Post-fire Restoration

Non-forested vegetation types such as chaparral, coastal sage scrub, pinyon-juniper, oak woodlands, and sagebrush steppe can also benefit from post-fire restoration.[16] Too-frequent reburns in these systems, often exacerbated by drought, can inhibit native regeneration and increase their vulnerability to non-native species invasion.[17] Treatment requirements and ecological strategies for these vegetation types vary significantly from forest restoration techniques and also vary widely by region. Implementation of non-forested restoration, which can reduce the likelihood of conversion to non-native annual grasses, will likely emphasize strategic locations, including roadsides, fuel breaks, and fire perimeters, where non-native grasses can most easily gain a foothold and invade burned areas before native vegetation recovers.[18]

Treatment Levels

Summary

To translate the Landscape Resilience Strategy's treatment priorities into action, it's necessary to estimate how much of the state would benefit from treatments aligned with each core concept. This section summarizes the approach to estimating treatment levels for each priority, presents the treatment-level estimates in Table 1, and briefly compares the estimates to the key modeling efforts that influenced the Strategy.

Treatment levels in the Landscape Resilience Strategy are estimates of general need across regions. Regional collaboratives are well situated to develop plans that estimate regionally specific treatment levels and activities needed to reestablish resilience and protect communities, including maintenance.

Treatment levels for the Strategy priorities were derived using geospatial analyses, vegetation and stand density index data, and values from existing documents and datasets. Treatment levels are presented as ranges because factors such as resources, weather, and fire season characteristics can affect project implementation pace in any given year. To account for these variables, unless otherwise noted, the estimated treatment level for each priority was buffered by 20% and rounded to the nearest thousand to produce a range.

Core Concept	Treatment Priority	Statewide Annual Treatment Levels (footprint acres)
Treat the Worst First	Conduct thinning in forested WUI intermix and interface with moderate to very high wildfire hazard.	150,000 – 230,000
	Conduct thinning in forested WUI influence zone with high to very high hazard.	
	Establish and maintain strategic fuel breaks in forests with moderate to very high wildfire hazard within 500' on each side of roadways in Northern California and the Sierra Nevada.	55,000 – 85,000
	Establish and maintain the existing and planned fuel breaks per the Southern California landscape strategy, plus new potential control lines.	
	Conduct thinning, followed by prescribed burning, in forested wildlands at high risk due to wildfire hazard and high tree densities.	335,000 – 500,000
Set the Stage for Beneficial Fire	In Northern California and the Sierra Nevada, conduct prescribed burns in forests and woodlands with low to moderate wildfire hazard and with high tree densities	180,000 – 270,000
	In Central and Southern California, conduct prescribed burns in montane forests and woodlands with low to moderate wildfire hazard.	
Post-fire Restoration	In montane forests, reforest high-severity burned patches that are distant (> 33 m) from live trees.	150,000 – 175,000
	In a diverse range of non-forest types, including chaparral, coastal sage scrub, pinyon-juniper, oak woodlands, and sagebrush steppe, restore areas burning too frequently.	5,000 – 22,500

Table 1. Estimated Treatment Levels for Landscape Resilience Strategy Priorities

Methodology

The method for estimating treatment levels for each priority varied, but typically included querying data layers of wildfire hazard, forest density, terrain steepness, infrastructure, and land designations.

Key Data Sources

The suite of data products outlined below formed the basis for determining treatment priorities and levels in the Landscape Resilience Strategy:

- Wildfire Hazard Potential (WHP) data that were generated by Pyrologix at 30 m pixels for California, including disturbances through 2021. Pyrologix calculates wildfire hazard potential using a combination of burn probability and predicted fire intensity. The burn probability is based on the FSim wildfire risk simulation model, and recent research has confirmed the reliability of those forecasts in California.[19]
- Forest density data from TreeMap 2016 were grown out to 2024 with the Forest Vegetation Simulator (FVS) and incorporated wildfires and treatments that occurred between 2016 and 2022. Forest density is an important metric for evaluating forest health[20] and potential tree mortality from fire.[21]
- Wildland-Urban Interface boundaries from FRAP 2025 Wildland and Urban Interface data.
- Road corridors from Open Street Map, focusing on motorways, trunks, and primary and secondary roads.
- Areas with administrative constraints on treatments from Wilderness, Roadless areas, and National Park Service lands.
- Sensitive areas were developed from CWHR Vegetation and Riparian Habitat datasets.
- Designations of forest, woodland, shrub, and other vegetation types were assigned based on classifications in the California Wildlife Habitat Relationships System.

Treat the Worst First

Conduct Thinning in High-Hazard Forested WUI Areas

- In WUI Intermix and Interface areas, treatment levels were estimated by tabulating acres that had both a moderate-to-very high Wildfire Hazard Potential (WHP) and a ground slope of less than 70%.
- In the WUI Influence zone, treatment levels were estimated by tabulating acres that had both a high-to-very high WHP and a ground slope of less than 50%.

Slope is a factor in these designations because it affects the feasibility and cost of project implementation. Stand Density Index (SDI) was not used in these calculations

given the emphasis on wildfire hazard around communities. The resulting ten-year annualized treatment level range is 150,000 to 230,000 footprint acres per year (Table 1).

Establish and Maintain Strategic Fuel Breaks

- In Northern California and Sierra Nevada forests, treatment levels were estimated by tabulating forested areas with moderate-to-high WHP that are within 500 feet of a roadway.
- In Central and Southern California, estimates came from the USDA Forest Service-led planning for the Southern California Fireshed Risk Reduction Strategy landscape, which includes existing and planned fuel breaks based on potential control lines identified using the Potential Operational Delineations framework. While not all potential control lines will be constructed and some existing lines may be transitioned back to native vegetation, reductions in proposed fuel break areas are likely to be offset by additional fuel breaks needed beyond those in the USFS-designated Risk Reduction Strategy landscape.

The resulting ten-year annualized treatment level range is 55,000 to 85,000 footprint acres per year (Table 1).

Conduct Thinning and Prescribed Burning in High-Risk Forested Wildlands

Treatment levels for thinning and prescribed burning in high-risk forest and woodland areas were estimated by tabulating areas meeting regionally-specific criteria for wildfire hazard, tree density, and slope. They were further winnowed based upon whether acres were considered "sensitive", which includes riparian habitat, wetland, several oak habitat types, and large size class conifer forests, or "general", which includes forests and woodlands not in the previously-defined areas or in sensitive or wilderness areas.

- In Northern California and the Sierra Nevada, the total acreage of sensitive forests in wildlands with high-to-very high WHP and tree densities in the "imminent mortality" range (relative Stand Density Index value greater than 60%) was further filtered to only include acres with slopes of less than 50%. Another 25% of these acres were excluded because retaining some clusters of dense tree stands for landscape heterogeneity is ecologically beneficial. Next, acres of general forests with high-to-very high WHP and tree densities in the "fully stocked" or "imminent mortality" range found on slopes of less than 50% were included for treatment.
- In Central and Southern California, treatment levels were estimated by tabulating forests and woodlands in non-sensitive areas with high-to-very high WHP and less than 50% slope, which is consistent with priorities in the Southern California Montane Forest Restoration Strategy.

The resulting ten-year annualized treatment level range is 335,000 – 500,000 footprint acres per year (Table 1).

Set the Stage for Beneficial Fire

Conduct Prescribed Burns in Lower Wildfire Hazard but Highly Dense Forests and Woodlands

Similar to the methods used to estimate treatment levels for thinning and prescribed burning, estimates of treatment levels for prescribed burning as the primary treatment were based on wildfire hazard, tree density, slope, and the same categorization of the area as sensitive or general.

- Estimates of acreage for this treatment priority in Northern California and Sierra Nevada included areas with low-to-moderate wildfire hazard but high stand densities ("imminent mortality" or "fully stocked" ranges), on ground slopes of less than 70%. These acres were further winnowed to estimate treatment levels. In general forests, all acres with stand densities in the "imminent mortality" range and 40% of acres with stand densities in the "fully stocked" range were included. In sensitive forests, 75% of acres in the "imminent mortality" range were included.
- As in Northern California and the Sierra Nevada, in Central and Southern California, estimates of treatment levels also included areas with low-to-moderate wildfire hazard, high stand densities ("imminent mortality" or "fully stocked" ranges), and ground slopes of 70% or lower. However, unlike in Northern California and the Sierra Nevada, all forested acres in Central and Southern California with stand densities in the "fully stocked" or "imminent mortality" range, including in wilderness areas, were included in the treatment level estimate, along with 25% of oak woodlands located outside of sensitive areas.

The resulting ten-year annualized treatment level range is 180,000 – 270,000 footprint acres per year (Table 1).

Restore Post-fire Landscapes

Conduct Post-fire Reforestation in Conifer Forests

Treatment levels for post-fire reforestation in conifer forests were estimated by applying a 50% constraint factor to *California's Reforestation Strategy's* estimate of the total anticipated reforestation needs, which combines the existing post-fire reforestation backlog since 2020 with expected annual losses from new high-severity fires through 2034 and does not include operability constraints. The Reforestation Strategy identified a backlog since 2020 of 1.3 million acres of need and estimates a near term range of 169,000 acres to 217,000 acres of future reforestation need per year. Addressing the backlog within 10 years and accounting for the range of future need results in a range of 300,000 – 347,000 acres a year. A constraint factor of 50% was used because many

areas are unlikely to be treated based on physical (e.g., steep slope, distant from roads) and, in some cases, regulatory constraints (e.g., sensitive habitat or roadless areas). Previous studies in California have found that less than 45% of the landscape is accessible for mechanical treatment under such constraints.[22,23] While backcountry crews and aerial operations can overcome some replanting constraints, success will likely be lower on steeper slopes and in less accessible areas that restrict wood removal or require ongoing maintenance[24]. Even a rapid expansion in reforestation capacity will not solve the challenges of restoring remote forests. If future need levels are lower than projected or less than 50% of the landscape is treatable, additional treatment efforts can be used to address backlog needs prior to 2020. Estimated reforestation treatment levels in the Landscape Resilience Strategy are similar to those identified as being necessary to minimize forest losses in the 2025 American Forests Report, after accounting for accessibility.

The resulting ten-year annualized treatment level ranges from 150,000 – 175,000 footprint acres per year (Table 1).

Conduct Post-Fire Restoration in Shrubland and Woodlands
Treatment levels for post-fire restoration in Central and Southern California's shrublands and woodlands were estimated using USDA Forest Service data and, where more comprehensive data were unavailable, several approximating calculations.

Forest Service monitoring suggests 340,000 acres of shrublands and woodlands in the Southern California ecological province experienced two or more wildfires between 2000 and 2024, increasing the potential that these acres would experience type conversion. Most shrubland conversion has been reported from the Southern California region, although recent analysis has noted conversion across many drier parts of the state.[25] While there may be restoration needs outside of Southern California's National Forests, the 340,000-acre estimate may also be an overestimate of the need on Forest Service lands as it includes burned areas that may have retained sufficient ecological integrity. Of these 340,000 acres, 50% are assumed to be inoperable, yielding a 10-year annualized treatment level of 17,000 acres per year.

Given the need to develop commensurate capacity to conduct post-fire restoration across a diverse range of non-forest types, including chaparral, coastal sage scrub, pinyon-juniper, oak woodlands, and sagebrush steppe, statewide, the proposed treatment levels were adjusted to reflect consultation with partners on current need for and capacity to implement restoration in these vegetation types.

The resulting range of 5,000 to 22,500 acres annually (Table 1) reflects a reasonable ramp up target and expectation of future need for restoration from wildfire in these ecosystems.

Comparison to Modeled Scenarios

Task Force Scenario Modeling

The Landscape Resilience Strategy combines multiple treatment priorities to encourage statewide progress toward healthy landscapes with reduced wildfire risk. By comparison, the management scenarios included in the Task Force scenario modeling effort separated many of these treatment priorities into specific scenarios (e.g., treating sensitive areas or focusing on improving forest health). As such, no single scenario from the Task Force modeling exactly matches the types and levels of treatments included in the Strategy. The *Wildfire Mitigation* scenario most closely aligns with the Landscape Resilience Strategy, as this scenario's priority treatments focus on areas of high and very high wildfire hazard potential across the WUI and general forest areas.

The modeled Task Force scenarios have varying priorities and treatment levels. The Landscape Resilience Strategy outlines 850,000 to 1,250,000 footprint acres of treatments per year, a treatment range that falls in between what was modeled in the *Wildfire Mitigation* and *Broader Landscape* scenarios (Figure 1). The Strategy includes acres of treatment beyond those in the *Wildfire Mitigation* scenario. These additional treatment acres are in sensitive habitats, forest stands with high mortality risk, and severely burned wildlands prioritized for restoration.

The Strategy does not include annual grass treatments along roadsides, which were included in the modeled scenarios and are incorporated in the Action Plan's Community Wildfire Preparedness Strategy, because they are difficult to quantify across California's extensive road network and often require local planning and prioritization.

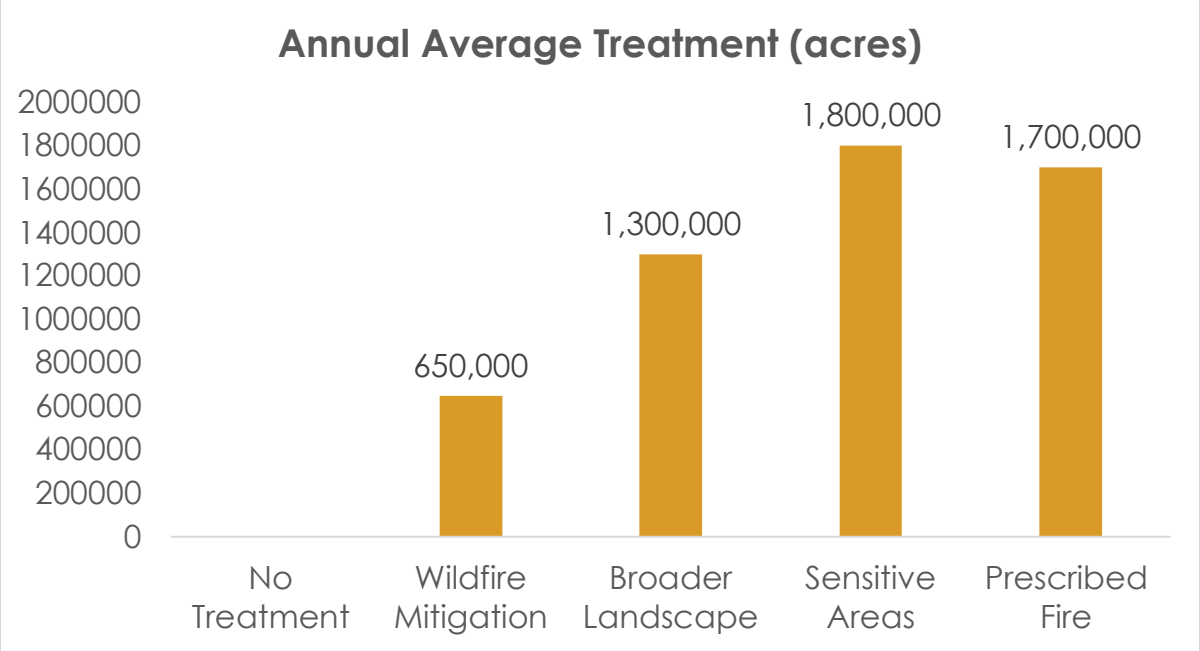


Figure 1: Annual footprint area treated under four management scenarios modeled for the Task Force.

2025 American Forests Report

The Strategy adopted the treatment-prioritization method used in the 2025 American Forests Report and included additional acres and treatment objectives in response to the study's findings. For example, the study concluded that restoring forest health is a key component to mitigating the impacts of their forecast. As a result, the Strategy not only retains its prioritization of treating forests with high wildfire hazard potential, but also proposes treating forests with lower wildfire hazard potential that are at imminent risk of mortality from drought, pests, or diseases. Both the 2025 American Forests Report and the Strategy prioritize significant increases in reforestation, though they differ in the number of acres to be treated. The Strategy doesn't expand on all the actions the 2025 American Forests Report identifies as important. For example, the report emphasizes the importance of climate-smart management of working lands, including extended rotations and silvopasture, and cautions that without a commensurate increase in wood utilization of cut materials, forests will remain a net source of carbon into the future. These management actions are not directly estimated in the Strategy, but are highlighted in the Action Plan.

Nature-Based Solutions Climate Targets

California's Nature-Based Solutions Climate Targets (NBS Targets) were developed through the natural and working land modeling included in the Scoping Plan (2022) to meet or exceed the carbon goals identified therein. The Landscape Resilience Strategy treatment levels advance California's progress to achieve the NBS Targets for wildfire risk reduction and reforestation. While direct comparisons of treatment priority targets are challenged by differences in timelines and acre accounting, the Strategy was designed to be complementary to the NBS Targets. For example, the NBS Target for scaling up beneficial fire includes use of managed wildfire. Although the Strategy doesn't estimate a ten-year annualized treatment level for managed wildfire, its priorities are intended to support landscape-scale use of beneficial fire after the ten-year management pulse.

Projected Benefits

The anticipated ecological and economic effects of the Landscape Resilience Strategy are estimated using a combination of scenario modeling results and literature review. The modeling results demonstrated how implementing the first 10 years of prioritized treatments called for in the Strategy would affect burn probability, burn severity, and tree density. These changes, in turn, would have significant implications for a broad range of ecological and other benefits.

By reducing the extent of high severity fires and overly frequent reburns, the Landscape Resilience Strategy will yield multiple benefits for communities and ecosystems. The Science Synthesis summarizes how scientific literature evaluates these benefits. Additionally, the Task Force modeling included a co-benefits valuation to help estimate

the expected impacts of following treatment approaches and levels under the scenarios. While projecting landscape-scale outcomes involves substantial uncertainty, findings from scientific studies, the 2022 Scoping Plan, the 2025 American Forests Report, and the Task Force modeling consistently support increasing treatments to foster resilient forest landscapes and to achieve a range of social and ecological benefits.

While these projections highlight the outcomes of divergent management approaches, they do not predict precise future values because of the complexity and interactions among external factors, such as future climate change, drought, insects, and wildfire behavior. However, comparing the relative differences in projections between scenarios is a useful tactic to illustrate the trade-offs and benefits of the management approaches.

Wildfire Resilience

The Landscape Resilience Strategy proposes increasing treatments in high-hazard forests to levels between those modeled in the Task Force *Wildfire Mitigation* and *Broader Landscape* scenarios. For these two scenarios, the projected change in area estimated to burn at high severity, which was based on a proxy of conditional flame lengths exceeding 8 feet, can illustrate the potential effects of implementing the Strategy.

Under the *Wildfire Mitigation* scenario, which has lower treatment amounts than the Landscape Resilience Strategy, 20 years of treatments were projected to reduce the proportion of high severity fire to 30% in forested areas, compared to 43% in the No Treatment scenario. Under the *Broader Landscape* scenario, which has slightly higher treatment levels than the Strategy, the proportion of high-severity fire in forested areas was projected as 24%. Finally, under the *Sensitive Areas* scenario, the proportion of high-severity fire in forested areas was projected to be 19% (Figure 2). Recent research corroborates these modeled findings; in the Sierra Nevada, fuel and density reduction projects reduced the threat of severe wildfire in treated areas by 88%.[26]

The modeling results also show that prioritizing the highest-hazard areas yields the greatest benefit per acre treated. Treating more area increased overall benefits, but each additional acre contributed less. Without treatment, high wildfire hazard statewide rose 4.5% over 10 years. After 10 years of treatment, the *Wildfire Mitigation* scenario reduced high wildfire hazard statewide by 22% relative to no treatment. The *Broader Landscape* scenario, which treated 68% more area by extending treatment into lower-hazard areas, reduced it by 27%. Thus, the prioritized acres in the *Wildfire Mitigation* scenario produced almost four times the hazard reduction per acre of the additional acres treated in the *Broader Landscape* scenario.

These results suggest that the Landscape Resilience Strategy has the potential to reverse the documented increasing burn severity trend in California's forests. Additionally, the Strategy's proposed increased use of beneficial fire in forests during and after the 10-year pulse of expanded treatments are expected to further restore a more frequent, less-severe wildland fire regime.[27]

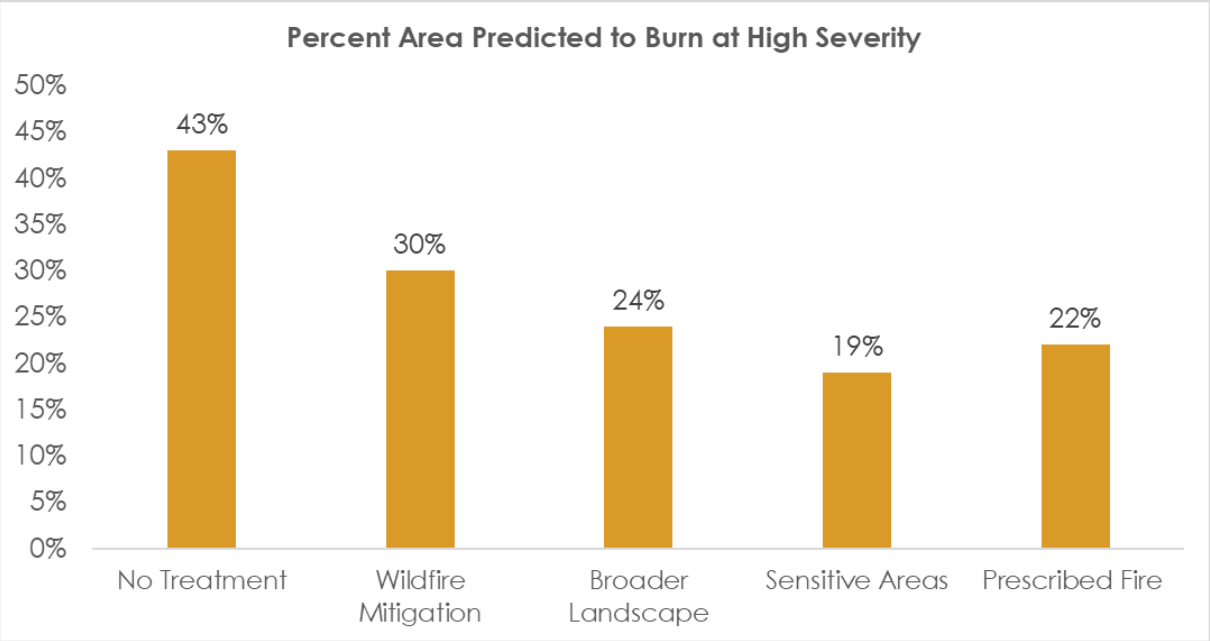


Figure 2: Estimated relative proportions of high-severity fire in forests after 20 years for each modeled scenario.

Healthy and Resilient Forests

In forested areas, reducing the density of overstocked stands will increase resilience to wildfires and tree mortality under a drier, warmer climate. The results of modeling the *Wildfire Mitigation* and *Broader Landscape* scenarios suggest that the levels and distribution of treatments in the Landscape Resilience Strategy would substantially curb the recent increase in forest areas that are unhealthy and at elevated risk of tree mortality (Figure 3).

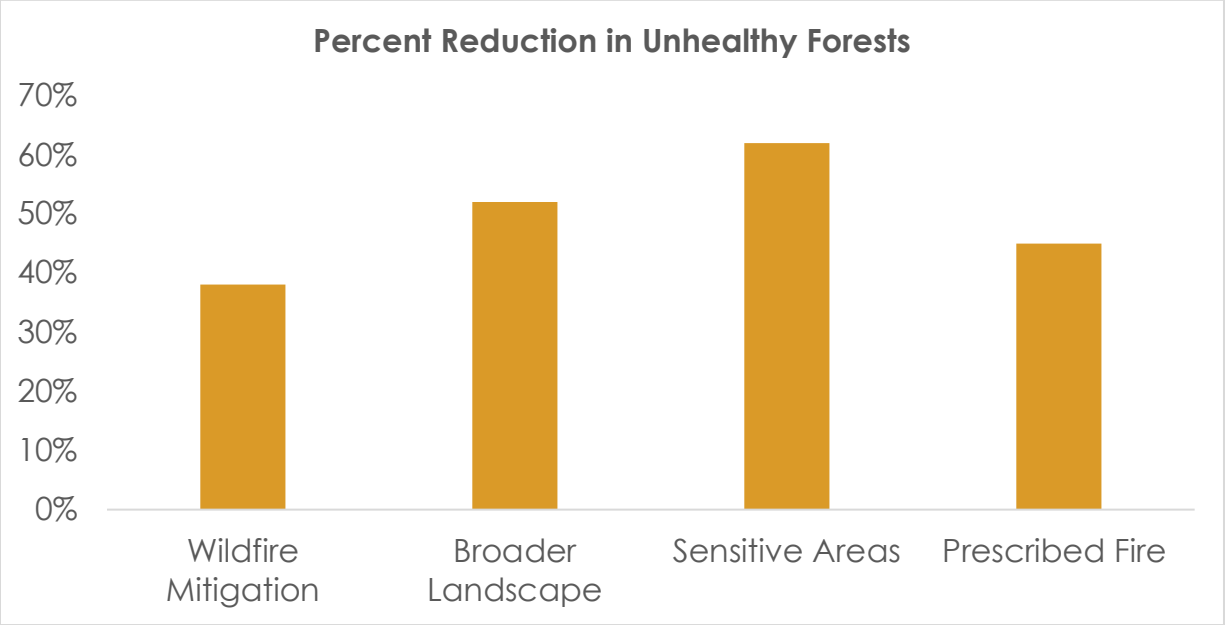


Figure 3: Percent reduction in forests with unhealthy Stand Density Index values after treatments in the modeled scenarios, relative to the no-treatment scenario.

The *Wildfire Mitigation, Broader Landscape, and Sensitive Areas* scenarios show increasing reduction of unhealthy forests (i.e., increased healthy forest areas), with increasing acres treated. However, the modeled *Prescribed Fire* scenario showed less improvement in forest health than the *Broader Landscape* scenario did, despite treating more acres. Consistent with prescriptions used and outcomes observed with prescribed burning in California,[28,29] the modeling applied low-intensity prescribed fire treatments in the *Prescribed Fire* scenario. These low-intensity treatments would not effectively kill the trees that would need to be removed in order to thin forests down to healthy stand densities; hence, this scenario offers a lower predicted benefit to forest health in terms of stand density modifications. However, prescribed fire treatments implemented with higher intensities were not explored in the Task Force modeling, and forest health may have been impacted differently under a different prescription.

Treating Priority Areas Offer Greatest Marginal Return for Metrics

As demonstrated in Figures 2 and 3, the rate of return for key metrics are maximized when efforts are concentrated within areas of highest priority based upon wildfire and mortality hazards. However, expanding treatments yields continued benefits across a range of indicators. This finding underscores the importance of targeting treatments to high-hazard areas. However, this does not mean treatments should stop once priority areas are treated, as additional acreage may still provide significant net benefits when accounting for broader societal gains, such as conserving critical forest habitats, improving air quality, and protecting water security, as discussed below. Additionally, ongoing maintenance of all treated areas must remain a priority to sustain the value of investments in wildfire resilience.

Avoiding Forest Loss

Active post-fire restoration, as emphasized in the Landscape Resilience Strategy, can deliver important long-term services by mitigating forest cover and carbon losses expected over the next half-century under a warming climate. The 2025 American Forests Report found that expanded treatments at levels similar to those in the Landscape Resilience Strategy would reduce the potential loss of future forest area by over 10 million acres, approximately equivalent to approximately 30% of California's current total forested area. Post-fire treatments can also inhibit the formation of extensive areas of downed woody fuels and shrublands that are vulnerable to intense reburns.[30,31]

Conserving Old Forests and Sensitive Species

The Landscape Resilience Strategy's emphasis on mechanical thinning and beneficial fire in sensitive forest areas is expected to offer much-needed protection for old-growth forest ecosystems. Without these interventions, research suggests old-growth-dependent species such as the California spotted owl and Pacific fisher could go extinct within the next 50 years due to wildfire-driven habitat loss.[32] Including sensitive owl habitats in designated treatment areas is needed to ensure long-term population resilience. Recent studies across all California forested regions with spotted owls demonstrate that these rare birds benefit from landscape-scale thinning treatments that enhance foraging habitat while conserving denser nesting and roosting habitat—an approach prioritized in the Landscape Restoration Strategy.[33,34,35]

Recreation and Societal Benefits

The Strategy's treatment priorities are critical to mitigating wildfire impacts on recreation activities and avoiding extremely costly wildfire damage to recreation facilities, including campgrounds and ski resorts. A recent study reported that between 2008–2017, California lost over $1.2 million in consumer surplus annually from canceled camping reservations due to fires and smoke, plus millions more in estimated health impacts from campers who stayed despite smoke.[36]

Preliminary findings released from a recent study found that high-severity fires in California reduced recreation visits to public lands (-33% in year one and -44% in year five), whereas low-severity wildfires and prescribed fires had mostly neutral effects.[37] Forest disturbances—specifically drought, wildfires, and beetle infestations—have cost millions of dollars in winter recreation value across the Sierra Nevada.[38]

By cultivating the healthy, mature forests and traditional practices upon which Tribal stewardship depends,[39] the Strategy can sustain vital cultural values and directly benefit Tribal communities.

By conserving and promoting forests through active stewardship, the Strategy will provide social benefits associated with jobs related to wood products and landscape management.[40]

Water Resources

Landscape resilience treatments provide substantial benefits for water resources, including by reducing erosion caused by large, high-severity wildfires. Such erosion can degrade water quality and cause sediment to accumulate in reservoirs, impacting fisheries, reducing storage capacity, and damaging infrastructure. The co-benefits valuation analysis evaluated and identified potential erosion-reduction benefits for major reservoirs that supply water and support hydropower, concentrated in the Sierra Nevada (**Error! Reference source not found.**). Under the *Wildfire Mitigation* scenario, treatment benefits for avoided sedimentation across the watersheds supplying these reservoirs average about $500 per treated acre relative to no treatment (cumulative 2024–2044). In the Sierran watersheds, which supply water to much of the state, benefits ranged from $1,000 to $2,000 per acre. These modeling findings build on published research from two Sierra Nevada watersheds.[41] Additionally, research in the Sierra Nevada has found that expanded thinning treatments combined with increases in beneficial fire would mitigate drought impacts in downstream reservoirs and rivers, with benefits for forest health, human uses, and aquatic species such as salmon.[42,43]

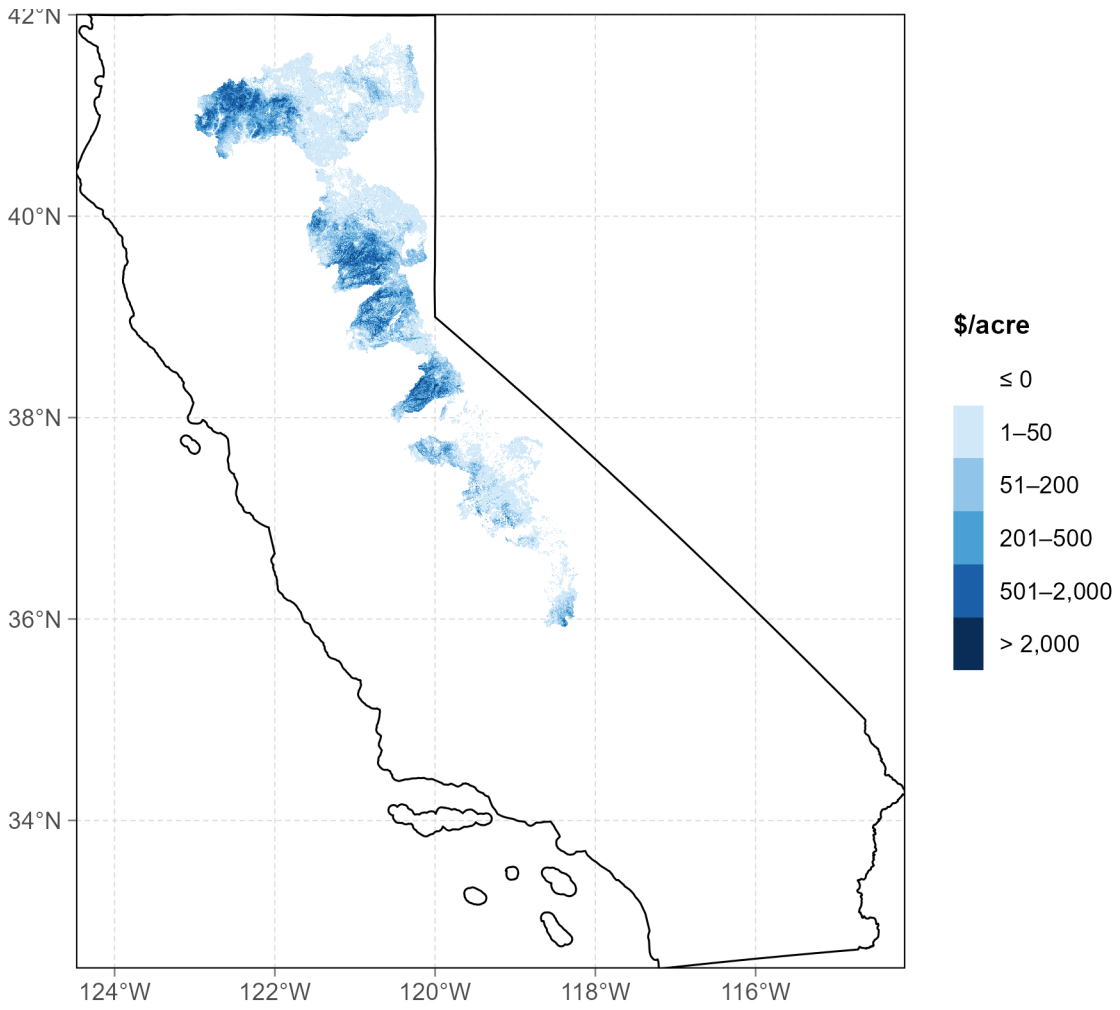


Figure 4: Estimated value of reduced erosion under a wildfire mitigation scenario compared to no treatment, averaged within HUC-12 watersheds and with a 3% discount rate.

Avoided Post-fire Debris Flows

The anticipated effect of the Landscape Resilience Strategy to reduce high-severity fire would provide an important benefit for many parts of the State, including the Central Coast and Southern California, by reducing the risk of debris flows,[44,45] which are extremely damaging to human lives and property.[46]

Avoided Loss of Homes and Other Structures

Recent research in Southern California found that expanded treatments would avoid several billion dollars over a decade in the cost of replacing homes and other structures damaged by wildfires in that region.[47] Furthermore, modeling in other areas such as the Lake Tahoe Basin found that treatments comparable to those in the Strategy would reduce risks of loss by 45%–76% for thousands of homes.[48]

Task Force modeling extends these regional analyses statewide. In the WUI, where wildfire most directly threatens communities, prioritizing treatments in the highest-hazard areas yields the greatest reduction in burn probability per acre treated. Statewide, WUI burn probability rose 2.9% over 10 years without treatment. After 10 years of treatment, the *Wildfire Mitigation* scenario reduced WUI burn probability by 14.1% relative to no treatment. The *Ignition Reduction* scenario, which treated 50% more area by adding treatments along road corridors and in lower-hazard WUI areas, reduced it by 16.6%. Treating more area increased the overall benefit, but each additional acre contributed less. The prioritized acres in the *Wildfire Mitigation* scenario produced nearly three times the reduction in WUI burn probability per acre of the additional acres treated in the *Ignition Reduction* scenario. However, because the additional acres treated in the *Ignition Reduction* scenario had relatively small footprints, analyzing the broader impact of those treatments was challenging and may warrant additional exploration.

Reducing the risk of structure loss to wildfires can help mitigate rising insurance costs across California.[49] Current research in Southern California is evaluating how treatments and resulting wildfire risk reductions affect insurance costs, which will help refine strategies in that region.

Air Quality and Public Health

Avoided public health impacts are a primary benefit of the Landscape Resilience Strategy. Recent peer-reviewed papers, as well as analyses from both the 2022 Scoping Plan and the Task Force's modeling, show that avoiding smoke-induced mortality can be the largest economic benefit of landscape resilience treatments, with projected values in the tens of billions of dollars over a decade.[50,51] The Science Synthesis highlights the massive economic toll of recent fire seasons, estimating the public health burden of wildfire smoke at between $15 billion and $45 billion a year from 2017 to 2021. A 2025 study found that expanding prescribed burning treatments in California to mitigate wildfires would significantly reduce smoke pollutants, even after accounting for the impacts of increased prescribed burns.[52] Additional research emphasizes that these impacts extend far beyond localized healthcare costs. As noted in the Science Synthesis, wildfire smoke also affects the health of firefighters, frontline workers, and businesses in agriculture and outdoor recreation, as well as the broader regional economy through lost productivity, reduced tourism, and supply chain disruptions.[53]

Carbon and Financial Benefits of Forests

The value of sustaining forests through proactive management can range into the thousands of dollars per acre, depending on the value of stored carbon in forests. When large amounts of carbon stored in trees are released as emissions during and after a large wildfire, the ecological impacts carry known social costs. As cited in the Science Synthesis, applying the social cost of carbon metrics to the 107 MMT CO2e

emitted during California's extreme 2020 wildfire season yields a societal damage estimate exceeding $12 billion, completely independent of the substantial public health costs from smoke.

Researchers have found that innovative use of wood from forest resilience treatments may be critical to achieving California's goals of reducing both wildfire hazard and CO2 emissions, while also supporting forest product jobs.[54] Woody byproducts of treatments are often burned onsite because there may not be cost-effective options for using them for other purposes. Using these materials for energy and other applications offers potential carbon benefits. Modeling in the 2025 American Forests Report found that using residual forest materials from the modeled expanded treatment objectives for bioenergy, biochar, or transportation fuels could avoid 33 million metric tons of CO_2 emissions. That study also found that revenues from wood products could offset 31 – 94% of treatment costs. The Landscape Resilience Strategy proposes wood-generating treatment levels comparable to those in the 2025 American Forests Report. Where possible, using treatment byproducts in more durable products, such as mass timber, would further offset emissions.

Resilience Treatments Achieve a Triple Win

Resilience investments deliver a triple win: protecting communities, supporting conservation and restoration of native ecosystems, and securing vital ecosystem services like water flows, clean air, and carbon sequestration. In many key watersheds across the state, the benefits of resilience treatments are likely to greatly exceed the costs of treatment.

A newly published study on US Forest Service treatments in the Western US highlights the high return on investment for wildfire resilience.[55] The study found a mean benefit-cost ratio (BCR) of 3.42, equivalent to a 13% annual return on investment (ROI) over a 10-year period. These economic benefits were driven primarily by avoided costs to human health and labor, followed by preserved housing values and carbon stocks. Notably, targeting large-scale treatments (greater than 2,400 acres) in high-risk areas substantially boosted efficiency, yielding a median BCR of 8.26 (a 23.5% annual ROI). Furthermore, the mean BCR was slightly higher in California at 3.79 (a 14% annual ROI), despite average national forest treatments in the state being somewhat smaller than the West-wide average.

The cumulative benefits to California from expanding treatments may be in the billions of dollars annually and could be far greater, especially when considering broader impacts that extend beyond state boundaries. For example, a study estimated the total economic impact of California's 2018 wildfires at $148 billion, noting that nearly one-third of those losses occurred outside the state because of widespread smoke impacts and supply chain disruptions.[56] Ultimately, landscape resilience investments function as

a high-yield public insurance policy by mitigating the threats of lost lives and property damage while preventing the degradation of lands and waters that provide essential services in a warming climate.

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