SIERRA NEVADA
CONSERVANCY

Testimony to the Little Hoover Commission
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OVERVIEW

Thank you for the opportunity to provide testimony to the Commission on the critical issue of the health of our forests. This testimony focuses on the Sierra Nevada Region, with a particular emphasis on the millions of acres of federally managed lands within the Region.

The dramatic tree mortality occurring in California, and particularly in the Sierra Nevada, has brought attention to the condition and importance of our forested landscapes. Governor Brown's Emergency Proclamation has resulted in a coordinated response between California state agencies, local governments, the federal government, and the private sector. The Sierra Nevada Conservancy is an active participant in the Tree Mortality Task Force and its Work Groups and we have provided grant funding for a number of projects addressing this issue.

My testimony today addresses the larger issue of forest health and resiliency, which has been a key focus of the Sierra Nevada Conservancy since its inception in 2005. During this period, a substantial degree of agreement has emerged amongst a wide range of stakeholders—many of whom have been on opposite sides of these issues—that our forested watersheds are in need of increased restoration activities. While there has been progress due to collaborative efforts building on this agreement, the level of activity has been inadequate to meet the challenge for a number of reasons, discussed further in my testimony.

Today the results of overgrown forests, the lack of adequate restoration activities, drought, and a changing climate are evident up and down the Sierra Nevada mountain range. The tree mortality in the southern Sierra Nevada is truly unprecedented—there is no historical record to suggest anything close to this level of mortality has occurred here. Tens of millions of dead trees and large fire scars from uncharacteristically large, severe fires dominate much of the Sierra landscape. Whether one is primarily interested in environmental issues or economic activity, the recent past and the current path do not bode well.

To be clear, what is occurring in the Sierra Nevada is not natural or normal. Fire is a natural part of the Sierra Nevada ecosystem and over the centuries frequent fire events molded the large mixed conifer and sequoia stands Europeans encountered in the 1800s. However, fires during that time often slowly burned all summer long, killing a few of the larger trees but predominantly clearing out the accumulated fuels and reducing competition, reburning every 10 to 20 years.[1, 2] The result was a very diverse landscape of open, closed, young, and old forests.[3] Over time, settlement in California led to significant changes in the forest, including a reduction in Native American ignitions, logging of the larger, more resilient trees, development of communities and infrastructure, and enhanced fire suppression. More recently, the use of restoration activities designed in part to mimic historic activities (prescribed and managed fire and mechanical treatments) has diminished.

Today, the culmination of those and other land management changes have created many forested areas that are far less resilient to fire and other disturbances. The result we see all too often—fires that once revitalized forests are instead destroying them, resulting in massive amounts of dead trees. More and more fires are escaping initial suppression and burning increasing areas of Sierra Nevada forests—on the west slope of the Sierra Nevada more acres have already burned this decade, with three fire seasons yet to go, than in any previously recorded decade (Figure 1).

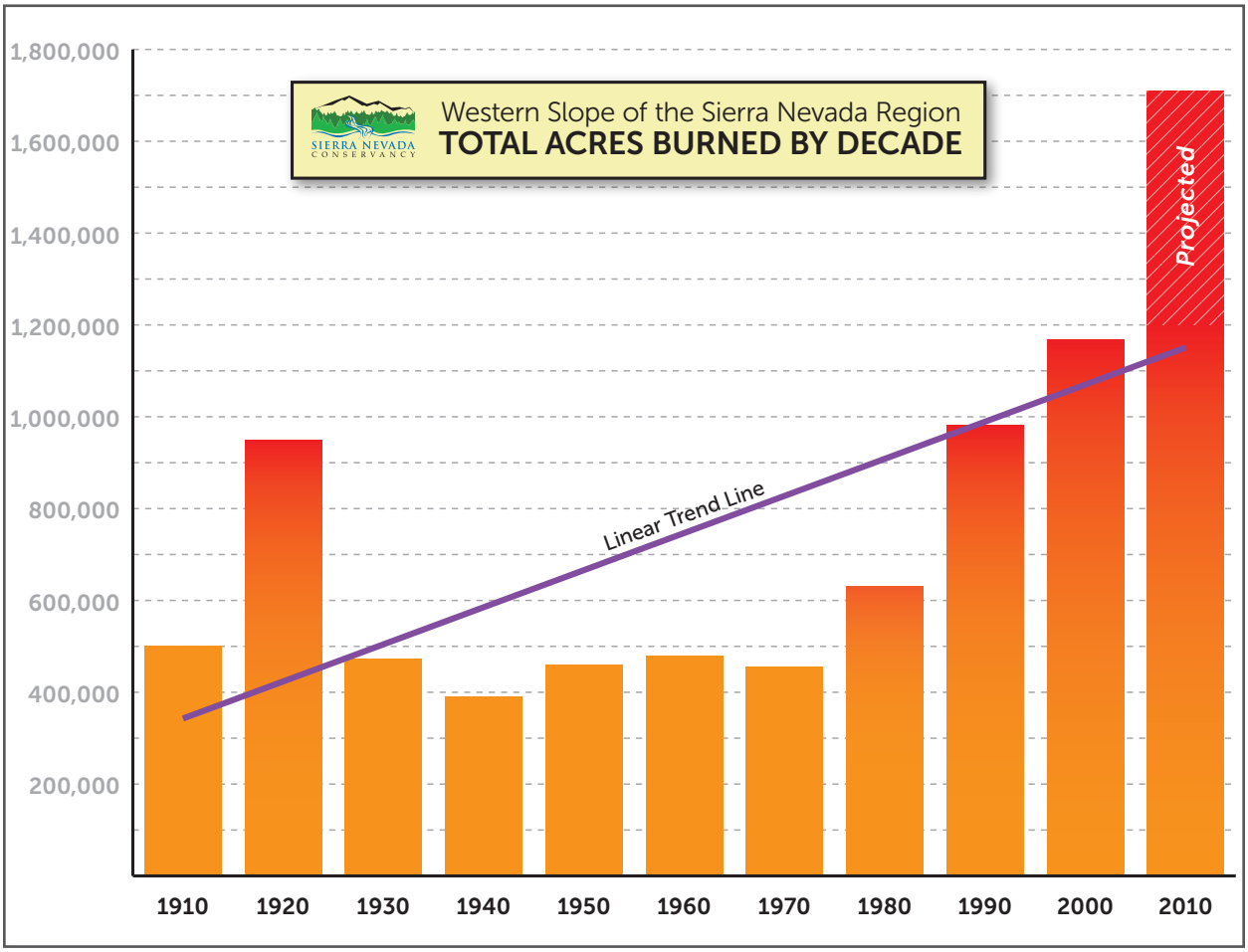

Figure 1. Total acres burned across the west slope of the Sierra Nevada Region over the last century. The hash marks on 2010 indicate the projected acres to burn in the 2017–2019 fire seasons based on the average acres burned each year in the current decade.

The impacts of the current conditions and the resulting events to California are significant. The devastating tree mortality from drought and bark beetles, experienced mostly in the southern Sierra Nevada to date, has resulted in a number of key adverse impacts, including:

- Threats to public safety and infrastructure from falling trees
- Loss of significant amount of carbon absorbed and stored, and increase in greenhouse gas emissions
- Loss of critical wildlife habitat
- Increased short-term and long-term fire danger

Large, severe wildfires likewise carry substantial consequences:

- Massive amounts of air pollution with public health consequences
- Loss of significant amount of carbon absorbed and stored
- Increased sediment production affecting water quality and water infrastructure
- Loss of critical wildlife habitat
- Increased fire suppression costs
- Loss of revenue from tourism and recreation

The underlying condition of overgrown forests in much of the Sierra Nevada contributes significantly to increased tree mortality and large, severe fires. While drought conditions and a changing climate exacerbate the situation, addressing the underlying problem by restoring our forested watersheds to a more resilient state can greatly alleviate these problems and offers the best protection for the future. There is plenty of evidence and broad agreement that we have the knowledge and tools to restore Sierra forests back to a healthy and more resilient state and reduce the adverse impacts that we are currently seeing. A significant increase in the pace and scale of mechanical treatments, prescribed and managed fire, and meadow and stream restoration needs to occur. Only with such an effort can the water our forested watersheds provide and the carbon they store, as well as the other ecosystem services they provide, be protected. Successful implementation is dependent on three primary actions:

- **Increase investment** in watershed restoration in the Sierra Nevada.
- **Address policy and process constraints** that increase cost and complexity, and have the unintended consequence of impeding needed restoration.
- **Support development of additional infrastructure** to utilize material removed as part of restoration.

It is for this reason that the Sierra Nevada Conservancy has joined with the US Forest Service Region 5 in leading the Sierra Nevada Watershed Improvement Program. The Forest Service manages nearly half of the forestlands in the Sierra and has identified millions of acres in need of restoration. Given the substantial benefits provided by these lands for all of California, a state-federal partnership is essential in achieving a substantial increase in the pace and scale of restoration. It is in California's best interest to assist in the restoration of these lands through investment and policy. A variety of other state and federal agencies are partnering on this effort, as are local governments, tribal entities, environmental and conservation organizations, the wood products industry, the outdoor recreation community, and other community organizations. This program is discussed in more detail later in this testimony.

SIERRA NEVADA CONSERVANCY BACKGROUND AND ROLE

The Sierra Nevada Conservancy (SNC) is a California state agency created by bi-partisan legislation (AB 2600) and signed into law in 2004. The SNC was created with the understanding that the environmental, economic, and social well-being of the Sierra Nevada and its communities are closely linked and that the Region and the state of California would benefit from an organization providing a strategic direction. The SNC Region (Figure 2), made up of all or part of 22 counties covering one-quarter of the state (over 25 million acres), is one of the most significant natural and biologically diverse regions in the world. The Sierra Nevada is the state's principal watershed, supplying more than 60 percent of the developed water supply to residents, agriculture, and other businesses and industries across the state. It is home to the headwaters of the State Water Project and a major contributor to

Figure 2. The Sierra Nevada Region is made up of all or part of 22 counties covering one-quarter of the state.

the federal Central Valley Project. The Region is also the primary source of origin of fresh water for the Sacramento-San Joaquin Delta.

The SNC's mission is to initiate, encourage, and support efforts that improve the environmental, economic, and social well-being of the Sierra Nevada Region, its communities, and the citizens of California. We carry out our mission by providing grants for projects that improve watershed and community health. The SNC also offers technical assistance and other support for collaborative projects in partnership with local government, nonprofit organizations, and tribal entities. We engage in policy discussions that affect the work we do in the Region and the benefits provided throughout California.

Financing for the implementation of the SNC's programs comes from the California Environmental License Plate Fund; Proposition 84, The Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coast Protection Bond Act; and Proposition 1, The Water Quality, Supply, and Infrastructure Improvement Act of 2014.

The SNC's actions are also guided by a number of statewide plans, including the CA Water Action Plan, the CA Bioenergy Action Plan, Safeguarding CA, and the AB 32 Scoping Plan.

AT RISK—THE BROAD RANGE OF BENEFITS THAT HEALTHY, RESILIENT FORESTS IN THE SIERRA NEVADA PROVIDE TO CALIFORNIA

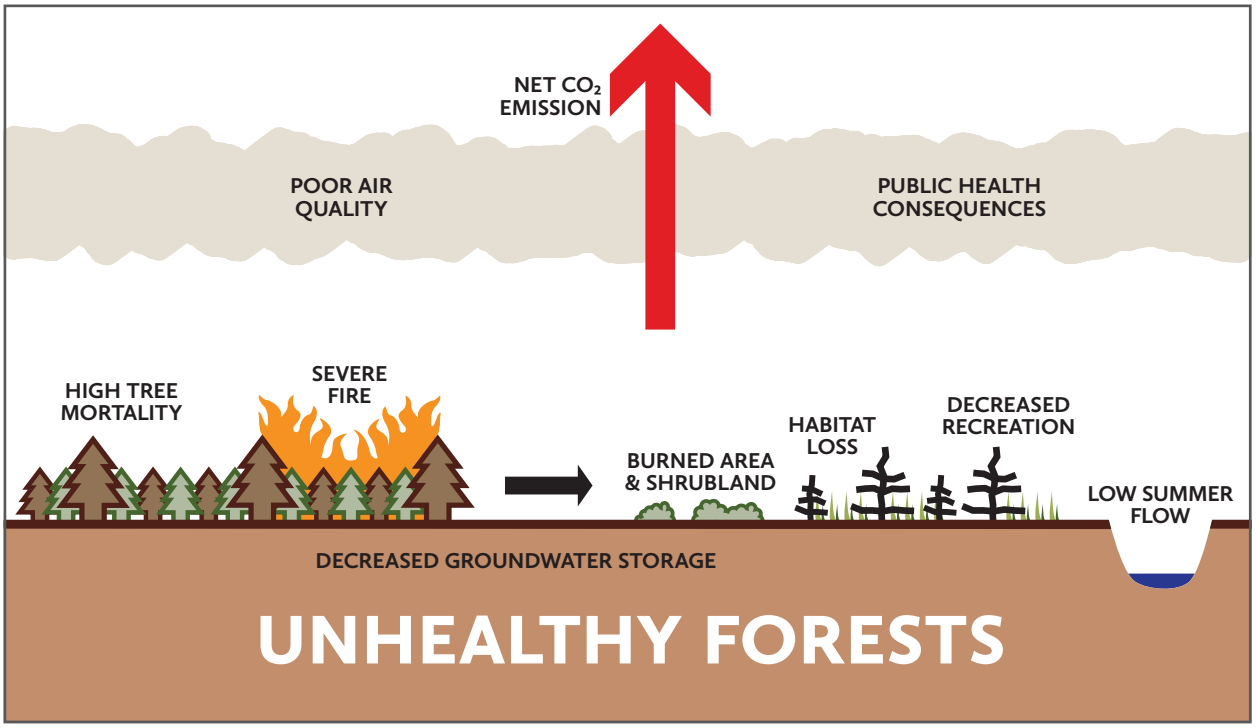

Figure 3. Carbon storage in unhealthy forests is unstable and more likely to contribute to climate change rather than offset it.

Healthy forests provide a variety of local, state, and national benefits including clean air and water, absorbing and storing carbon from the atmosphere, endangered and other species habitat, recreational opportunities, renewable energy, and wood products. Millions of California residents hundreds of miles away depend on these watersheds for their water supply, as do many California farmers and businesses. State policy makers responsible for the state's landmark climate change program recognize the important role healthy forests play in absorbing and storing carbon—and the emissions that occur when forests die or burn.

However, with significant portions of the Sierra Nevada forests unhealthy and lacking resilience, many of these benefits have been diminished and more are at serious risk. The process of restoring degraded, overgrown watersheds into healthy, resilient landscapes offers the only viable option to protect and enhance these benefits into the future. With a changing climate likely to result in higher temperatures and less snowpack, these benefits will become even more threatened and the need for action more urgent. The primary benefits at risk include the following:

Carbon Capture and Storage

Forests are identified as California's largest carbon sink by the California Air Resources Board. In 1990, it was estimated that our forested areas were removing 13 million metric tons of carbon dioxide in a year. However, many of today's forests are overgrown, and they are no longer the reliable carbon sink that California has depended on (Figure 3).

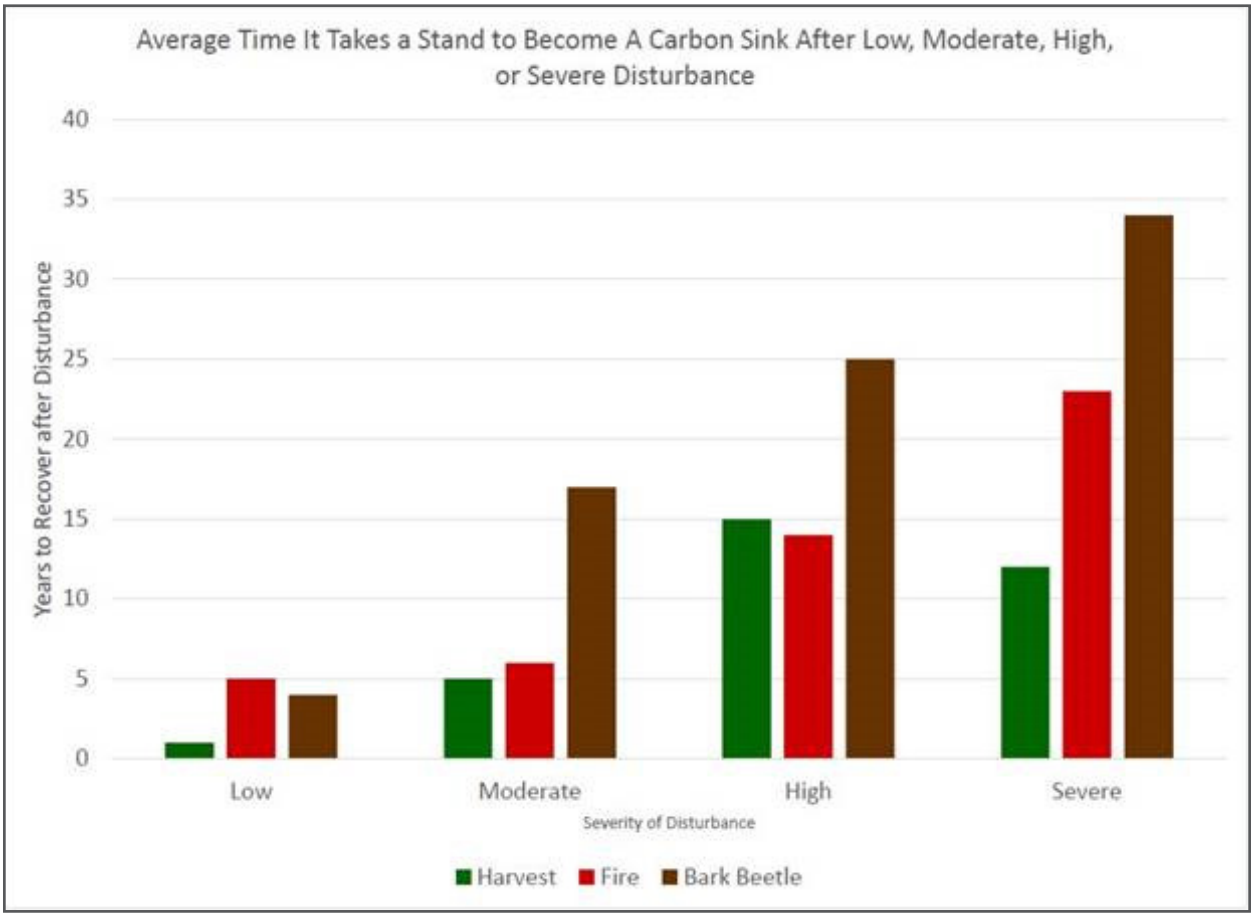

Figure 4. Average time it takes a forest to recover as a carbon sink after a disturbance. Adapted from Raymond 2015[1].

- **Recent tree mortality will have both immediate and long-term impacts on the stability of carbon in Sierra Nevada forests.**
  - The Sierra Nevada Conservancy estimates that 53 MMTCO2e (an amount equal to the annual emissions of 11 million cars) of live tree carbon shifted to the dead pool due to tree mortality from beetles and drought in the southern Sierra in 2016.
  - Over 50 million trees—many of them large trees that were absorbing and storing large amounts of carbon—in the southern Sierra are no longer actively sequestering carbon, with nothing to replace that loss over the short-to-medium term.
  - Beetle-killed forests take much longer than other disturbance areas to become net sequesterers (Figure 4).

Figure 5. The emissions released in the Rim Fire equaled what 2.3 million cars would emit in a year—only a fraction of what will be released as fire-killed trees decay over time.

- **An increase in high severity fire is having long-term implications on carbon storage.**
  - In recent decades, the percentage of acres burned at high-severity was around 20 percent—the 2013 Rim Fire burned at 40 percent high-severity and the 2014 King Fire at nearly 50 percent.
  - High-severity wildfires emit millions of metric tons of CO2e in their plume during the fire event, with estimates of post-fire emissions being as much as five times greater than during the fire.
  - The Rim Fire released more greenhouse gas emissions in its smoke plume than the city of San Francisco produces in a year, and those emissions represent only 15 percent of what will be released from the burn footprint as dead trees decay (Figure 5).

- **We can't count on post-fire regrowth to balance carbon emissions from fire events anymore.**
  - In some areas of the Sierra Nevada, forests that burned at high severity are not regrowing as forest.[4] More and more areas are experiencing a change in vegetation type from forest to shrub or grasslands, which can reburn at high severity in less than a decade[5] and store less than 10 percent of the carbon than the forests they replaced.

- **Healthy forests, even during drought, can continue sequestering carbon from the atmosphere at a significant rate,[6] and the larger the tree the more carbon it will pull from the atmosphere on an annual basis.[7]**
  - Research demonstrates that the presence of very large trees in pre-1900 California forests resulted in 25 percent higher carbon storage per acre than the overgrown stands of many Sierra forests today .[8] Large trees also actively sequester more carbon on an annual basis than smaller trees.[9]
  - Overcrowded trees grow slowly due to resource competition and therefore absorb less carbon than trees in a more natural condition (Figure 7).
  - A recent study in the Sierra Nevada highlighted the carbon benefits of recently treated, healthy forests compared to overgrown forests. Over a 10-year period starting in 2002, all treated areas gained in sequestered carbon while the untreated areas actually lost carbon.[10] These observations come from before the drought and the gap between treated and untreated has likely grown significantly since.

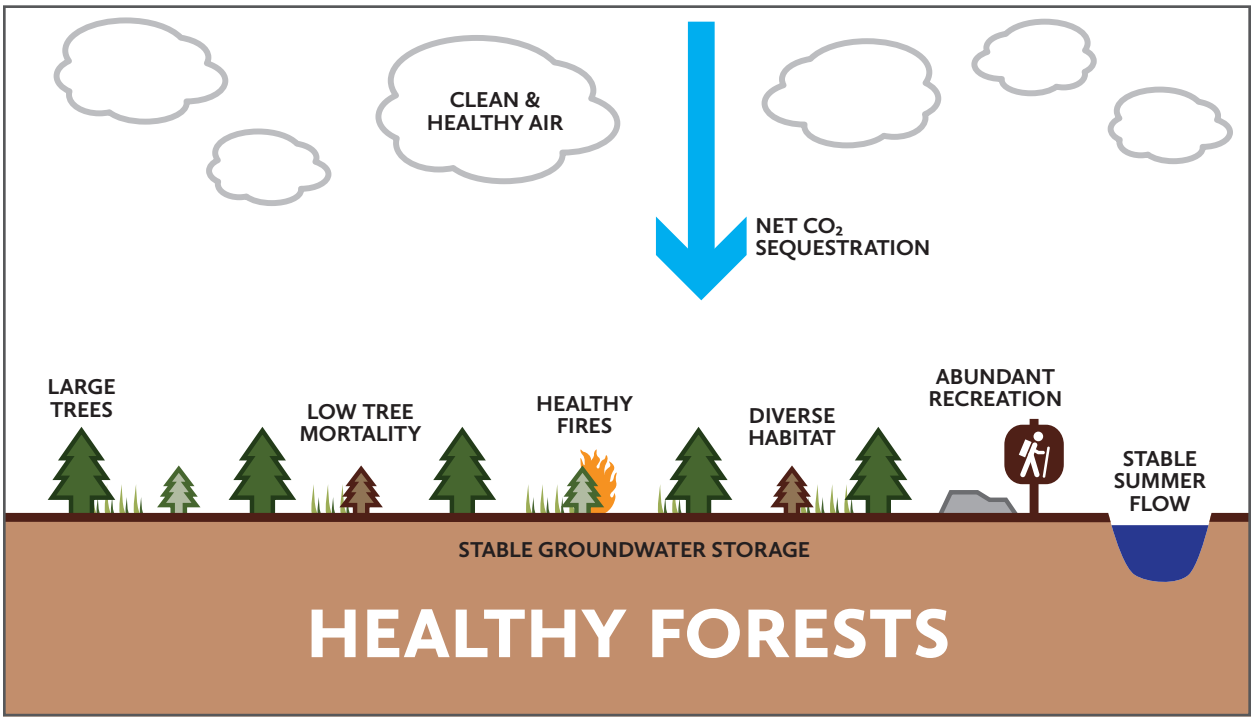

Figure 6. Healthy forests provide more stable carbon storage for California.

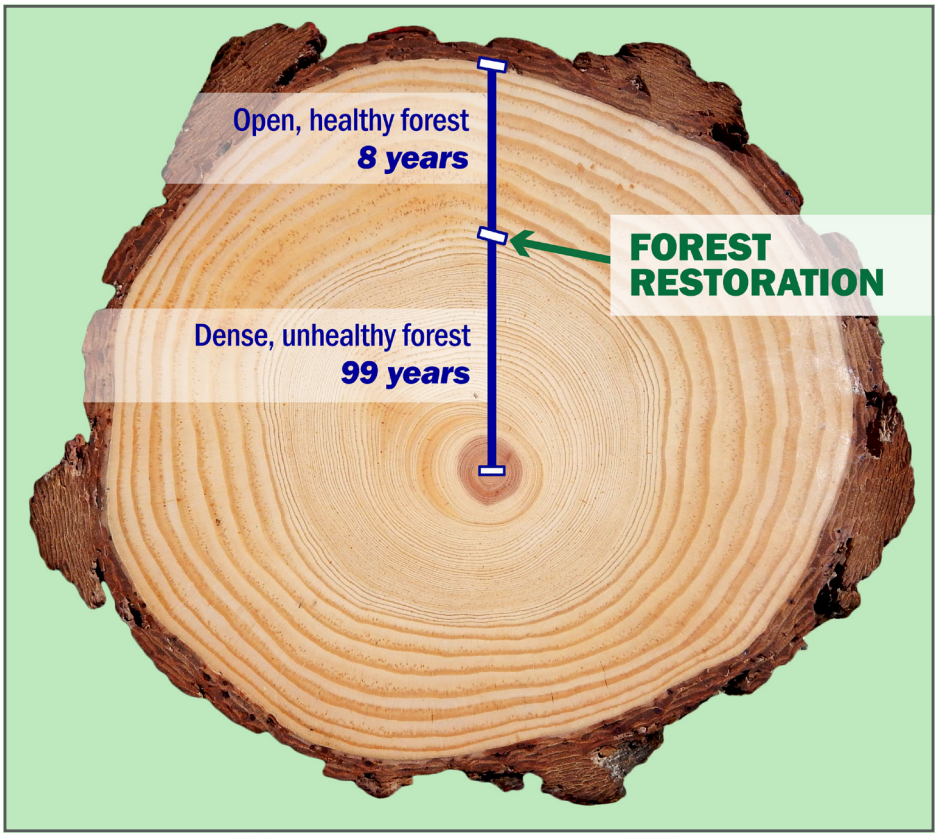

Figure 7. Ecologically sound forest thinning can free up resources for remaining trees, allowing them to put on more growth and sequester more carbon.
Photo credit: U.S. Forest Service, Pacific Southwest Research Station.

Water Supply, Timing, and Quality

Healthy forested ecosystems work to maximize the Sierra snowpack, which is our largest form of natural storage of water. More than 60 percent of California's developed water supply comes from forested watersheds in the Sierra Nevada, and more than 75 percent of the Sacramento-San Joaquin Delta's unimpaired inflow comes from the Sierra.[11, 12]

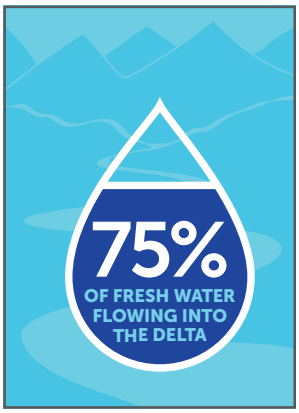

Figure 8. 75 percent of the fresh water flowing into the Delta comes from the Sierra Nevada Region.

- **Climate change projections suggest that the future will hold more precipitation in the form of rain and less as snow for the Sierra. Taking actions that allows our forested watersheds to maximize snowpack will become even important in the future.**
  - Recent climate research on Sierra Nevada snowpack by the UCLA Center for Climate Science estimates that, compared to the snowpack levels of 1981-2000, Sierra snowpack will diminish by 48 percent by 2100.
  - A study located in Arizona examined the snow retention rate of a number of locations under a variety of treatments compared to untreated forests. Treated sites resulted in greater snow accumulation, as well as longer snowpack persistence into the spring.[13]
- **There is substantial evidence that healthy resilient forests can increase water yield: a number of studies have shown returns on forest management of increased snowpack and increased instream flow.** [14, 15]
  - In 2015, the Nature Conservancy published a meta-analysis of 150 existing studies on forest management and water supply and analyzed the impacts on potential water yield from a number of diverse forest management strategies. Their analysis found possible returns of up to an **increase of six percent** in overall potential yield.[16]
  - In an area of Yosemite National Park where managed fire has been used to restore the forests over the last few decades, water yield has been shown to have maintained, and potentially increased, while in the adjacent forests, where no ecological restoration has been done, water yield has decreased.[17]
- **Landscapes that suffer severe fire see dramatic increases in sediment that runs off into streams and reservoirs, and a change in the timing and capture of snowmelt.**
  - High-severity fire reduces vegetative cover, exposing more soil to the elements. These high-severity burn areas can experience runoff and erosion rates five to ten times greater than low- or moderate-intensity burn areas (Figure 9).[18] Not only does this sediment

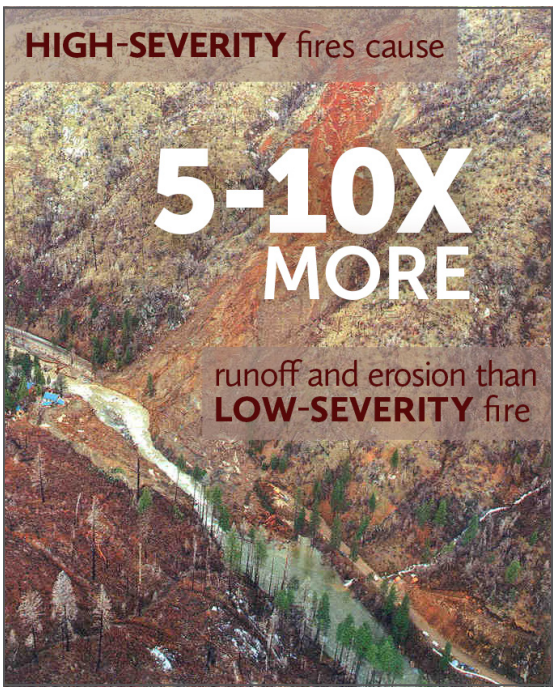

Figure 9. Areas burned at high-severity experience significantly more erosion than areas burned at low- or moderate-severity.

impact water quality and water infrastructure, it also displaces water storage capacity in reservoirs.
  - High-severity fires and extensive tree mortality expose much of that area's snowpack to direct sunlight and shift melt times to earlier in the spring when the water flowing downstream is less able to be captured.

Public Health

Trees are capable of removing airborne pollutants such as ozone, nitrogen dioxide, and particulate matter via uptake by leaf and needle surfaces. When forests burn at high severity, they become a source of massive air pollution.

- **Studies suggest severe "stand-replacing" forest fires are increasing in frequency and extent, and climate change will likely exacerbate the situation leading to increases in wildfire size and severity.**[19, 20, 21]
- **For children, the elderly, and those with pre-existing cardiovascular and respiratory conditions, there can be serious complications as a result of exposure to wildfire smoke.**
  - With fire comes smoke, and while there are significant variables in how and what type of smoke is formed, research is clear that smoke, and all of its constituents, is bad for humans.[22, 23, 24]
  - Fresno County's Department of Public Health reported a 411 percent increase in emergency room visits for respiratory issues over a 72-hour period while the 2015 Rough Fire was burning.[25]
- **Black carbon is also produced—in large quantities—by wildfire. Some analyses indicate that black carbon could be worse than methane emissions when it comes to global warming contributions.**[26]
  - Black carbon is often grouped with greenhouse gasses, but is actually a very small particulate that is formed with incomplete combustion.
  - The pollutant also represents significant public health risks for cardiovascular and respiratory diseases, as well as cancer and, potentially, birth defects.[27]
- **Large wildfire events tend to occur late in the summer, when air quality conditions are already bad, uncontrollably exacerbating health conditions at that time.**
  - Prescribed and managed wildfires are done during times when the smoke impacts are minimal and controlled. Using this management tool reduces the likelihood of larger, more sever wildfires.

Wildlife Habitat

Sierra Nevada forests are home to 60 percent of California's animal species. Over one-third of these animal species are listed by the Department of Fish and Wildlife as rare, threatened, or endangered, but current forest conditions are making the protection of their habitat extremely challenging.

- **The keys to long-term preservation of wildlife are the conservation of existing complex habitats and the improvement, reestablishment, and management of degraded habitats. Active forest management is a critical component to achieving these goals.**[28]
- **Recent research shows that critical habitat can be severely impacted by high-severity wildfire.**
  - In the King Fire, almost 34,000 continuous acres burned at high severity, resulting in a homogenous stand of dead trees with almost no habitat diversity.
  - Of the more than 10 established California Spotted Owl sites that burned in that 34,000 acre

patch of high severity, none were recolonized post-fire. In fact, GPS-tracking of local owls showed the owls avoided that patch even for foraging, preferring the adjacent areas that burned in more of a mosaic.[29]

Sustainable Rural Economies

Rural economies benefit from healthy forests, and the work done to get them there. Wood products and outdoor recreation both can contribute significantly to rural communities' economic well-being. Spending on activities related to healthy and resilient forests contributes to job opportunities and earnings in these sectors, as well as the potential for local tax revenue collection on the goods and services purchased. Maintaining the economic sustainability of these sectors is also important to support the ability of land managers to undertake the management actions needed to improve forest health and reduce fuels: while some forest management activities may result in revenue, most of the action needed on national forests and other public landscapes will, in fact, require investment.

Historic and Cultural Resources

While a wide range of people value California forests for the natural resources they provide, the relationships Native Americans and tribes have with these resources is closely tied to their psycho-social-spiritual, cultural, and physical well-being. The loss of access to these resources, and perhaps especially traditional foods and their habitats, can affect more than diets: it can threaten the associated knowledge and identities embedded in stories, ceremonies, songs, and the community processes of collecting, preparing, and sharing foods.[30,31,32,33] A growing number of examples exist that make use of indigenous peoples' legacy knowledge of and connection with their lands to shape forests into resilient, carbon-capturing landscapes. In many cases, tribes have legal and financial resources additive to conventional landscape management agencies, and their participation can create synergies in application, permitting, and financing forest management activities. In return, participating tribes have the opportunity to work on and, in some cases, manage landscapes to which they have historic and pre-historic ties.

A PATH FORWARD—RESTORING FOREST AND WATERSHED HEALTH AND RESILIENCE

The conditions of today's Sierra Nevada forested watersheds are resulting in significant adverse impacts to a range of benefits for California and its residents and future climate change is expected to put these benefits at great peril. However, we possess the tools to slow or stop those impacts. Utilizing ecologically sound restoration techniques at a much greater pace and scale is the only manner in which we can address this situation. It is in that context that the above referenced Sierra Nevada Watershed Improvement Program was launched.

Sierra Nevada Watershed Improvement Program

In light of the extreme need faced by forests in the Sierra Nevada Region, the Sierra Nevada Conservancy, in partnership with the US Forest Service (USFS), established the Sierra Nevada Watershed Improvement Program (WIP) in early 2015. The WIP is a coordinated, integrated, collaborative program to restore Sierra forest health through increased investment, needed policy changes, and increased infrastructure. This comprehensive effort is being organized and coordinated in close partnership with

other federal, state, and local agencies, as well as diverse stakeholders, and aims to increase the pace and scale of ecologically sound restoration in the Region. It built on the substantial collaborative work already occurring in the Region, with an understanding that more such effort is needed.

While WIP is intended to assist in increasing efforts on all lands, a primary early focus is on the USFS lands, which make up the largest portion of Sierra forested lands (more than 40 percent). The USFS has estimated that in order to return their lands to ecological health, 500,000 acres a year should be restored. In recent years, the amount actually treated has been in the 150,000 to 200,000 acres range. It is important to note that the estimates of need was released prior to the massive tree mortality outbreak and efforts are currently underway to update the restoration needs.

As noted earlier, the WIP targets three primary areas that must be addressed in the forests of the Sierra Nevada if they are to be restored to ecological health:

- **Increase watershed restoration investment in the Sierra Nevada**

The level of state, federal, local, and private investment being made into our forested watersheds is inadequate to the meet the need. The consequences outlined above result in far greater costs than the restoration worked needed, in forms of fire suppression, losses of property and infrastructure, and other socio-economic costs.

At the state level, a number of funding sources exist where some level of investment is being made, but the opportunity exists for increasing investment:

- Greenhouse Gas Reduction Fund
- Proposition 1
- State Responsibility Area Fund
- Timber Regulation and Forest Restoration Fund (AB 1492)

At the federal level, a key issue that has been identified is a modification of the way in which fire suppression for larger fires is funded. Currently these activities are financed through the USFS's base budget, which results in less funding being available for restoration and other activities. (California pays for such extraordinary costs through an Emergency Fund.) Last year, a majority of the USFS's budget was used for fire suppression, up from about 20 percent only a few years ago. There have been numerous efforts in Congress to address this issue, but to date, it continues to be a significant contributor to the poor health of so many of our public forests.

It is also important to identify other investment mechanisms that would result in the beneficiaries of healthy forests to contribute more directly to the needed restoration. This includes developing mechanisms for payments for "ecosystem services," end user water fees (public goods charge), and the use of private investment targeted at ecological outcomes.

- **Address policy and process constraints that increase cost and complexity**

There are many policy and process constraints that result, often inadvertently, in constraining our ability to restore our landscapes at the appropriate pace and scale. **Understanding that many policies, processes, and rules are in place to reduce the risk of adverse impacts of actions, it is important to note that given today's conditions, it is often the failure to act that carries the greatest risk.** Finding a balance between the need for restoration and the range of constraints faced is essential. Examples of areas that need to be addressed include the following:

- State and Federal Regulatory Processes: Identifying specific opportunities to demonstrate more efficient approaches to landscape restoration planning as it relates to National Environmental Policy Act (NEPA), California Environmental Quality Act (CEQA), state and federal Endangered Species Acts (ESA), and other permitting processes is critical to increasing the pace and scale of ecological restoration. For example, there is growing evidence that large, severe fires are having dramatic impacts on species such as the California spotted owl, despite regulatory and management restrictions to protect them.

  The variety of policies, regulations, issues, responsible agencies, and range of stakeholders active in the Sierra Nevada make landscape-level restoration complicated and challenging. Identifying opportunities to improve the efficiency of planning processes and enhancing the coordination and integration of various processes will result in increased ecologically sound restoration activities in the Sierra Nevada.

- Air Quality Regulations: Prescribed and managed fire, under appropriate conditions, is an important restoration tool that improves forest resiliency and reduces the risk of large, high-intensity fires. However, a number of factors including air quality regulations, staffing, funding, and liability issues can restrict the use of prescribed and managed fire. Existing policies may have the unintended consequence of enabling larger, more damaging fires to occur and result in far more emissions than would have been released by prescribed fire.

Figure 10. Existing policies may have the unintended consequence of enabling larger, more damaging fires (left) to occur and result in far more emissions than would have been released by prescribed fire (right). Photo Credit: U.S. Forest Service.

Example (Figure 10): In fall 2015, the USDA Forest Service Pacific Southwest Region, National Park Service Pacific Region, CAL FIRE, Sierra Nevada Conservancy, multiple environmental organizations, and two prescribed fire councils signed the Memorandum of Understanding for the Purpose of Increasing the Use of Fire to Meet Ecological and Other Management Objectives (MOU).[34] The MOU recognizes that the state's wildland ecosystems have evolved with fire, which provides landscape resilience and renewal. The purpose of the MOU is to "...document the cooperation between the parties to increase the use of fire to meet ecological and other management objectives in accordance with... [specified provisions]." Modifications to the MOU are currently underway and a number of additional agencies and organizations have signed on to it.

- **Develop additional infrastructure to utilize material removed as part of restoration**

With the significant amount of material that needs to be removed as part of ecological forest restoration, utilizing this material becomes a key factor. Some of the material removed can be used for production of traditional wood products. **By creating value for the other material, costs can be significantly offset and adverse impacts from other means of disposal can be minimized**. The state has taken a number of actions to enhance utilization of biomass to create electricity including the Bioenergy Action Plan (2012), SB 1122 (2012), Governor Brown's Tree Mortality Emergency Proclamation, and SB 859 (2016). Nonetheless, the overall capacity of such facilities is significantly less than a decade ago. Opportunities for enhancing utilization include the following:

- Maintain and upgrade existing facilities
- Expand utilization technologies through state and federal funding programs such as Electric Program Investment Charge Program (EPIC) and the Wood Utilization Grants
- Provide incentives for creation of infrastructure

Forest management and biomass utilization can play important roles in maximizing the air quality benefits of forests: by treating forests to reduce the potential for severe wildfires, forest management activities can reduce wildfire emissions that have impacts on both human health and the climate.[35] Treatments that involve the use of prescribed fire result in some emissions, but the scale of those emissions is much smaller compared to a wildfire. In addition, such activities are regulated based on local favorable atmospheric conditions and managed to minimize air quality impacts.[36]

CONCLUSION

Timely implementation of the WIP is essential if Californians are to continue to receive the many benefits that come from the Sierra Nevada Region. Failure to do so will continue to result in significant adverse impacts to the state's environment and economy.

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