The Nature Conservancy
Protecting nature. Preserving life.™

California Regional Office
201 Mission Street, Fourth Floor
San Francisco, CA 94105

dedelson@tnc.org
esmith@tnc.org
nature.org
nature.org/california

Written Outline of Comments by David Edelson, Sierra Nevada Project Director, and Edward Smith, Forest Ecologist for The Nature Conservancy, for the Little Hoover Commission Public Hearing on Forest Management (April 27, 2017)

- The Nature Conservancy is one of the world's leading conservation organizations. We work in all 50 states and in nearly 70 countries around the world. The Conservancy was launched in 1951 primarily as a land trust working to conserve biological diversity through land acquisition, conservation easements, and other strategies. Since then, our work has evolved to include addressing some of the world's biggest environmental problems, like clean water, climate change, ocean protection, and land conservation and management.

- Our work in the Sierra Nevada is part of a Conservancy program called Restoring America's Forests, one of our North America priorities. Restoring America's Forests is based on the premise that many of our publicly owned national forests, particularly in the western United States, are in unhealthy condition and at risk of high-severity wildfire, insect and disease epidemics, and other threats. Restoring America's Forests seeks to increase the pace and scale of ecologically based forest management to improve forest health for the benefit of nature and people.

- The problems facing Sierra Nevada forests are well described in the written testimony presented by Jim Branham of the Sierra Nevada Conservancy, Dr. Scott Stephens of UC Berkeley, Chief Ken Pimlott of California Department of Forestry and Fire Protection, and others to the Little Hoover Commission on January 26, 2017. To summarize, many Sierra forests are in an unhealthy condition because of logging, fire suppression, and other management practices during the past century. More specifically, many Sierra forests are densely choked with small trees and brush, and have far fewer large trees, large snags, and large downed logs than the forests that evolved here for millennia prior to European settlement.

- The current condition of Sierra forests, combined with drought, climate change, increased development in the wildland urban interface, and other factors, have contributed both to widespread insect and disease epidemics and to wildfires becoming larger, hotter, and more destructive. This is not only a serious problem for wildlife and nature – it is also a significant people problem. Fires threaten lives and property, megafires release enormous amounts of carbon, and unhealthy forests, meadows and watersheds threaten California's water supply and water security.

- While there is significant focus on Sierra forests being overly dense with brush and small trees and prone to destructive wildfires and insect and disease epidemics, there are other important aspects to the problem. First, most of the Sierra's mature and old growth forests outside of wilderness areas and national parks have been logged, and most Sierra forests are

severely lacking in the huge trees, large old snags, and giant downed logs that characterized the forests that were here prior to European settlement. The logging of old growth forests and big trees has had negative impacts on wildlife that inhabit these forests, like the California spotted owl and the Pacific fisher and has dramatically changed our forest ecosystems. Ecologically based management needs to reflect these concerns by protecting and conserving the remaining large trees and accelerating the growth and reestablishment of old growth forest conditions where appropriate on the landscape.

- Second, low and moderate-intensity fire is a natural process that has served to shape and maintain healthy forests for thousands of years, reducing the density of brush and small trees and allowing the large, fire-resilient trees to thrive. By suppressing virtually all wildfires, we have unintentionally but very significantly modified forest conditions by allowing unnaturally dense growth of shrubs and small trees. Therefore, where safe and appropriate, we need to reintroduce "good fire." Sierra forests can thrive with low and moderate-intensity managed wildfire and controlled burns as natural regulators of the forest ecosystem. While high-severity wildfire is a real problem, we also need considerably more "good fire" on the landscape.

- To address these problems requires that we significantly increase the pace and scale of ecologically based management with the goal of restoring healthier, more resilient forest conditions that can withstand drought, wildfire, and climate change. Ecologically based management includes, where appropriate, mechanical thinning, controlled burning and managed wildfire. If we don't increase the pace and scale of ecologically based management, we will continue to see large swathes of our Sierra forests lost to high severity wildfire and insect and disease epidemics, particularly with climate change.

- Mechanical thinning (logging) is an important tool to address the problem, but it cannot be the only tool. Thinning alone cannot solve the problem, because many areas are too steep and too remote to allow access for mechanized equipment, and because ecologically based thinning is too expensive given the vast scope of the problem. In addition, thinning alone does not provide the full range of fuels reduction, nutrient cycling, and other benefits to the forest; for that, we need to complement thinning with controlled burning and managed wildfire. On the other hand, there are areas, particularly close to homes and communities, where expanded use of fire may not be appropriate and where thinning remains the best option.

- The Nature Conservancy has undertaken several analyses and pilot projects to address forest health, wildfire risk, and forest restoration in the Sierra Nevada. First, with the U.S. Forest Service, Sierra Nevada Conservancy, and others, we co-authored the Mokelumne Watershed Avoided Cost Analysis (http://www.sierranevada.ca.gov/our-work/mokelumne-watershed-analysis). That paper showed that, while proactive forest management to reduce wildfire risk is expensive, it is 2-3 times less expensive than the costs associated with large wildfires, including costs of suppression, rehabilitation, and lost timber, real estate, and related values. In other words, ecologically based forest management is a very good investment, avoiding loss that is 2-3 times the initial cost of investment.

- In a later study, we examined the potential water supply benefits of undertaking ecologically-based thinning at a landscape scale, an issue not considered in the Mokelumne study (http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/california/forest-restoration-no-sierra.pdf). Our analysis suggested that, while additional research focused on ecological thinning in Sierra Nevada forests is needed, applying current management at an expanded, watershed scale has the potential to increase downstream water supply by several percent, depending on the watershed and water year. The economic value of this increased supply could be significant, potentially serving as a basis for investment in forest thinning by downstream water beneficiaries. The Conservancy is working with the Sierra Nevada Research Institute at UC Merced and other researchers to test this hypothesis at the American River Headwater and other sites.

- The Conservancy has several pilot projects where we are implementing and researching scientifically based forest restoration with the goal of developing practices and policies that can be used elsewhere in the Sierra. At our Independence Lake Preserve in the Little Truckee watershed, we have implemented forest thinning to protect water quality, enhance forest health, and reduce risk of high-severity wildfire, and we have an approved plan to implement a controlled burn at the Preserve in previously-thinned areas in 2017.

- In addition, we are partnering with the Tahoe National Forest, Placer County Water Agency, Sierra Nevada Conservancy, Placer County, American River Conservancy, and the Sierra Nevada Research Institute on the American River Headwaters/French Meadows Project. This pilot project covers approximately 26,000 acres of public and private land and aims to implement forest, meadow, and watershed restoration while undertaking research on potential water supply benefits. The project is using a collaborative governance structure and fundraising approach with the goal of complementing the Forest Service's staff and budget in a way that can be replicated elsewhere to increase the pace and scale of forest restoration.

- Some of the critical barriers to increasing the pace and scale of forest restoration include insufficient funding, the regulatory and policy structure, and lack of timber and biomass infrastructure. The Conservancy is working to address these barriers at the federal level and in numerous western states, including California.

- Some of the key policies we recommend to increase the pace and scale of forest restoration include:

    a. Funding

        i. Under current practices, an ever-growing portion of the Forest Service's budget is used for fire suppression, and funds appropriated to improve forest conditions and reduce wildfire risk are regularly "borrowed" to fight fires. We should reform these practices by increasing the funds available for forest restoration and preventing those funds from being "raided" to fight fires. The Conservancy supports legislation like the Wildfire Disaster Funding Act, with bi-partisan support, to address this problem. We also support increase federal appropriations to address forest health and wildfire issues.

ii. There is a need for additional state funding to address the forest health problem on both federal and private lands. We support increased appropriations and use of both existing funding sources, like Proposition 1 and cap and trade revenues, and potentially new funding sources, such as a 2018 park or water bond. Longer-term, there is a need to develop a more stable and reliable source of state funding for upper watershed conservation and restoration, such as a public goods charge on water.

b. Regulations, laws and policies

i. Given the realities of limited budgets and staffing, forest management needs to occur at a watershed scale (tens of thousands to hundreds of thousands of acres), rather than at a project scale (hundreds to thousands of acres). In addition, management needs to be more strategically targeted at watersheds where the risks to nature and people are greatest and where the enabling conditions support working at a larger scale.

- NEPA and other laws can be fine-tuned to support watershed scale analysis and decisions, with environmental sideboards to ensure that management is focused on the full range of restoration needs (e.g., protecting and promoting large trees and old forest structure, reintroducing good fire into the landscape), and not just on accelerating logging.
- The Nature Conservancy supports the Tahoe-Central Sierra Forest Restoration Initiative developed by the Sierra Nevada Conservancy and the Tahoe Conservancy as one such multiple watershed scale approach.
- The Nature Conservancy is developing a GIS analysis, the Sierra Blueprint: Regional Prioritization of High Value-High Risk Watersheds for Ecological Restoration in the Sierra Nevada-Southern Cascade Bioregion, which is a tool that can be used to prioritize landscapes as well as management activities within priority landscapes.

ii. We need to address multiple barriers to increased use of "good fire" in the Sierra by better coordinating air quality compliance, increasing training for fire managers, raising public awareness of the economic and ecological benefits of controlled burns and managed wildfire, and other steps.

c. Timber and Biomass Infrastructure

i. Many biomass energy facilities have closed in recent years, and much of the Sierra is lacking biomass or timber infrastructure to make economic use of small diameter wood. We need policy and funding support for bioenergy and small diameter wood infrastructure to efficiently utilize the byproducts of

forest restoration through tax incentives, incentivized Power Purchase Agreements, and subsidies for hauling costs.

ii. In conjunction with the large landscape pilot projects discussed above, the Forest Service should utilize long-term stewardship contracts to increase the certainty of wood and biomass supply and attract private investments in new and refurbished biomass facilities.

April 2014

## Mokelumne Watershed Avoided Cost Analysis:

# Why Sierra Fuel Treatments Make Economic Sense

High-severity wildfires in forests of California's Sierra Nevada pose a serious threat to people and nature. Although proactive forest management can reduce the risk of high-severity wildfire, the pace and scale of fuel treatments is insufficient, given the growing scope of the problem. Using the upper Mokelumne River watershed as a representative case, we sought to answer the following question: Does it make economic sense to increase investment in fuel treatments to reduce the risk of large, damaging wildfires? Our analysis suggests that the economic benefits of landscape-scale fuel-reduction treatments far outweigh the costs of wildfire.

Recent wildfires in California and the West have destroyed lives and property, degraded water quality, put water supply at risk, damaged wildlife habitat and cost hundreds of millions of dollars. For example:

- The 2013 Rim Fire—located just south of the Mokelumne River in the central Sierra Nevada—burned nearly 257,000 acres, much of it at high severity, at a cost of more than $127 million, not including the costs to the economy and tourism.
- The 2013 Yarnell Fire in Arizona killed 19 firefighters, destroyed more than 100 homes and damaged the town's water system.
- The 2002 Hayman Fire in Colorado burned 138,000 acres, destroyed more than 600 structures, and deposited more than 1 million cubic yards of sediment into Strontia Springs Reservoir—a primary drinking water source for the City of Denver—at a growing cost of more than $150 million.

The Sierra Nevada provides more than 60 percent of the developed water supply for California. High-severity wildfire places this water supply at risk. The upper Mokelumne River watershed in the central Sierra Nevada supplies drinking water to 1.3 million residents of the San Francisco Bay Area and provides valuable goods and services, including but not limited to forest and agricultural products, hydropower energy, recreation, wildlife habitat and carbon sequestration. Like other Sierra Nevada and western watersheds, much of the Mokelumne watershed is at very high risk of wildfire (figure ES-1).

Although wildfire and the associated costs are increasing in the western United States, few studies have taken a hard look at the costs and benefits of fuel treatments to determine if an increased investment in treatments makes economic sense. Through a collaborative process with key stakeholders and using state-of-the-art models for fire, vegetation and post-fire erosion, we analyzed the potential impacts of a landscape-scale fuel treatments program in the upper Mokelumne watershed. In addition, we examined who would benefit the most from investing in fuel treatments and reducing the risk of high-intensity wildfires. Our findings can help inform forest management not only in the Mokelumne watershed, but also in similar watersheds throughout the Sierra Nevada and the western United States.

The Nature Conservancy
Protecting nature. Preserving life.

SIERRA NEVADA CONSERVANCY

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

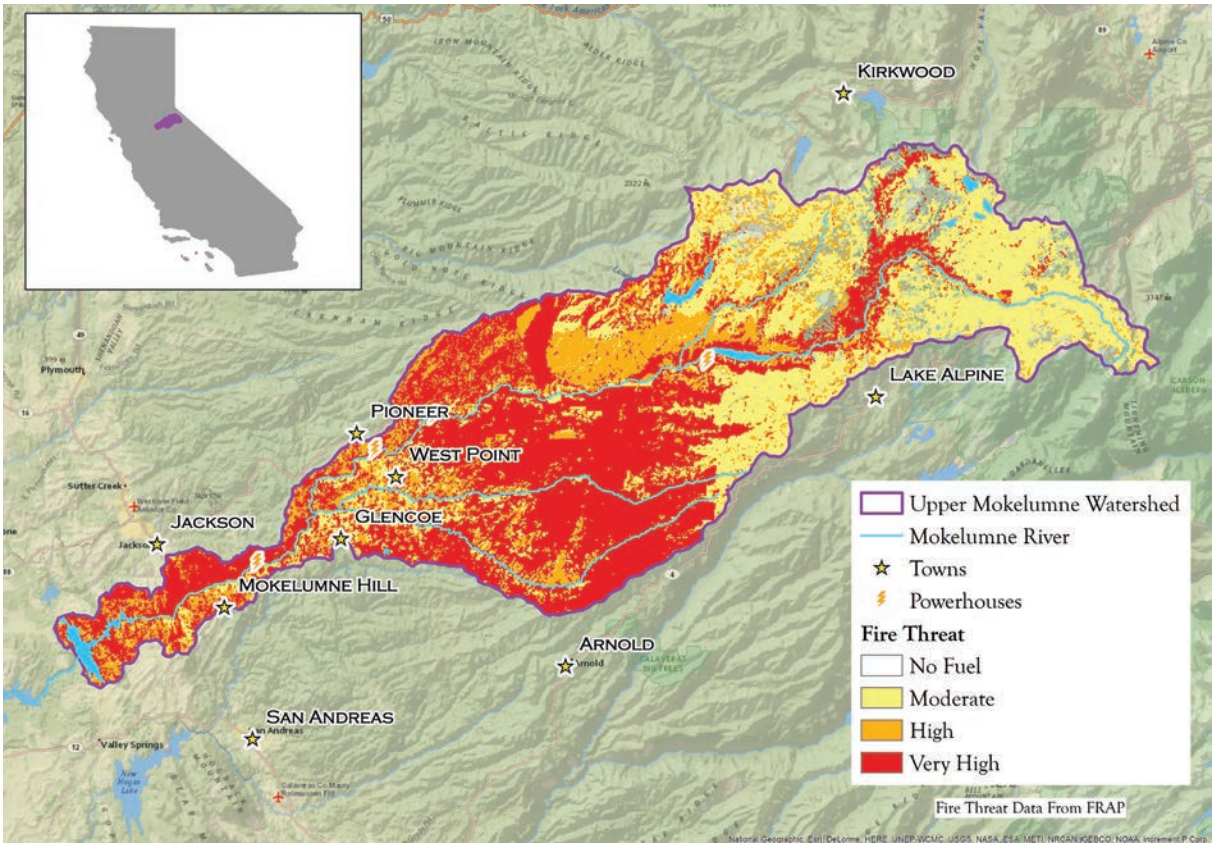


**FIGURE ES-1.** Fire Hazard in the Upper Mokelumne Watershed

## Process

In February 2012, the Sierra Nevada Conservancy, The Nature Conservancy, and the U.S. Forest Service convened a diverse group of stakeholders to consider whether an economic case could be made for increased investment in fuel reduction in the upper Mokelumne watershed. This group included land managers (the Forest Service, Bureau of Land Management, Sierra Pacific Industries); water and electric utilities (East Bay Municipal Utility District, Pacific Gas & Electric); state and local agencies (California Department of Water Resources, California Department of Forestry and Fire Protection and county governments); environmental organizations (Sustainable Conservation, Environmental Defense Fund); and local stakeholders (Foothill Conservancy, Amador-Calaveras Consensus Group, West Point Fire District).

We established an Advisory Committee to help guide the overall process and analysis, a Technical Committee to address issues relating to science and modeling, and a consulting team, led by ECONorthwest, to conduct the economic analyses. Using a collaborative process, we developed a site-specific fuel-treatments scenario, targeting areas of high fire risk to homes, communities and utility infrastructure, as well as post-fire sediment erosion risk to waterways. We commissioned studies to simulate the outcomes of future fires with and without fuel treatments—specifically forest thinning and controlled burning. The Advisory Committee, Technical Committee and consultants subsequently reviewed the analysis, vetted and approved each chapter of the report and endorsed the report's findings and conclusions.

## Analysis

Our analysis focused on modeling wildfire in the Mokelumne watershed both with and without implementation of the fuel-treatments scenario. We analyzed the size and intensity of five potential representative fires based on fire history in the region, current forest conditions and state-of-the-art wildfire models. We modeled the fuel-treatments scenario to identify how active forest management would likely modify wildfire behavior and post-fire erosion over a 30-year time period. Using these results, we quantified the financial costs and benefits of the treatments, focusing on those elements to which a dollar value can readily be assigned such as homes, infrastructure, timber, biomass energy, carbon and employment.

The analysis was based on conservative assumptions regarding potential costs and benefits, not a worst-case wildfire scenario. For example, the nearby 2013 Rim Fire was significantly larger than all five modeled fires combined and burned at higher intensity. In addition, we did not consider wildfire impacts with economic values that could not be readily determined, such as the effects of fire on wildlife habitat, recreation, tourism, and public health and cultural sites. Thus, in multiple respects, our conclusions likely underestimate the costs associated with future wildfires and the benefits of active management, suggesting an even stronger case for action.

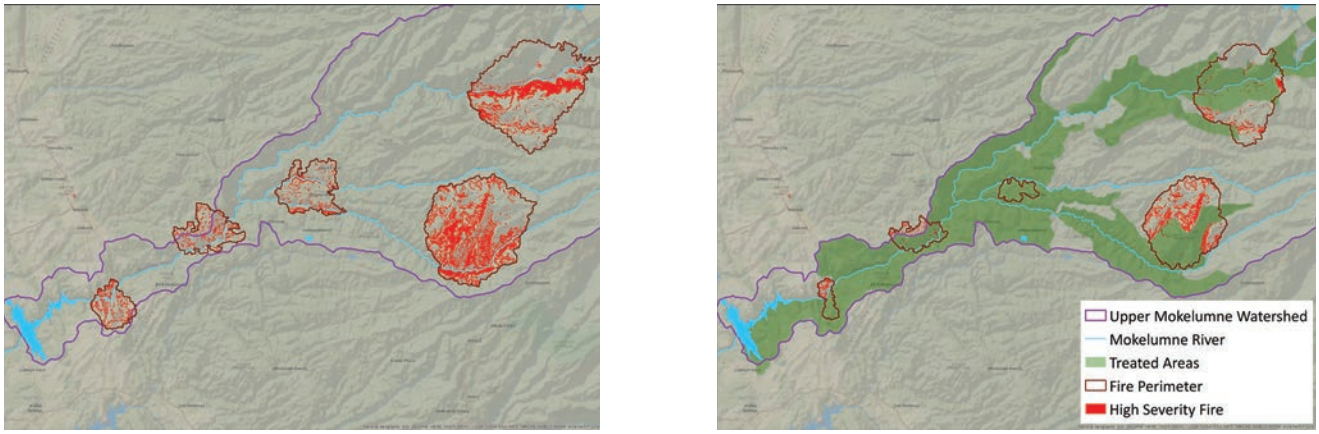


**Figure ES-2.** High-intensity Wildfire Pre- and Post-Treatments

## Key Findings

- **Fuel treatments can significantly reduce the size and severity of wildfires.** Proactive forest management can significantly modify fire behavior by reducing fire severity, size and rate of spread. Our results showed that the modeled fuel-treatments scenario reduced the size of each of the five fires by 30 to 76 percent, or a total reduction in size of approximately 41 percent. More importantly, the modeled scenario reduced the acreage of high-intensity wildfire by approximately 75 percent (figure ES-2).

- **The economic benefits of modeled fuel treatments are 2-3 times the costs.** In total, across the categories of benefits quantified in this report, the value of avoided costs significantly exceeds the cost of fuels management (figure ES-3). The avoided losses in terms of both costs and lost income opportunities include the value of structures saved from wildfire and the costs of fire suppression and post-fire restoration, as well as potential revenue from carbon sequestration, merchantable timber and biomass that could be used for energy. For each cost category, we estimated a range of values from low to high. Using the high estimates for benefits ($224 million) results in a benefit-cost ratio for the fuel-treatments scenario of 3.3:1. Even when applying a more conservative approach, using the low estimate for benefits ($126 million), the benefits of investing in fuel treatments are nearly twice the costs, with a benefit-cost ratio of approximately 1.9:1.

- **There are many beneficiaries from increased fuel treatments, especially taxpayers.** The economic benefits of fuel treatments accrue to a wide range of landowners, public and private entities, taxpayers and utility ratepayers. As shown in figure ES-4, the primary beneficiaries are the State of California, federal government, residential private property owners (and their insurers), timber owners, and water and electric utilities. By comparison, the costs of fuel treatments are largely borne by public land managers (and, by implication, taxpayers). An accelerated fuel-treatments program would also result in an estimated 35-45 jobs relating to fuel treatments and 7-10 biomass-to-energy jobs over a 10-year period. These figures represent a significant addition to the current number of such jobs in these rural areas.

| **Costs** | | |
|---|---|---|
| Fuel Treatment | $68,000,000 | $68,000,000 |
| **Benefits** | **Low** | **High** |
| Structures Saved | $32,000,000 | $45,600,000 |
| Avoided Fire Cleanup | $22,500,000 | $22,500,000 |
| Carbon Sequestered | $19,000,000 | $71,000,000 |
| Merchantable Timber from Treatment | $14,000,000 | $27,000,000 |
| Avoided Suppression | $12,500,000 | $20,800,000 |
| Biomass from Treatment | $12,000,000 | $21,000,000 |
| Avoided Road Repairs and Reconstruction | $10,630,000 | $10,630,000 |
| Transmission Lines Saved | $1,600,000 | $1,600,000 |
| Timber Saved | $1,200,000 | $3,130,250 |
| Avoided Sediment for Utilities (water supply) | $1,000,000 | $1,000,000 |
| **Total Benefits** | **$126,430,000** | **$224,260,250** |

**Figure ES-3.** Total Costs and Benefits for Fuel-Treatments Scenario

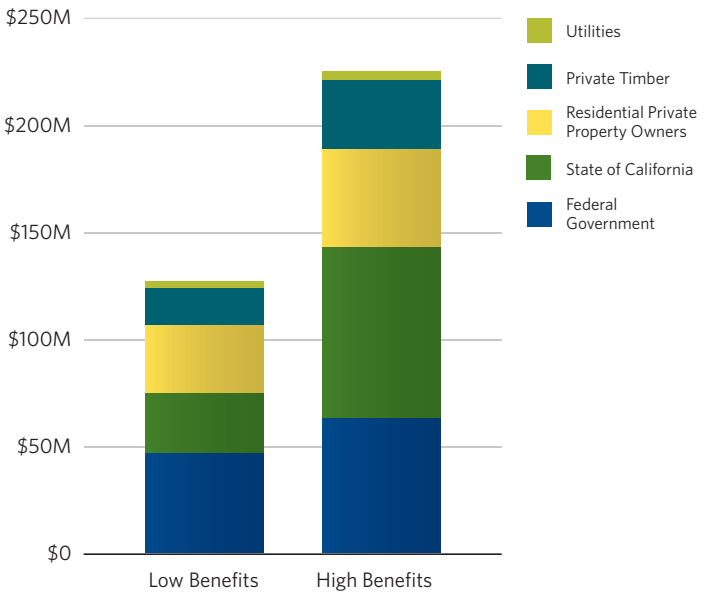


**Figure ES-4.** Fuel Treatments Beneficiaries

## Summary

In sum, our analysis shows that it makes economic sense to invest in forest management to reduce the risk of destructive, high-severity wildfires in the upper Mokelumne watershed. Although achieving such benefits requires a significant increase in the pace and scale of fuel treatments, the long-term cost savings far exceed the costs of the initial investment. To the extent that the Mokelumne is representative of other fire-adapted forested watersheds of the Sierra Nevada and the western United States, this report makes the economic case for significantly increasing investment in fuel treatments in western forests.

**FOR A COPY OF THE FULL REPORT:**
SierraNevada.ca.gov/Mokelumne

**FOR MORE INFORMATION:**


The Nature Conservancy — Protecting nature. Preserving life.

**David Edelson**
dedelson@tnc.org

**Kristen Podolak**
kpodolak@tnc.org

Sierra Nevada Conservancy

**Kim Carr**
kim.carr@sierranevada.ca.gov

**Nic Enstice**
nic.enstice@sierranevada.ca.gov

**Sherry Hazelhurst**
shazelhurst@fs.fed.us



Produced in cooperation with the USDA Forest Service.
Photography: Cover: © Katherine K. Evatt and Foothill Conservancy; This page: Above: © Mathew Grimm / Environmental Defense Fund; Below: © Noah Berger EPA



FSC 100% From well-managed forests www.fsc.org Cert no. © 1996 Forest Stewardship Council

# Estimating the WATER SUPPLY BENEFITS from Forest Restoration in the Northern Sierra Nevada

The Nature Conservancy

Protecting nature. Preserving life.

# Executive Summary

Approximately two-thirds of California's water—including drinking water for 23 million people—originates in the Sierra Nevada as snow and rain. A number of interrelated factors, including historic land management practices, climate change, drought, and a growing population, are threatening the capacity of the Sierra Nevada to meet current and future demands for water. To address this issue, The Nature Conservancy explored whether increased investment in Sierra Nevada restoration may be a valuable strategy for increasing and enhancing California's water supply. This report examines the extent to which investing in forest and meadow restoration could increase water supply and improve the timing of water availability. We focused our analysis specifically on restoration at the watershed-scale on national forests in the northern Sierra Nevada.

Using syntheses of over 150 studies on the relationship between forest harvest and water yield, we estimated the potential water yield impacts from mechanical thinning to restore a forest's ability to store snow and use water more efficiently. Our analysis suggests that, if the current scale of forest restoration is increased three-fold, there could be up to a 6 percent increase in the mean annual streamflow for individual watersheds. In the Feather River, the watershed with the greatest area available for thinning, we estimated thinning might produce ~97,000–285,000 acre feet of additional runoff. We used a cost-benefit analysis to compare the costs associated with this increased pace of forest restoration to the economic value of water supply benefits to downstream hydropower, agricultural, and urban water users. We found that the economic benefits from increased hydropower generation and water uses are sufficient to cover between one-third and the full cost of thinning, assuming a low or high water response to forest thinning.

A firefighter douses flames during the 2013 Rim Fire, the largest wildfire recorded in the Sierra Nevada. © Justin Sullivan/Getty Images

Meadow restoration also has the potential to modify downstream water supply, particularly the timing of flows. Healthy, restored meadows may hold water during periods of high runoff and release it later in the season than would occur in a degraded meadow. We reviewed the only study to date that quantified the shift in water timing from meadow restoration to understand the potential of restoration to improve water supply timing. Given the lack of research, we did not extrapolate these findings to meadows across the northern Sierra Nevada.

In this preliminary assessment, we made some generalized assumptions that require further research and data collection to validate. Future research should quantify more precisely the water yield response from ecologically based forest thinning, especially at a large watershed scale, and more precisely calculate the economic value of increased water supplies for individual watersheds. Constrained public agency capacity and budgets make accelerating thinning challenging, but these findings suggest that investment by hydropower generators and downstream water users may be a cost-effective power production and water procurement strategy and can help to overcome funding barriers. Given the many other non-water benefits of such restoration efforts—including fire risk reduction and fish and wildlife benefits—our assessment suggests that investing in Sierra Nevada forest restoration deserves consideration as a cost-effective water supply strategy for California.

LEFT: Snow covers the ground in a thinned forest stand at Independence Lake Preserve. © Simon Williams, The Nature Conservancy