



Fire on the Mountain: Rethinking Forest Management in the Sierra Nevada

Report #242, February 2018



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Dedicated to Promoting Economy and Efficiency in California State Government

The Little Hoover Commission, formally known as the Milton Marks "Little Hoover" Commission on California State Government Organization and Economy, is an independent state oversight agency.

By statute, the Commission is a bipartisan board composed of five public members appointed by the governor, four public members appointed by the Legislature, two senators and two assemblymembers.

In creating the Commission in 1962, the Legislature declared its purpose:

...to secure assistance for the Governor and itself in promoting economy, efficiency and improved services in the transaction of the public business in the various departments, agencies and instrumentalities of the executive branch of the state government, and in making the operation of all state departments, agencies and instrumentalities, and all expenditures of public funds, more directly responsive to the wishes of the people as expressed by their elected representatives...

The Commission fulfills this charge by listening to the public, consulting with the experts and conferring with the wise. In the course of its investigations, the Commission typically empanels advisory committees, conducts public hearings and visits government operations in action.

Its conclusions are submitted to the Governor and the Legislature for their consideration. Recommendations often take the form of legislation, which the Commission supports through the legislative process.

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In Loving Memory of Carole Jean D'Elia

Executive Director, 2013-2017



*An extraordinary leader,
public servant, mentor and friend*



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Letter From The Chair

February 5, 2018



The Honorable Kevin de León
President pro Tempore of the Senate
and members of the Senate

The Honorable Patricia Bates
Senate Minority Leader

The Honorable Anthony Rendon
Speaker of the Assembly
and members of the Assembly

The Honorable Brian Dahle
Assembly Minority Leader

Dear Governor and Members of the Legislature,

A century of mismanaging Sierra Nevada forests has brought an unprecedented environmental catastrophe that impacts all Californians – and with it, a rare opportunity for transformational culture change in forest management practices.

The opportunity should not be lost. Proactive forest management practices recommended by the Commission gradually will rebuild healthy high-country forests that store more water, resist new insect infestations and check the speed and intensity of wildfires. Investing upfront to create these healthier forests will pay dividends in the long run by curbing the spiraling costs of state firefighting and tree removal while building stronger recreation and sporting economies in the Sierra Nevada. Forests largely restored to the less crowded natural conditions of centuries ago – through greater use of prescribed burning to replace unilateral policies of fire suppression and mechanical thinning to remove buildup of forest fuels – also will improve wildlife habitat, enhance environmental quality and add to the resilience of mountain landscapes amidst the uncertainties of climate change.

The immediate crisis is visible to anyone who recently has traveled in the Sierra Nevada, especially in its southern range where entire mountainsides are brown with dying and dead forests. A plague of bark beetles following years of drought has killed 129 million trees and counting. Rural counties are reeling from costs of removing and storing dead trees that threaten their public safety. Rural homeowners, often retired and on fixed incomes, are having to tap their life savings to take down dead trees near homes and buildings.

On a larger scale, state government, too, is spending millions of dollars to remove dead trees near highways and other public infrastructure. State and federal firefighting costs have risen year by year to battle catastrophic wildfires during a lengthening fire season on millions of acres of the state's dense, overgrown forests. California's public- and investor-owned energy providers are budgeting emergency funds to remove dead and dying trees near power lines. Water districts are spending their reserves to remove soils from reservoirs in the wake of catastrophic mountain wildfires.

All these are symptoms of a larger problem of forest mismanagement and neglect. The Commission spent a year reviewing crisis conditions in Sierra Nevada forests and listening to suggested remedies. During three

hearings, an advisory committee meeting and visits to mountain communities, Commissioners heard extensive testimony and a wide range of views from government agencies and stakeholders about this environmental disaster and the encouraging developing consensus around policy changes that will begin to resolve it.

The obstacles to progress are daunting and tremendously complex, however. The federal government owns nearly 60 percent of the forests that cover one-third of California, which complicates a state response to the immediate crisis and plans for longer-term solutions. Many of the biomass facilities that might have burned millions of dead trees for energy generation have closed or are closing. A century of fire suppression remains firmly entrenched within federal and state firefighting agencies and has left forest floors deep in flammable groundcover. Plans for prescribed burning to rid the forests of dense groundcover often clash with regional air quality regulations, even as emissions from catastrophic wildfires nullify hard-fought carbon reduction accomplishments. Finally, familiar old divisions between the timber industry and environmentalists hinder policy goals to thin overgrown forests to their original conditions.

The Commission is encouraged by the state's actions to date. Governor Brown's Tree Mortality Task Force, established in November 2015, has received high marks for coordinating 80 state, federal, tribal and local agencies, utility companies, nonprofit organizations and other stakeholders in a unified response. The Commission recommends that the task force evolve beyond the immediate bark beetle crisis into a long-term forest management entity with funding to guide a transformation in managing Sierra forests that incorporates transparency and accountability. The Commission also is encouraged by the state's legal authority to treat and thin federal forests in cooperation with U.S. agencies. Growing cooperation between the state and federal governments bodes well for the necessary transformation in how both will manage their public forests.

Success will require willingness over the course of years to invest more for proactive forest management, including greater use of prescribed burning, and less reliance on reactive firefighting. It especially will depend on enhancing public awareness of the role of Sierra Nevada forests in the wellbeing of California. The Commission respectfully submits these findings and recommendations and looks forward to assisting you for healthy forests in California.



Pedro Nava
Chair, Little Hoover Commission

Contents

6 Executive Summary

10 Introduction

Study Scope	10
The Commission’s Prior Work on the Subject	10
Study Process	11
Report Format	11

12 The Tree Mortality Crisis as an Introduction to Forest Management in California

The Tree Mortality Crisis: 129 Million Trees Dead... and Counting	12
How We Arrived Here: Policy + Drought + Bark Beetle	12
Fire Suppression Led to Overcrowding, Less Forest Diversity	12
Historic Drought	14
Enter the Bark Beetle	14
The Local Impact	14
Funding Challenges	14
Heightened Risk of Severe Wildfire	15
Water Quality	15
In Short: Healthy Forests Benefit All Californians, But Mostly the Locals Bear Immediate Costs of Forest Mismanagement	16
How The State is Responding to the Tree Mortality Crisis	16
The Tree Mortality Crisis is a Symptom of Larger Problem	18
A Broader, Long-Term Focus on Forest Management	18
Why Healthy Forests Matter	18

20 Increasing Pace and Scale through Collaboration

Pace and Scale Needs	20
Forest Ownership	21
Federally-Owned Forests	21
Private Forests	22
Uses of California’s Forests	23
Landscape-Level Collaboration	23
Good Neighbor Authority	24
The Logistics of Collaboration	24
Building Trust	24
Landscape-Level Collaboration Takes Time and Money	25

Contents

Supportive and Decisive Decision-Makers	27
Summary	27
Recommendations	27
30 CAL FIRE L.A. Moran Reforestation Center (LAMRC) Tour	
32 Embracing Fire as an Essential Tool for Forest Resiliency	
California’s Fire-Adapted Forests	32
When Natural Fire Regimes Reign	33
Benefits of Using Prescribed Fire	34
What the State is Doing to Increase the Use of Prescribed Fire	34
California’s Prescribed Burn Programs	37
Challenges to Using Prescribed Fire	39
Human Encroachment on Forests	39
On-the-Ground Conditions	39
Costs Associated with Prescribed Burning	41
Carbon Sequestration	41
Air Quality Concerns	42
Monitoring Air Quality	42
Public Messaging	43
Impact at the Local Level	44
Conclusion	45
Recommendations	45
46 California’s Wood-Processing Infrastructure	
Declining Sawmill Capacity	47
SB 859 Working Group	48
Regional Approach	50
Sustainable Harvesting and Environmental Impact	50
The Commission’s Next Steps	51
Biomass Electricity	51
Little Hoover Commission Advisory Committee Meeting on Biomass	52
Who Pays?	52
Decentralization of Energy	53
High-Hazard Feedstock Availability	53
Displacement of Other Types of Biomass	54
Air Pollution and Environmental Justice Communities	54
A Biomass Energy Policy is Needed, Along with Education	54
Recommendation	55

Contents

56 Outreach and Education

The State Needs a Comprehensive Public Awareness Campaign on Forest Health	56
Targeted Campaigns on Forest Health	57
Measuring Attitudes	58
Recommendation	58

60 Looking Forward: Turning Plans into Action

The Evolution of the Tree Mortality Task Force: Multi-Jurisdictional Planning and Measuring for Long-Term Forest Resiliency	61
A Potential Steering Committee	61
Accountability in Implementing the Forest Carbon Plan	62
Recommendations	63

64 Appendices

Appendix A: Public Hearing Witnesses	64
Appendix B: Meeting Participants	66
Appendix C: Proclamation of State of Emergency	67
Appendix D: Goals and Actions in the draft Forest Carbon Plan	71

73 Notes

Executive Summary

California's forests are reaching a breaking point. Poor management policies that interrupted the natural and historical cycle of fire, combined now with a changing climate, have left forests vulnerable to disease, insects, catastrophic fire and drought. If the state does not take appropriate action soon, Californians risk losing the priceless benefits provided by forests. One forest supervisor told the Commission that management decisions made during the next five to 10 years will determine the forests' condition in 100 to 200 years.

The Commission is encouraged that state leaders recognize the need for decisive action to restore California's forests to resiliency. But much work is needed to change a culture focused almost solely on emergency firefighting to one that supports long-term forest restoration and management.

Prioritizing forest management for the long run – for the healthier, less overgrown forests that enhance watersheds and wildlife, reduce the scale of catastrophic wildfires and better withstand the scourges of bark beetles and a warming climate – will require more money and staff. The Commission typically does not recommend increasing financial and human resources to fix problems, but here it recognizes the savings that ultimately will result from such investment.

Today, California spends all too much for the immediate, emergency consequences of its long-neglected forests. Massive landscapes once sustained by beneficial, low-intensity wildfire are overrun with fire-intolerant trees and thick carpets of forest fuels that can turn even the smallest campfire or sparking power line into a raging firestorm. Property damage and firefighting costs for local, state and federal governments run into the billions of dollars annually. Property damage for the wildfires in October 2017 alone exceeded \$9 billion dollars, and the state spent approximately \$700 million fighting fires between July 2017 and mid-January 2018.¹ After devastating fires, local water districts pay millions more to remove tons of eroded soils from mountain reservoirs that

supply downstream customers. Now state government has invested millions of dollars responding to the horrific damage of bark beetles and the tree mortality crisis in the Sierra Nevada; when CAL FIRE testified before the Commission in January 2017, only 15 months following Governor Brown's declaration of a State of Emergency for tree mortality, it already had allocated more than 80,000 hours of staff time and \$43.6 million dollars solely to responding to the crisis. Local governments and private landowners also are spending heavily to remove hazard trees as a result of the tree mortality crisis. The costs of long neglecting and mismanaging forests have become an unsustainable burden in California.

The new investments the Commission recommends are intended to drive a strategy in which the state pays more for front-end forest management, and eventually, pays less reacting to crises and disasters.

The Commission's findings and recommendations (listed in full at the end of this section) fall into five categories:

- ***Increasing Pace and Scale of Forest Restoration through Collaboration.*** Speeding up and expanding treatments to restore forests to good health demands greater teamwork between state government and the federal government, which owns nearly 60 percent of the forest land in California. California has authority to conduct forest restoration work on federal land through the Good Neighbor Authority authorized in the 2014 Farm Bill. Success will depend on joint government plans and work at the ecosystem and watershed level.
- ***Creating a Culture where Fire is a Tool, not a Threat.*** California's forests evolved with fire and were shaped by fire. Though the increasing number of homes built in or near forests means fire cannot feasibly be returned to the forest everywhere, prescribed fire, where possible, should be used to treat forests. Prescribed fires

work in calm conditions that prevent fire from burning out of control and limit smoke and carbon emissions.

- ***Developing a Long-Term Plan for Forest Materials.*** Appropriate management will result in trees being removed from the forest. When possible, this wood should generate income for forest management. The state already is working to boost demand, within state government and externally, for California forest products, particularly from smaller-diameter trees that historically have had little value. Bioenergy from forest biomass is another option for smaller-diameter wood. The Commission heard important arguments for and against forest bioenergy. As the Commission monitors state efforts to maximize demand for removed wood, it would like the state to develop a long-term bioenergy plan – one that clearly delineates the state’s position on bioenergy and mitigates the effects of using or rejecting it.
- ***Educating Californians on Forest Resiliency.*** Californians are woefully uneducated on the importance of healthy forests and the benefits they provide. The state should invest in a large-scale outreach and education campaign to inform the public about the ecological importance of forests and the necessity for prescribed burns to bring about a lasting culture change in how the state views and treats its forests. Fortunately, a model already exists in California in how the state has approached drought education.
- ***Planning for the Long Term and Ensuring Accountability.*** Formalizing a multijurisdictional planning process will be necessary to undertake the long-term work of restoring California’s forests. Here, too, the state has a successful model in the Tree Mortality Task Force. A scaled-down version of this task force could be used as a steering committee for the larger forest restoration effort. Ensuring accountability for goals stated in the state’s Forest Carbon Plan also will be critical in successfully managing the forests of California. The Commission recommends regular reporting on progress toward these goals, and may hold future hearings on the topic.

Little Hoover Commission Recommendations on Forest Management

Recommendation 1: Led by CAL FIRE, the State of California must engage in collaborative landscape-level forest management for long-term forest resiliency. This planning process should include stakeholders at all levels of government, Native American tribes, scientists, environmental and environmental justice groups, private industry representatives and local residents. Because forest health impacts Californians in urban and coastal areas, efforts should be made to include representatives from non-forested regions to elevate the importance of California’s forests to the entire state’s wellbeing. Leaders also should review existing forestry practices and procedures, including the state’s Forest Practice Rules, to assess whether they facilitate forest resiliency in a changing climate.

- Over time, funding gradually should be shifted from reacting to the consequences of poor forest management to preventative treatments that promote forest health and resilience. This should include spreading the costs among a greater array of beneficiaries of healthy forests statewide.
- State agencies should plan to make greater use of the Good Neighbor Authority to perform treatments on federal land.
- State leaders should continue to remind federal lawmakers and policymakers of federal obligations to its forests within California.

Recommendation 2: On CAL FIRE funds that have time constraints for encumbrance and liquidation, the Department of Finance should allow longer timelines to facilitate collaborative large-scale forest management planning.

Recommendation 3: The State of California should lead a policy shift from fire suppression to using fire as a tool.

- This should include creating dedicated prescribed fire crews. These job classifications should be designed to attract the state’s top talent, with pay comparable to non-prescribed fire crews.

Recommendation 4: Treating the land at the scale outlined in the draft Forest Carbon Plan will require more resources. CAL FIRE, local air districts and other affected agencies should develop a list of positions they will need to meet the draft Forest Carbon Plan goals of treating 500,000 acres of nonfederal land per year, 500,000 acres of USDA Forest Service land per year and 10,000 to 15,000 acres of Bureau of Land Management land per year. State agencies should assume that at least part of the federal lands acreage treated will be by state entities working under the Good Neighbor Authority, and predict their staffing needs accordingly. The Legislature should then fund these extra positions, including the positions at the local level.

- As more funding – such as the jump from \$40 million to more than \$200 million in Greenhouse Gas Reduction Funds between FY 2016-17 and 2017-18 – is allocated for forest management to CAL FIRE and other agencies, these entities must be responsible for properly planning for its use, including an adequate number of staff with necessary skills. If new positions are necessary, CAL FIRE and other agencies and departments should not be penalized for developing the resources needed to successfully administer the forest management program.

Recommendation 5: The California Air Resources Board, land managers and other stakeholders should continue to actively work to find ways to increase prescribed burning through better use of technology, including modeling software, traditional portable air quality monitoring and new low-cost sensor monitoring.

- State agencies and other stakeholders should continue to participate to the extent possible in the Fire MOU and Air, Land and Water meetings, as well as other collaborative cross-jurisdictional efforts to overcome the barriers to prescribed fire. Pertinent agencies that currently do not participate in these efforts should participate.

Recommendation 6: The State of California should encourage the development of additional infrastructure to utilize material removed from the forests as part of long-term forest management.

- The California Natural Resources Agency, along with members of the steering committee and the interagency leads for each recommendation, should report back to the Commission on the implementation of the SB 859 working group’s recommendations.
- The state should issue grants to small communities so they can develop infrastructure according to their needs.

- The state should develop a statewide biomass policy that takes into account the needs of different parts of the state. All stakeholder communities, including environmental justice, should provide input into this policy.
- Part of this plan should explore the potential of biomass near forested communities with newer, cleaner facilities vis-à-vis the economies of scale provided by larger facilities.
- Additionally, this should include research on the public benefits provided by biomass energy within the context of the Renewables Portfolio Standard policy of “least cost best fit,” and whether those benefits qualify biomass energy as the best fit in certain situations. Further, analysis of public benefits should give consideration to whether biomass should receive subsidies to lower costs in certain cases, particularly in facilities developed or retrofitted with cleaner technology.

Recommendation 7: To better educate Californians about the suite of benefits healthy forests provide to the state, the state should consider the following:

- The state should invest in a long-term forest health campaign similar to Save our Water by contracting with an organization that can use its expertise to raise public awareness of forest health issues. A high-ranking person within the Governor’s Administration – preferably the Governor – must champion this effort. Outreach messages should be based on research.
- The Legislature should fund extensive statewide public outreach campaigns for CAL FIRE to continue to educate the public on the benefits of healthy forests and prescribed fire.
- The California Natural Resources Agency should work with the Department of Education to catalog existing educational resources on resilient forests, the history of fire in California’s ecological development and from where pupils’ water originates to allow teachers to easily access and incorporate the information into their curricula. Additionally, the California Natural Resources Agency should advertise this collection to teachers to spread awareness of these resources.
- The California Natural Resources Agency should collaborate with state colleges and universities offering forestry programs to increase awareness of forest health concerns in their communities, to both educate the public and increase enrollment

- in these programs. Forestry technical advisors affiliated with universities should be consulted on where they are encountering educational gaps to help identify where efforts should be targeted.
- Water districts should play a greater role in educating their customers on the sources of their water. To facilitate this, the state should provide funding for an organization to create educational toolkits that water agencies easily can customize.
- The state should provide grant funding for an educational organization to bring lawmakers, policymakers and their staff to forests to teach them about the benefits provided by forests, the consequences of forest neglect and the different forest treatment outcomes. The organization should work closely with the Legislature and other appropriate bodies to overcome logistical hurdles.
- Californians' knowledge levels and attitudes toward forest health should be measured at the onset of educational campaigns, and policymakers should set clear goals for the changes they would like to see in those attributes. These should be measured throughout the campaigns, with course corrections designed as necessary if the state does not meet its outcomes.

Recommendation 8: The Tree Mortality Task Force should evolve into a forest management planning entity, with dedicated funding.

- It should help set a strategic direction for forest management, identify measureable goals, decide how to track results and recommend course corrections to better achieve those goals.
- It should advise on how to incorporate technology in assessing and improving forest health.
- This should include reviewing the planning process and developing recommendations on where streamlining can occur.

Recommendation 9: The California Natural Resources Agency, its relevant departments and the California Environmental Protection Agency should regularly report to the Legislature and post online progress on the metrics listed in the Forest Carbon Plan, as well as the steps it is taking to begin implementing the plan. The Commission may hold a follow-up hearing on these steps as well as the progress made on its recommendations.

Introduction

The Little Hoover Commission began its review of California forest management in January 2017 as the state grappled with an unprecedented tree die-off. At that time, 102 million trees in the Sierra Nevada had died from bark beetle infestation. Commissioners expressed interest in learning about the state's coordination and collaboration, both among its own agencies and with federal, local, private and nonprofit organizations. They viewed this review as a starting point, however, in examining the larger picture of forest management in California. The Commission wanted to learn about how the state managed its forests to prevent or mitigate future crises, not just within the forests themselves, but in related impacts such as catastrophic wildfire, greenhouse gas emissions and watershed degradation.

Study Scope

The Commission focused its review on the Sierra Nevada because of the speed at which the infestation spread and the scope of devastation it inflicted. Over the course of the Commission's study, the die-off climbed to 129 million trees. In addition to the crisis itself, the Commission also recognized the role the Sierra Nevada plays for all Californians through the carbon it sequesters, water originating from it, hydropower generated within it and habitat provided by it, as well as the economic and recreational opportunities the mountain range provides.

The Commission's spotlight on the Sierra Nevada is not intended to diminish the importance of other forests within the state or other ongoing tree mortality crises. Oak trees in Southern California are dying from the Gold-spotted Oak Borer, a beetle native to Arizona believed to have been introduced to California by travelers bringing firewood across state lines. An estimated 100,000 oaks have succumbed to this beetle.² More than a million oaks and tanoaks in Northern California also have died from sudden oak death since 1995.³ Orange and San Diego Counties currently are combating the Kuroshio shot borer beetle, native to Thailand and Vietnam and believed to have arrived through the state's ports. It is still disseminating throughout the state via firewood and has killed more than 70,000 trees.⁴ Properly managing all of the forests within the state, including urban forests, is critical so Californians can continue to enjoy the benefits they provide.

The Commission's Prior Work on the Subject

The Commission last addressed forest management in its 1994 report, *Timber Harvest Plans: A Flawed Effort to Balance Economic & Environmental Needs*. Timber Harvest Plans serve as environmental impact reports in the state's environmental review process under the California Environmental Quality Act (CEQA). The provisions for Timber Harvest Plans are laid out in the state's Forest Practice Rules, which implement the Z'berg-Nejedly Forest Practice Act of 1973 and several other pieces of legislation.

In its study, the Commission concluded, "the intra-agency process for reviewing Timber Harvest Plans is complex, lengthy and costly, resulting in inconsistency and inequity."⁵ It found that there was inconsistent policy application across state departments, litigation was a primary means of achieving goals and the state focused more on process than outcomes. The Timber Harvest Plan process, wrote the Commission, examined potential damage to the environment on a parcel-by-parcel basis instead of across ecosystems, failing to protect the environment by "making it difficult to assess cumulative impacts over time and throughout watersheds"⁶ Additionally, the Commission noted that there was little follow-up to ensure Timber Harvest Plans actually were followed. As a result, the Commission concluded, "what occurs in the real world may have very little relationship to what is prescribed in a harvest plan, and there is no mechanism for linking demonstrated effectiveness of mitigation measures to future policy directives."⁷

The Commission considered incorporating a re-visit of its 1994 report into this study on forest management. However, it ultimately decided to focus on a larger picture of forest management, including collaboration with the federal government to restore its vast acreage of forests within the state. Delving into the minutiae of the Timber Harvest Plan process would considerably extend the study process when it is imperative to act now, the Commission decided.

Though the Timber Harvest Plan process fell outside of the scope of this study, the Commission believes it is important to creating and maintaining forest resiliency. This is especially important as California becomes hotter and dryer, leaving its forests susceptible to drought, wildfire, disease

and insect threats. The Commission urges the state to review its Forest Practice Rules, and the legislation behind them if necessary, to ensure that California's forests are being managed for resiliency in a changing climate.

Study Process

The Commission held three hearings and an advisory committee meeting during this study. The first hearing, on January 26, 2017, introduced the Commission to the tree mortality crisis and provided details on how the state is responding. In its second hearing, on April 27, 2017, Commissioners heard the "boots on the ground" perspective of those doing the hands-on work of responding to the crisis and managing forests. Additionally, the Commission was introduced to larger concepts of forest management. The focus on restoring forests to resiliency continued in the third hearing, on August 24, 2017. The Commission's advisory committee meeting on August 23, 2017, looked at the role of bioenergy in responding to the tree mortality crisis and long-term forest management.

Additionally, the Commission and staff went on three site visits. The first was to the Blodgett Forest Research Station within the El Dorado National Forest in April 2017. Led by Scott Stephens, a professor of fire science and the chair of the Division of Ecosystem Science at the University of California, Berkeley, this site visit allowed the Commission to see firsthand the different methods of restoring forests to resiliency. In May 2017, the Sierra Nevada Conservancy took Commission staff to Shaver Lake in Fresno County, an area hard hit by the tree mortality crisis. Staff learned about collaborative efforts to manage forests within California and the work the North Fork Community Development Council has done to spur economic growth with wood removed from the forest. Staff also learned about the private sector's role in reforestation. Finally, in November 2017, staff visited the L.A. Moran Reforestation Center in Davis, California, to learn about CAL FIRE's work to collect, clean, test and store the seeds from California's trees and reopen its nursery to aid reforestation.

Report Format

The first chapter of the report introduces the reader to the tree mortality crisis and outlines the benefits forests provide for Californians. The three subsequent chapters

discuss the Commission's findings and recommendations on how California may better restore its forests for resiliency – through collaboration, changing the culture surrounding fire and finding the right balance in wood processing infrastructure. The next chapter discusses the need to educate Californians about the importance of resilient forests. The report concludes with the Commission's recommendations on planning for the future and holding the state accountable to its forest management goals.



The Commission visited Blodgett Forest Research Station, operated within the El Dorado National Forest by the University of California, Berkeley, as part of its study process.

The Tree Mortality Crisis as an Introduction to Forest Management in California

The Sierra Nevada is home to stunning national parks, the country's largest alpine lake and Giant Sequoias – among the world's largest trees and the planet's oldest living things. It is celebrated for its beauty and recreational opportunities but also provides a critical element of California's natural resources infrastructure. The region supplies 60 percent of the state's developed water, including the State Water Project, much of the Central Valley Water Project and the Sacramento-San Joaquin Delta.⁸ Its roughly 10 million forested acres, 25 percent of the state's landmass, are an important source of carbon storage in California.⁹ Every Californian benefits in one way or another from the Sierra Nevada, making it one of the state's most important resources. Yet the Sierra Nevada also is home to a disaster partially of our own making: the largest tree die-off in recent memory, the result of bad policy mixed with natural forest conditions meeting worst-case weather conditions.

The Tree Mortality Crisis: 129 Million Trees Dead... and Counting

In just eight years, California has lost more than 129 million trees, conifers primarily, to the tree mortality crisis



The red trees in the foreground and background demonstrate the extent of the tree mortality crisis.

Photo credit: Ciana Gallardo

enveloping the Southern and Central Sierra Nevada.¹⁰ This crisis differs from other tree mortality episodes due to its vast range, the speed at which it has spread and the devastation it has inflicted. Though trees began dying in 2010, officials began describing the crisis in 2014 as unprecedented: Nearly eight million trees died between 2010 and 2014. Another 3.3 million died in 2014. Twenty-nine million died in 2015. Sixty-two million died in 2016, with about two million more a month dying in 2017.¹¹

How We Arrived Here: Policy + Drought + Bark Beetle

California arrived at this devastation through the interplay of forest management policies that created overgrown and overcrowded forests, a historic drought and bark beetles pervasive in the state's forests.

Fire Suppression Led to Overcrowding, Less Forest Diversity

A century-old policy of putting out all fires, known as fire suppression, has created overcrowded forests. Before European settlement, naturally-ignited fires and those lit by Native Americans cleared the forest of debris that could cause severe fires. These events and practices also checked the growth of new trees that would compete with older, bigger trees. The result, said Jim Branham, executive director for the Sierra Nevada Conservancy, a state agency that works to improve the well-being of the Sierra Nevada region, was a "very diverse landscape of open, closed, young, and old forests."¹² This diversity is essential to forest resiliency and helps forests survive a variety of threats.

Fire suppression began to dominate land management policies following a series of devastating fires encountered by westward-expanding settlers.¹³ The 1871 Peshtigo Fire killed about 1,500 people in Wisconsin and Michigan when slash-and-burn fires for both farming and

Forest Health and Resiliency

There is a danger of treating forests as if they have human characteristics by thinking in terms of “forest health” instead of forest resiliency, scientists cautioned the Commission. The Commission understands this concern and in most cases uses the term resiliency. However, this report predominately is aimed at non-scientists, for whom the term forest health is more intuitive than forest resiliency. For ease of messaging, the Commission at times uses the terms interchangeably.

UC Berkeley professor Scott Stephens defined forest resiliency for the Commission as, “the ability of an ecosystem to absorb impacts before a threshold is reached where the system changes into a different state (such as forest changing to a large shrubland after a severe wildfire).” The Tree Mortality Task Force further outlined the following characteristics of a resilient forest:

Diversity: Healthy forests include a range of natural growth stages, as well as naturally occurring species of flora, fauna and microbiota. Generally, insect and disease populations target one type or species of tree. A diversity of species will help reduce the possibility of one insect or disease killing all the trees in a region. Control of non-native invasive species will also encourage naturally occurring species.

Capacity: With enough space, sunlight, nutrients and water, trees have the capacity to grow and thrive. They become stressed when lacking these elements, which makes them more susceptible to attack by insects and diseases, as well as large-scale disturbances such as drought or wildfire. They also are stressed by rapid and dramatic change, such as being broken up through nearby land activities or climate patterns that reduce water or elevate air temperatures.

Complexity: Forest complexity includes the naturally occurring range of tree species and the presence of shrubs, meadows, open ground and natural regeneration. Managing for greater natural complexity generally improves a forest’s ability to respond to disturbance, and supports wildlife that feed on insects that may be attacking trees.

Fire-adapted: For millions of years California’s forests have evolved with fire. Healthy resilient forests both survive and benefit from fire, which is natural and necessary to a healthy forest ecosystem. Forests that experience appropriate frequencies and severities of fire, or other vegetation treatment practices that mimic fire, are more likely to support species that will survive wildfire and other disturbances.

Intact: Forest landscapes that are not impacted by land development or human-caused change to tree and vegetation species allow ecological processes to occur at their natural, historic pace.

Sources: Scott Stephens, Professor, Fire Science and Chair, Division of Ecosystem Science, University of California, Berkeley. January 26, 2017. Written testimony to the Commission. Also, Tree Mortality Task Force. November 2016. “Achieving Long-Term Forest Health and Resilience in California.”

railroad construction met a windy cold front, creating a deadly firestorm.¹⁴ In 1902, the Yacolt Fire in Washington and Oregon killed 38 people.¹⁵ Then the 1910 Big Burn in Washington, Idaho and Montana killed 86 people, burned three million acres and destroyed an estimated eight billion board feet of timber – enough to build 800,000 houses.¹⁶

The federal government implemented legislation in response to these disasters and put policies in place for fire suppression. This included the 1911 Weeks Acts, which funded state fire prevention and suppression efforts.¹⁷ This effort essentially quashed experiments of preceding

decades when settlers in California and elsewhere in the West and South used Native American methods of prescribed burning, known as light burning, as part of land management.¹⁸ Eventually, all fire was viewed as a threat to forests, and the “debate was resolved in favor of aggressive fire control,” wrote U.S. Forest Service officials.¹⁹ In 1926, U.S. Forest Service rules required that all fires be controlled before they exceeded 10 acres.²⁰ In 1935, it adopted its 10 a.m. policy, in which sufficient resources were to be assigned to fires to put them out by 10 a.m. the next day.²¹

Scientists estimate that prior to European settlement in

California, fires burned approximately 4.5 million acres annually in California.²² In comparison, between 1950 and 1999, fires burned about 250,000 acres annually, less than 6 percent of the historical average.²³ Within a few years, the natural fire regime in which Sierra forests evolved and thrived largely ceased.

Historic Drought

California's historic drought greatly weakened Sierra forests. When overcrowded forests encounter drought, more trees compete for less water and leave the trees vulnerable to disease and insects. Drought also reduces moisture in fuels littering the forest floor, increasing wildfire risk. It reduces relative humidity and makes trees more likely to die from wildfire – and at lower temperatures that healthier trees normally would withstand. Further, snowpacks are reduced and melt sooner, extending the length of the fire season.²⁴

Enter the Bark Beetle

Forest overcrowding, drought and the bark beetle created a perfect storm for tree mortality. There are 600 species of bark beetle in the United States, about a dozen of which reproduce in California's conifers. The bark beetles at the heart of this crisis are native to California's forests and play a critical role in the ecosystem: They process decaying wood from dead and dying trees and turn it into nutrients needed for regrowth. This helps trees decompose and new ones to take their place. The problem is not that these beetles are here. Wholesale eradication of these beetles would be catastrophic for the ecosystem. The problem is an ecosystem where nature's delicate balance has been knocked askew by policy and drought which created conditions for beetles to overrun the trees.

Bark beetles bore into trees to reproduce. They tunnel



The holes in the wood indicate where bark beetles have tunneled, ultimately killing the tree.

into a tree and lay eggs at the end of the tunnel. Many species release a fungus that converts the tree's tissues into food for the larvae when the eggs hatch. A healthy tree will release sap or pitch to push the bark beetle out of the tree. A drought-stressed tree will be unable to produce this sap, however, allowing beetles to successfully lay their eggs. Worse, upon reproducing, beetles release a pheromone that attracts swarms of other beetles to the tree. Trees cannot withstand thousands of beetles depositing thousands of eggs within them. Even more deadly, thirsty trees often release a gas into their trunk to try to trick roots into pulling in more water. This gas acts as a pheromone for bark beetles, attracting still more beetles to the weakened tree.²⁵ The end result is 129 million dead trees and counting.

The Local Impact

The immediate public health and safety impact has fallen squarely on the communities in the Sierra Nevada. Dead and dying trees threaten people, homes, infrastructure and evacuation routes. Officials call these hazard trees. The state is working to remove hazard trees from areas under its jurisdiction, while local officials and homeowners are doing the same – but with far less available money.

Funding Challenges

Lack of adequate funding presents the largest challenge to protecting public safety. Governor Brown's 2018-19 proposed budget includes nearly \$100 million for CAL FIRE to perform forest management activities through its resources management function and its vegetation management program.²⁶ Though \$100 million is not an insignificant sum, it is but a drop in the bucket of the proposed \$2.1 billion budget.

In September 2017, Governor Brown signed a bill delivering \$220 million in cap-and-trade funding to CAL FIRE for healthy forests and fire prevention programs.²⁷ But the department simultaneously lost an estimated annual \$80 million in State Responsibility Area fees due to suspension of that program through 2030. The Governor has proposed another \$160 million in cap-and-trade funding for healthy forests in 2018-19.²⁸

Local funding is more precarious, the Commission learned. Many counties affected rely on California Disaster Assistance Act (CDAA) funding, which provides a 25 percent match for work completed on public rights-of-way. In a February 2017 meeting with Commission staff, Supervisor Randy Hanvelt of Tuolumne County explained the toll this

takes on county and homeowner budgets:

“When we initially realized we had a problem, we assessed the trees along the 600 miles of county roads in Tuolumne County and determined there were approximately 9,000 hazard trees on those roads. At a conservative estimate of \$1,000 per tree for removal, we were looking at \$9 million for roadside tree removal. At a 25 percent match for disaster assistance funding, that’s \$2.25 million that we had to come up with out of our reserves. Our reserves were \$2.3 million, so the entirety of our reserves had to go just for the match. There are 1,200 miles of roads that are not in the county system; these are considered privately owned. The people who live along these roads are at risk, but they don’t have the money to remove those trees and there is no CDAA funding for that. And the tree mortality grows and grows every day. We estimate we now have \$30 million worth of tree removal. We are oversubscribed on our reserves and the devil is at our door.”²⁹

A bill in the California state legislature, SB 265 (2017, Berryhill), would have reduced the CDAA match from 25 percent to 10 percent if it had passed.³⁰ The bill failed to make it out of committee, however.

Heightened Risk of Severe Wildfire

Though the tree mortality crisis does not itself cause wild-



Like state officials, local representatives’ first concern is protecting their constituents from the effects of the crises stemming from poor forest management.

Source: Randy Hanvelt, Supervisor, Tuolumne County

fire, stands of dead trees and buildup of forest fuels heighten the threat of catastrophic fires. Unchecked underbrush burns hotter when it ignites and provides a ladder for fires to climb into mature trees. Trees that historically thrived in the Sierra developed defenses against low-intensity wildfire. Their bark can withstand lower-temperature fire and they shed their lower branches so that surface fire cannot climb into the treetops. But, as tree canopies fill in, shade-tolerant trees begin to thrive and they are less fire resistant. Further, accumulated underbrush allows fire to overcome those defenses and burn hotter and climb into the tree canopy. Crown fires that burn at and move along tree-tops are the hardest to suppress due to an unlimited supply of fuel. Crown fire behavior is unpredictable, and kills most of the trees in its path.³¹ Sierra Nevada acreage burned by high-severity fires rose from 17 percent in 1984 to 30 percent in 2006 due to overcrowded forests filled with unhealthy trees.³²

The impact of varying forest management policies on wildfire can be seen in the 2013 Rim Fire that ravaged Tuolumne and Mariposa counties. Researchers learned how the fire behaved differently depending on the maintenance history. Areas that were up-to-date on management “moderat[ed] the impacts of the Rim Fire on communities, human safety and natural resources.”³³ Put simply, properly managing forests saves lives and property, and helps preserve the forests that provide so many benefits to Californians.

Water Quality

The tree mortality crisis also continues to spotlight the degradation occurring in Sierra watersheds that supply so much of the state’s water for farms and urban areas. Overgrown forests release less water for these needs. A Nature Conservancy report found that thinning forests to make them healthier could increase downstream water yields by up to 6 percent.³⁴ The loss of diverse habitat under current management practices includes the loss of valuable meadows. Meadows absorb and hold water and release it later in the year when it’s most needed.³⁵ Overgrown forests also trap more of the annual snowpack in their higher branches, causing it to evaporate rather than reach the ground and flow downhill to water storage facilities.³⁶

Wildfire has an especially negative impact on these critical watersheds. Eric Coyne, Tulare County Deputy County Administrative Officer for Economic Development, Film & Tourism, painted the following picture for the Commission:

“The Rough Fire hit Fresno and parts of Tulare hard. You’ve got the standing vertical load that creates a wall of fire. It burns so hot, so long, that instead of seeing scorched earth, you see moonscape. Nothing is able to grow there for well over a decade. It’s sterile. It can’t support life. So, you’ve had your first hit, which is to air quality. Then it starts raining. You’ve lost all of the binders and this hill is just going to come down because there’s no root system or anything to hold it. It washes into the watershed, and then is carried down to the valley floor in the water system and you get all the contaminants in there.”³⁷

Dave Eggerton, general manager of the Calaveras County Water District (CCWD), similarly described the negative impacts of poor forest management on the Calaveras Watershed – and consequences for CCWD ratepayers. Soil erosion, particularly following the 2015 Butte Fire, severely degraded water quality, he told Commission staff. “The watershed looks like a milkshake,” and treating it costs millions of dollars, he said. But not treating it would negatively impact downstream users, particularly the more than 300,000 residents living in the City of Stockton.³⁸ The Placer County Water District likewise dredged its water infrastructure several times to cope with a runoff of sediment in the wake of the 2014 King Fire, Ashley Conrad-Saydah, deputy secretary for Cal EPA, told Commission staff.³⁹ Finally, the scale of firestorms that have grown ever more common in recent years scorch of Sierra Nevada soils into hardpan, blocking their natural function of capturing water and replenishing aquifers at lower elevations.

In Short: Healthy Forests Benefit All Californians, But Mostly the Locals Bear Immediate Costs of Forest Mismanagement

All Californians benefit from healthy forests that supply fresh water, clean the air and store carbon. But it is the small mountain towns, the local rural areas that lack strong economies, lucrative tax bases and concentrated political power that are bearing the economic brunt of tree mortality crisis. Their lives, property and infrastructure are threatened by dead and dying trees and the consequences of massive wildfires. Their insurance rates are increasing. They are the ones spending their financial reserves to dredge local water infrastructure. It is their budgets being depleted to address the widespread local impacts.

Across a multitude of study topics, the Little Hoover Commission has long stressed the importance of trust in

government. Here it is relevant again. Local communities often have little say in how the forests around them are managed. Yet they bear the immediate costs and consequences for mismanagement. Towns in the Sierra Nevada are fertile ground for taxpayer resentment of government, their grievances a corrosive obstacle to facilitating trust in the public sector, whether at city hall, the county courthouse or the state Capitol. Trust in government is just one of important reasons the State of California must take every action available to restore the forests within its borders to resiliency.

How The State is Responding to the Tree Mortality Crisis

Governor Brown declared a State of Emergency in response to the crisis in October 2015. His declaration issued 19 directives to help the state address first the public safety hazard presented by the crisis. Some of the directives also focused on longer-term options to make use of the dead trees, once removed from the forest. These directives can be viewed in Appendix C.

CAL FIRE, the Office of the Governor, and the Governor’s Office of Emergency Services (Cal OES) formed a task force in November 2015 – the Tree Mortality Task Force – to implement the directives in the State of Emergency and coordinate with other levels of government. It comprises approximately 80 state, federal, tribal and local agencies, utility companies, nonprofit organizations and other stakeholders. To implement the Governor’s directives, the task force identified the following statewide goals:

- Provide coordination among agencies/entities.
- Establish and focus efforts on High Hazard Zones.
- Identify funding sources.
- Reduce regulatory impediments.
- Provide public education.
- Expand the use of bioenergy.
- Identify potential storage/utilization sites.
- Distribute equipment across counties.
- Work to identify and promote local wood markets.⁴⁰

The task force has identified the following High Hazard Zones to guide the state’s response to the crisis, shown on the next page:

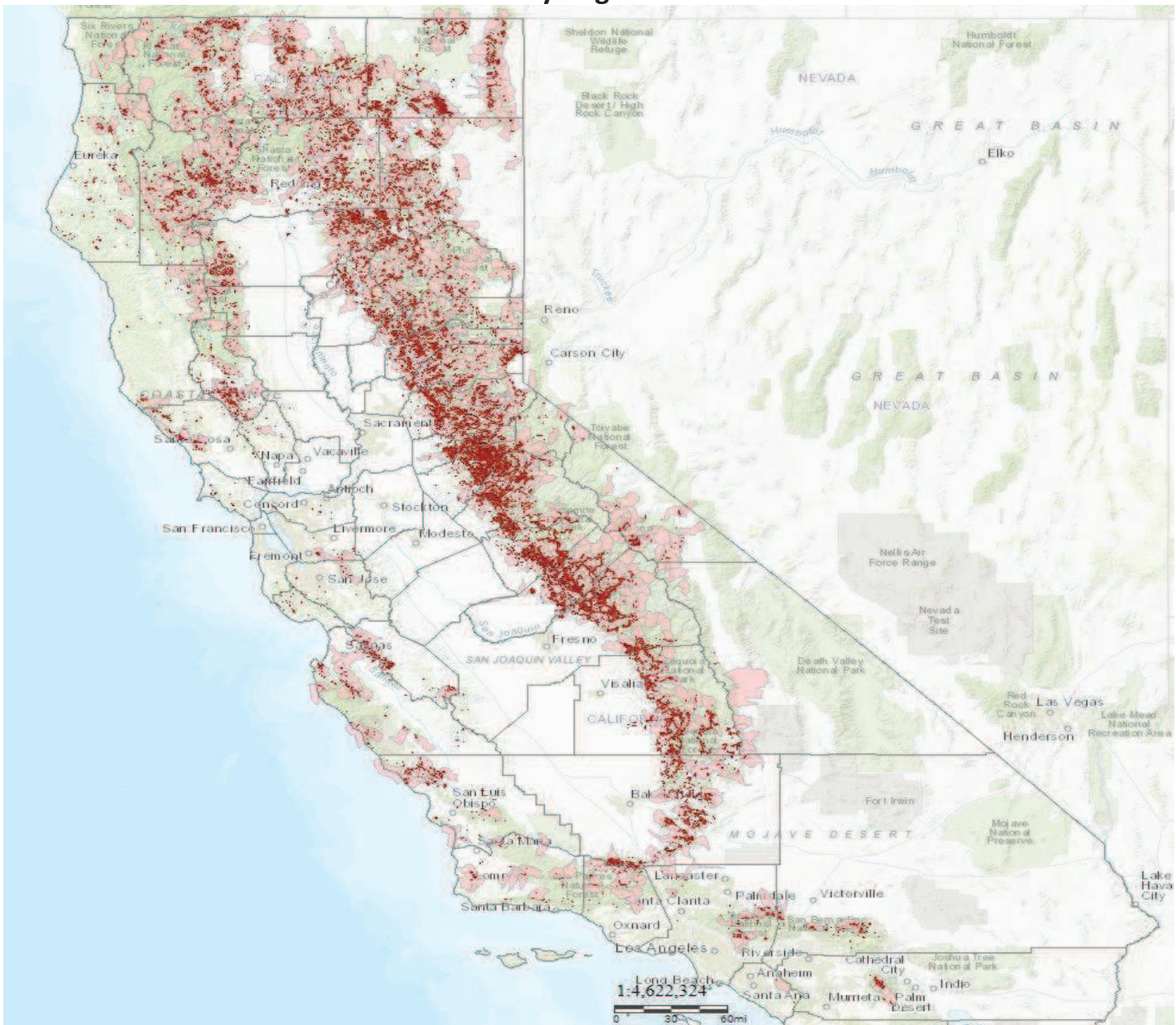
- High Hazard Zone Direct (Tier 1): These High Hazard Zones are in close proximity to communities, roads and utility lines. They represent a direct threat to public safety.
- High Hazard Zone Indirect (Tier 2): These High Hazard Zones are defined by watersheds that have significant tree mortality, combined with community and natural resource assets. Work at the Tier 2 level supports broader forest health and landscape-level planning issues.⁴¹

The large size of the task force could have proven to be an unwieldy stumbling block, but the group generally receives

positive reviews. Most concerns about the task force center on whether it is working to create resilient forests for the future. Witness Karen Buhr, executive director for the California Association of Resource Conservation Districts, told Commission staff she believes the task force is doing an excellent job in triaging the immediate crisis. But she doesn't see enough focus on long-term forest health, she added.⁴² Task force officials told the Commission they are working on landscape-wide treatments for the long run, but agreed their immediate focus is the threat to human life and public safety.⁴³

In his 2018 State of the State address, Governor Brown announced the creation of a task force to review forest management with the goal of reducing catastrophic wild-

Tree Mortality High Hazard Zones



The bright red represents Tier 1 High Hazard Zones, while the pink indicates Tier 2 High Hazard Zones.

Source: Tree Mortality Viewer. Last updated September 2017. <http://egis.fire.ca.gov/TreeMortalityViewer/>.

fire threats and increasing resiliency and carbon storage.⁴⁴

The Tree Mortality Crisis is a Symptom of Larger Problem

This Commission report goes beyond the tree mortality crisis and notes it is merely a symptom of the state's larger forest management problem. Millions of dead trees are the consequence of bad policy combined with bad luck. While the scale of the tree death is unprecedented, the state failed to take the aggressive actions necessary to prevent the crisis. Officials have long known that California's forests are overgrown and that the state's climate is getting hotter and dryer. They know, too, that the public safety threats posed by dead and dying trees, the depleted local and personal budgets, the millions of taxpayer dollars spent in response to the crisis and the number of staff hours across nearly 80 agencies and organizations responding to the crisis is just the beginning unless California invests fully in forest management.

Scientists have long established that California will become dryer and that climate change will increase the number and intensity of wildfires.⁴⁵ Forestry experts have long sounded the alarm that insects and disease threaten 25 percent of California's forests.⁴⁶ Officials recognize the impacts of the state's overgrown forests. With this information in front of California's leaders, there are no excuses for inaction.

A Broader, Long-Term Focus on Forest Management

The good news: State officials are planning a stronger future for California's forests through the draft Forest Carbon Plan. The plan, currently being finalized by the California Natural Resources Agency, California Environmental Protection Agency and CAL FIRE – with execution to be conducted by multiple agencies statewide across every level of government – implements the forest carbon goals in the 2030 Target Scoping Plan Update. The 2030 Target Scoping Plan Update outlines how the state plans to meet its greenhouse gas reduction goals, as well as California's other climate change policy objectives. The final Forest Carbon Plan is expected to be released in February 2018.

The current draft of the Forest Carbon Plan describes forest conditions, projects future forest conditions in a changing climate and identifies forest health goals. It then details the actions the state and other entities will take to

reach those goals.⁴⁷ One set of forest management objectives includes sequestering carbon and reducing black carbon and greenhouse gas emissions. Additionally, California will manage its forests for wildlife habitat, watershed protection, recreation, tribal uses, public health and safety, forest products and economic development at the local and regional levels.⁴⁸

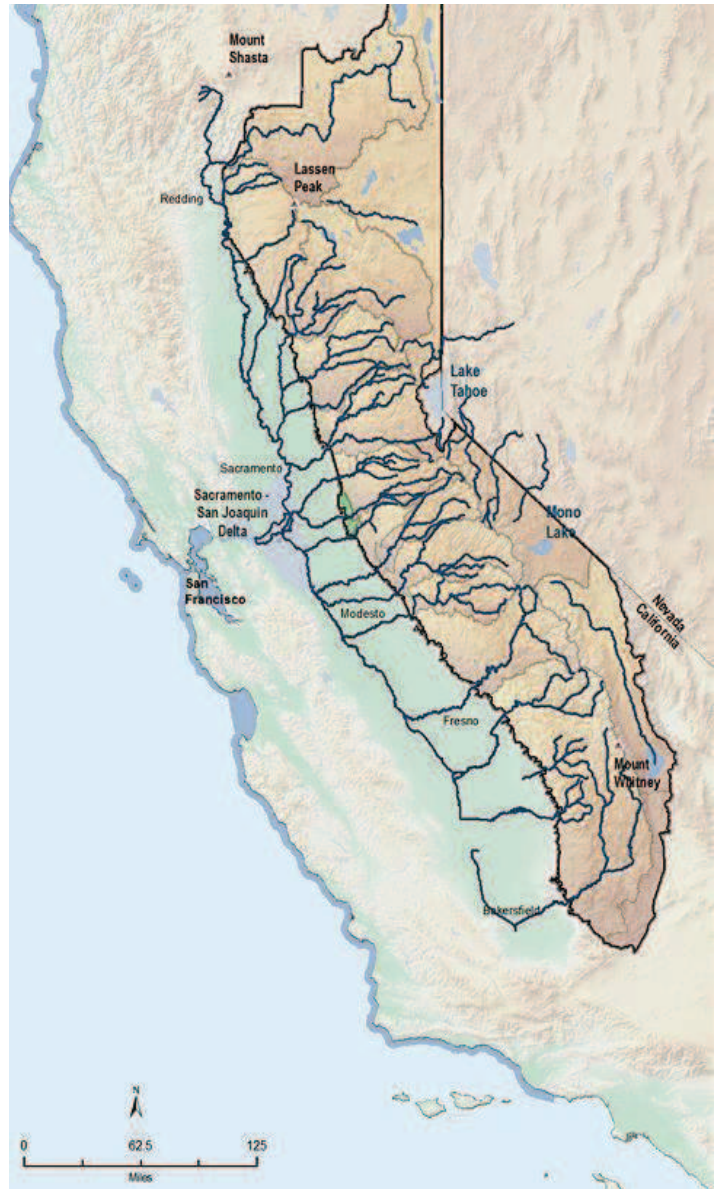
Why Healthy Forests Matter

It is important for Californians to understand why healthy forests in the Sierra Nevada matter in their everyday lives and how exactly they benefit a population of 40 million. Mr. Branham summarized these benefits in his testimony and in a site visit with the Commission:

- **Carbon Capture & Storage.** California's forests store enormous amounts of carbon. One hectare (about 2.5 acres) of redwood forest, for example, stores the equivalent of annual greenhouse gas emissions by more than 500 Americans. Combined, California's forests and wildlands stored an estimated 850 million tons of carbon in 2010.⁴⁹ However, unhealthy forests crowded with small trees store less carbon than healthy forests with large trees. Experts estimate that the Sierra Nevada's forests store 25 percent less carbon than they did 150 years ago.⁵⁰ As large conifer forests are killed off, they often are replaced by chaparral, which stores 90 percent less carbon than the conifer forests.⁵¹ Further, largely due to catastrophic wildfires, California's forests emitted 69 million tons of carbon between 2001 and 2010. Forests and wildlands represented 5 percent to 7 percent of total state carbon emissions during those years.⁵² The 2013 Rim Fire near Yosemite alone produced greenhouse gas emissions equivalent to the emissions of 2.3 million vehicles in one year.⁵³
- **Water Supply, Timing & Quality.** As noted earlier, healthy forest practices create healthier watersheds, with the possibility for increased water yield. The Sierra Nevada is the headwaters for more than 60 percent of the state's developed water supply and includes the Central Valley Project and State Water Project.⁵⁴ As a warming climate results in more rain and less snow, healthy forests will play an important role in maximizing the snowpack. When forests give way to fire, watersheds are exposed to increased sediment

loads that harm water quality and infrastructure, and can fill reservoirs.⁵⁵

- **Public Health.** High-severity fires are more likely than those of lower-intensity to send their smoke longer distances, resulting in more Californians breathing in the smoke.⁵⁶ The most vulnerable populations are the most susceptible to its harmful effects: children, the elderly and those with cardiovascular and respiratory conditions.⁵⁷ Further, Mr. Branham testified, wildfires produce black carbon, a form of particulate matter that could be worse than methane for global warming. In addition to increasing risks for cardiovascular and respiratory diseases, black carbon can cause cancer and potentially, birth defects. Finally, though the fire season is increasingly longer, the worst wildfires often happen in late summer when air quality is at its worst, furthering the strain on sensitive populations.⁵⁸
- **Wildlife Habitat.** Sixty percent of California’s animal species reside in the Sierra Nevada. One-third are considered to be rare, threatened or endangered. Though a few species thrive in scorched habitat, many of these species lose their natural conditions when poor forest management results in wildfires. For example, the 2014 King Fire created a high-severity burn of 34,000 continuous acres that previously housed more than 10 California Spotted Owl sites. Post-fire, the owls have not returned to any of those sites, nor do they forage in that area.⁵⁹
- **Rural Economies.** Rural communities depend on healthy forests for recreation-generated income as well as jobs in the forest products industry. Losing forests to insects, disease or wildfire affects jobs and much-needed tax revenue.
- **Historic and Cultural Resources.** Forests are important to Native Americans’ well-being, Mr. Branham testified. Losing these forests “threaten[s] the associated knowledge and identities embedded in stories, ceremonies, songs, and the community processes of collecting, preparing, and sharing foods,” he stated. The state can create resilient forests by tapping Native Americans’ knowledge and connection with the land, and ensuring their involvement in forest management.⁶⁰



The Sierra Nevada watershed provides more than 60 percent of California’s developed water supply. Source: Sierra Nevada Conservancy. “Sierra Nevada Watersheds.” Visit <http://www.sierranevada.ca.gov/SNWatershed> to learn more about the individual bodies of water within the watershed.

Resilient forests indisputably benefit California’s air quality, water quantity and quality, health, wildlife, economy and native people. The tree mortality crisis is a warning that California no longer can neglect its forests. The amount of work to be done is immense, the investment required substantial and a change in culture imperative.

Increasing Pace and Scale of Forest Restoration through Collaboration

The state and its partners must dramatically accelerate forest treatments in order to restore California's forests to resiliency. Of the approximately 10 million acres in the Sierra Nevada alone, nearly six million acres of forestland are in dire need of restoration.⁶¹ So pressing is the need that scientists and government officials frequently repeat the same mantra – increase pace and scale. Work must be done faster on a much larger area.

“Given today’s conditions, it is often the failure to act that carries the greatest risk.”

– Jim Branham, Executive Officer, Sierra Nevada Conservancy

Several obstacles stand in the way of the work – the sheer size of job, the multiple uses of the forest and land ownership. With most of the forests within California owned by the federal government, the state faces a challenge in having to deal with the consequences of neglected forests without – until recently – having a say in managing them. This chapter will discuss how the state should take advantage of an opportunity created in the 2014 Farm Bill to conduct work on federal forests.

But perhaps the most complex impediment has been a history of competing and impassioned stances taken by private landowners, scientists, conservationists, forest industry representatives, federal foresters, tribal governments and state officials. The Commission heard that breakthroughs had been made, and while models of cooperation existed, there simply weren't enough of them yet. Mr. Branham described how the situation has changed since the Sierra Nevada Conservancy was formed 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,” he said. “While there has been progress due to collaborative efforts building on this agreement, the level of activity has been

inadequate to meet the challenge...”⁶²

Mr. Branham and others acknowledge that collaboration is painstaking and hard. It requires people, time and money. It requires patience when progress slows or stalls. It requires compromise and incentives. And, it requires leaders prepared to take action unpopular with some stakeholders when consensus cannot be reached. These are not things that decision-makers like to hear. But if California wants to continue to rely on the benefits provided by its forests, then it needs to make the necessary investments to protect them. If it won't make these investments, then policymakers and lawmakers must be upfront with Californians so they can prepare themselves for what's coming: more fires, poorer water quality and worsening air quality.

In addition to developing new plans, policies and collaboration, leaders also must look at existing forestry practices and procedures, such as the Forest Practice Rules and the legislation behind them, and assess whether they facilitate forest resiliency in a changing climate.

Pace and Scale Needs

Forests cover one-third of California, roughly 33 million of California's approximately 100 million acres.⁶³ Expressed differently, Californian forests cover an area roughly the size of the state of New York.

The backlog of restoration treatments also is large. Approximately six million acres of forest within the Sierra Nevada need to be treated.⁶⁴ The U.S. Forest Service (USFS) commits in the draft Forest Carbon Plan to increasing yearly forest treatments from 250,000 acres to 500,000 acres on all National Forest Systems Lands in California so that by 2030, nine million acres will be treated with fuels reduction, managed and prescribed fire, weed removal and road improvements to reduce sedimentation.⁶⁵ That is a good start, wrote Tuolumne County Supervisor Randy Hanvelt to the Commission, but what

about the rest of the land the USFS owns in California, he asked, and what about maintenance of treated land?⁶⁶

Further, National Forest Systems Lands present only part of the picture. Similar to the USFS, CAL FIRE identifies a need to increase yearly treatments to 500,000 acres statewide from its current average of roughly 17,500 acres, though it acknowledges that this number currently isn't feasible. Instead, it plans to ramp up to treating 60,000 acres per year by 2030 of tree, grass or shrub-dominated vegetation through its Vegetation Treatment Program.⁶⁷ The Commission further discusses this in the next chapter and recommends that the department begin identifying the resources it would need in order to increase forest treatments to 500,000 acres per year, plus maintenance.

The most feasible way to ramp up pace and scale is collaboratively at the landscape level, or extensive areas with linkages between different ecosystem elements ranging from vegetation to wildlife. Working at the landscape level is important beyond acreage treated, as Department of Forestry and Fire Protection (CAL FIRE) Director Ken Pimlott testified, because it is possible to achieve an economy of scale that smaller projects do not. Further, these projects provide more opportunity for collaboration and the ability to leverage funding across multiple levels of government."⁶⁸

Forest Ownership

Of California's 33 million forested acres, the state owns only about 730,000 acres, or about 2.2 percent.⁶⁹ Local governments own approximately 0.8 percent.⁷⁰ California has certain legal responsibilities for much of the land owned by private landowners, and the state also has a responsibility to protect its residents. When most of its forests are owned by another government and the consequences of forest neglect are so devastating, the state must be prepared not only to collaborate, but take a greater leadership role where possible.

Federally-Owned Forests

By far the largest forest landowner in the state is the federal government, which controls 57 percent of California's forests.⁷¹ The state cannot require the federal government to manage its forests. The U.S. Forest Service is a valuable leader and partner in several collaborative activities – it advocates an “all lands, all hands” approach – and many stakeholders are quick to praise USFS Region 5 Forester Randy Moore's willingness to consider science-based forest management solutions. However, there are constraints outside of his control, particularly funding, which impede

forest management.

USFS' fire suppression costs have soared from 15 percent in the early 1990s to more than 50 percent in 2017 – the most expensive year on record. That year alone, it spent more than \$2 billion in fire suppression, exceeding the nearly \$1.6 billion allocated plus additional Congressional appropriations.⁷²

The steep fire suppression costs have increasingly impacted other programs, including forest management. Fire suppression funding is based on a ten-year average of appropriations. With ever-lengthening fire seasons and ever-increasing catastrophic fires, these appropriations cannot keep up with actual fire suppression costs.⁷³ The organization then “borrows” from its other programs, including forest management, to pay for fire suppression costs that have exceeded the allocated amount.

After declaring a State of Emergency for tree mortality, Governor Brown wrote a letter to then-U.S. Department of Agriculture Secretary Tom Vilsack requesting additional federal funds and technical assistance.⁷⁴ Secretary Vilsack responded with an acknowledgment that forest management work was dependent on changes to the structure of the organization's fire suppression budget:

“...the key to truly accelerating implementation of management and restoration tools is to fix the Forest Service's broken fire budget. With a record 52 percent of the Forest Service's budget dedicated to fighting wild-fire in 2015, compared to just 16 percent in 1995, the Forest Service's ability to do more restoration work within the current budget structure is severely constrained by the increasing proportion of resources spent on fire. Stopping the chronic depletion of non-fire programs will enable the Forest Service to restore an additional 1 million acres annually and 300 million board feet. Our ability to do more of the critical forest management and restoration that we all recognize is so urgently needed will continue to be limited until Congress fixes the underlying budget issues.”⁷⁵

There have been multiple unsuccessful attempts in Congress to put an end to borrowing from forest management programs to put out fires.⁷⁶ While California's leaders should continue pressing the federal government to live up to its obligations, years of failed attempts to fix this problem means the state must plan on taking a leadership role

Forest Ownership in California



One challenge for the State of California is that it only owns about 2 percent of the forests within its borders. The federal government owns 57 percent; private landowners own 39 percent; and local governments own the remaining percent.

Source: United States Forest Service. February 2016. Pacific Northwest Research Station. California's Forest Resources: Forest Inventory and Analysis, 2001 – 2010. Pages 16-22.

in forest management, with the budgetary and personnel support necessary to support that leadership role.

Private Forests

Private landowners own approximately 39 percent of California's forests.⁷⁷ The vast majority – 99 percent – own fewer than 500 acres. However, this accounts for about 40 percent of the state's private forests.⁷⁸ The rest are owned by large landowners; Sierra Pacific Industries, for example, a private timber company and the state's largest private forest owner, owns more than 1.6 million acres of the state's forests.⁷⁹

Many of these forests fall within the State Responsibility Area, defined as "land that provides forest or range products, watersheds not owned or managed by the federal government or within the boundaries of incorporated cities, and where CAL FIRE has the primary financial responsibility for preventing and suppressing fires."⁸⁰

To encourage private forest owners to manage their forests in line with California's forest resiliency goals, the state relies on a suite of regulation and incentives. Forest Practice Rules governing commercial tree harvesting have been developed in accordance with the 1973 Z'Berg-Nejedly Forest Practice Act, 1983 Timberland Productivity Act, 1970 California Environmental Quality Act (CEQA), 1969 Porter Cologne Water Quality Act (California Water Code), 1970 California Endangered Species Act and subsequent revisions of those statutes.⁸¹

In addition to its collaborative work with other agencies, local governments, Fire Safe Councils and other organizations to assist landowners, CAL FIRE provides technical assistance, research, demonstration projects and educational programs, often targeted to small or medium landowners. It awards grants to smaller non-industrial landowners to help manage forests for resilience. Additionally, it engages in cooperative projects with private landowners, as well as undertaking projects that benefit landowners such as its seed bank and nursery.⁸²

But there is limited funding to assist private landowners on their nearly 13 million acres of forest in implementing treatments promoting forest resilience over the long term. For example, preparing and obtaining approval for environmental review documents is an activity with which small landowners need assistance, CAL FIRE officials testified.

At the Commission's request, CAL FIRE outlined the challenges private landowners face in managing their forests. The state must focus on addressing these needs as part of its strategy to return California's forests to resiliency:

- There are limited grant and private landowner funds available to support and implement projects.
- Educating landowners on management options and objectives is time-consuming.
- Many landowners have little or no experience managing forest lands.
- Locating resources (Registered Professional Foresters, contractors, other expertise and labor) is difficult.
- Economies of scale for smaller landowners do not exist.

- Allowable length of contracts and grant agreements are too short to adequately accomplish some kinds of activities.
- Navigation of complex regulatory limitations is difficult for landowners.
- Ever-shrinking infrastructure to support commercial sale of forest products makes effective forest management more difficult.⁸³

The Commission was encouraged to see steps taken to



The areas highlighted in yellow represent the regions for which CAL FIRE has a statutory responsibility to prevent and suppress wildfire. Source: Board of Forestry and Fire Protection. September 2017. Revised Vegetation Treatment Program Environmental Impact Report. Page 1-9.

assist private landowners during its study process. CAL FIRE representatives testified at the Commission’s August 2017 hearing that landowners were required to obtain 50-year deed restrictions on their property to receive certain types of funding. This was a result, the Commission learned, of an interpretation of Public Resources Code 4799.05 requiring eligible funding recipients to describe how the project benefits will last for at least 50 years.⁸⁴ The deed restriction interpretation unsurprisingly dampened enthusiasm for participation, CAL FIRE officials testified.⁸⁵ Before the release of this report, however, the Commission learned that the department had developed guidelines to meet the 50-year benefit requirement without requiring deed restrictions. The Commission applauds the department for working diligently to assist private landowners in overcoming obstacles to further the state’s forest resiliency goals.

Uses of California’s Forests

Complicating California’s ownership picture is the wide variety of ways forests are used. National forests have a multiple use mandate that includes “recreation, grazing, timber, watershed protection, wildlife and fish, and wilderness.”⁸⁶ The draft Forest Carbon Plan outlines additional forest uses, including carbon sequestration, aesthetic resources, water quantity and quality, economic opportunities and recreation- and tourism-related services.⁸⁷ Managing forests for multiple uses is a balancing act, complicated by many stakeholders valuing one or a few uses above others. Conflicts over uses can end up in court, resulting in delayed projects, scarce funds spent on litigation and an increased backlog of forest restoration work. Consequently, collaboration among diverse stakeholders in the development and implementation of projects is critical.

Landscape-Level Collaboration

The uncertainties of federal funding make it essential to use the most efficient and feasible planning methods for forest treatment. In short, the state must step up and invest in collaborating at the landscape level in order to leverage the expertise and resources of multiple stakeholders. This also creates a mechanism outside of litigation to address the varied and sometimes conflicting stakeholder concerns and desired forest outcomes. A larger leadership role by the state does not mean that

state officials should stop reminding the federal government of its obligations – because they should not – but that California has too much at stake to wait for someone else to save a key piece of the state’s infrastructure.

Good Neighbor Authority

Fortunately, there is a mechanism in place to cut through the land ownership problem. Congress gave states the authorization to perform work on federal land through the Good Neighbor Authority in the 2014 Farm Bill. The Good Neighbor Authority allows USFS to sign an agreement with any state agency to implement authorized watershed restoration activities on USFS land. In short, it allows state agencies to act on behalf of USFS, and they may conduct activities needed to restore the watershed, such as timber removal or prescribed fire. Proposed projects must go through the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) review processes before they can be implemented. With USFS approval, state agencies can contract out the work to other agencies or private contractors if necessary.

In February 2016, the USFS Pacific Southwest Region and California Natural Resources Agency signed a Master Good Neighbor Agreement that allows all parties to carry out “authorized forest, rangeland, and watershed restoration services,” testified Barnie Gyant, deputy regional forester.⁸⁸ It allows individual national forests within California to enter into Supplemental Project Agreements with the departments within the California Natural Resources agency.

Currently, there are two Supplemental Project Agreements in place. One, on the El Dorado National Forest, completes a fuel break by CAL FIRE on federal and non-federal lands to protect nearby communities. It also funds NEPA and CEQA work, and includes a \$908,000 USFS contribution. The other, on the Sierra National Forest, has USFS and CAL FIRE crews jointly treating tree mortality-stricken areas in the forest and surrounding lands.⁸⁹

In written comments to the Commission, Mr. Moore stated that his organization would increase opportunities to support the State of California in efforts to restore resiliency to California forests, indicating that USFS views the state as a leader in forest management.⁹⁰

The Logistics of Collaboration

The Commission queried representatives from different levels of government and private organizations about how

Wyden Amendment

The Good Neighbor Authority has a counterpart in the Wyden Amendment. This authorizes the U.S. Forest Service to enter into agreements with tribal, state and local governments to perform watershed work at the federal government’s expense. USFS currently is using this authority to perform work on state and private lands adjacent to the Sierra National Forest to treat areas affected by tree mortality.

Sources: U.S. Forest Service. December 16, 2013. “Wyden Amendment Reauthorized. <https://www.fs.fed.us/spf/coop/wyden>. Accessed August 3, 2017. Also, Barnie Gyant, Deputy Regional Forester, Pacific Southwest Region, U.S. Forest Service. August 24, 2017. Written testimony to the Commission.

to make collaborative efforts succeed. It learned about the Dinkey Collaborative Forest Landscape Restoration Project, or Dinkey Collaborative for short, as a model case study on a trip led by the Sierra Nevada Conservancy. Later, members of the collaborative testified before the Commission. Certain key themes were consistent throughout these conversations, visits and witness testimony: trust, time, funding and supportive decision-makers.

Building Trust

Participants in collaborative efforts said that building trust is the foundation for success. How do you build trust among parties that previously may have been at opposite tables in a courtroom? Susan Britting, executive director for Sierra Forest Legacy was candid in her testimony to the Commission on the steps necessary to establish trust among the set of stakeholders ranging from her conservationist organization to sawmill owners to USFS in what became the Dinkey Collaborative:

- **Neutral Third-Party Facilitator Who Promoted Mutual Learning.** “From the beginning,” testified Ms. Britting, “all parties appeared willing to approach the problem differently, but were wary of direct engagement with each other. The neutral third party facilitator, funded by the U.S. Forest Service, helped the group establish an investigative approach and structure that supported mutual learning and problem solving. This approach was essential to addressing the conflicts between logging and species conservation that had formed the basis of past conflict.”⁹¹

Judging the Likelihood of Success: How One Group Decides When to Collaborate

How does a non-government organization with limited resources decide whether to participate in a collaborative or not? Sierra Forest Legacy Executive Director Sue Britting offered the following criteria that her organization uses to judge the likelihood of a collaborative's success:

- Is the purpose and desired outcome clearly stated?
- Are the prospective decision-makers committed to honoring and applying the results of the collaborative process?
- Is there a commitment to support neutral facilitation and project management?
- Is the process transparent with a clearly-defined governing structure?
- Are the stakeholders willing to contemplate a resolution that meets their interests, but may be different from a position they currently support?
- Is mutual learning a cornerstone to the process?

Source: Sue Britting, Executive Director, Sierra Forest Legacy. August 24, 2017. Written testimony to the Commission.

- **Science-Based Approach.** All decision-making must be grounded in science, the Commission learned. Mr. Gyant shared an example: "In the Dinkey CFLRP, California Department of Fish and Wildlife biologists are working alongside Forest Service silviculturists and biologists to develop tree removal guidelines, wildlife habitat guidelines, and species protection measures that both enhance wildlife habit and create restored forest conditions. This process of collaboratively developing treatment guidelines with experts inside and outside the Forest Service has built a foundation of trust with non-government organizations that had been reluctant to work with the Forest Service in the past."⁹² The science-based approach goes beyond project development, however; it is an integral part of continuous adaptive management and

monitoring within the collaborative.⁹³

- **Funding.** While funding is necessary for collaborative success in its own right, as will be discussed shortly, it is also a powerful signal of commitment to a course of action. To Sierra Forest Legacy, receiving long-term funding to support research on the Pacific fisher and California spotted owl was an important signal of the federal government's commitment.⁹⁴

Landscape-Level Collaboration Takes Time and Money

Collaborative representatives agreed on the time-consuming nature of these ventures. Director Pimlott outlined the process from CAL FIRE's perspective in his August 2017 written testimony:

The larger the landscape-level project, the more the project proponents will need to coordinate. Most of these types of projects will include both state and federal land. For state land, this is often under several different private ownerships. It can be very time consuming to plan a project and get all of the required landowner buy-in for the project. Once this is complete, the environmental review and land access agreements must be coordinated. Depending on the project location and funding source, California Environmental Quality Act (CEQA) will need to be completed and National Environmental Policy Act (NEPA) may also need to be completed. For landscape-level projects, these environmental reviews cover larger areas of land and therefore take longer to complete.⁹⁵

Inextricably linked to staff time is funding. It is well understood that funding is required to pay for forest restoration, but budgets often do not cover a sufficient level of staff to participate in collaborative processes. A technical advisor for one organization told Commission staff that given the nature of her job, she should be a part of five collaborative efforts. Yet she only had the time to fully participate in one. "Collaboration simply takes additional time," Mr. Gyant testified, noting that particularly indi-

In Their Own Words: The Sierra Nevada Conservancy on the Sierra Nevada Watershed Improvement Program

During the course of its study, the Commission heard testimony about several collaborative efforts. Policymakers should pay particular attention to Sierra Nevada Conservancy Executive Officer Jim Branham's January 2017 testimony on the Sierra Nevada Watershed Improvement Program and his subsequent recommendations. The excerpt below has been edited for space and uniformity; Mr. Branham's complete testimony can be found on the Commission's website at www.lhc.ca.gov.

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 were released prior to the massive tree mortality outbreak and efforts are currently underway to update the restoration needs.

[...] 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 meet the need. The consequences outlined above result in far greater costs than the restoration work needed, in forms of fire suppression, losses of property and infrastructure, and other socio-economic costs. [...]
- ***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. [...] 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. [...]*
 - ✓ *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.*
- ***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.

viduals or groups with small or no budgets have difficulty participating in these efforts.⁹⁶

The State of California has touted the benefits of landscape-level collaboration. As will be discussed in more detail in the next chapter, to actually ramp up that collaboration, it will need to pay for agency officials to attend frequent meetings in remote areas of the state. It will need to pay for agency officials to spend appropriate amounts of time working on not just project development, but charters and governing documents for collaborative entities. It will need to pay for extensive CEQA and NEPA reviews. And it will need to provide grants to non-government organizations so that they can fully participate in collaborative processes.

Supportive and Decisive Decision-Makers

Even the best collaborative planning is meaningless if decision-makers do not implement the projects and recommendations of the collaborative. For all of the Dinkey Collaborative's work, for example, USFS still has the ultimate authority on what does and does not happen on the forests under its stewardship.

California's leaders must accept the reality, however, that sometimes consensus cannot be reached in a timely manner. Californians do not have the luxury of time when restoring their forests. When agreement isn't possible, policymakers must be prepared to rely on the best available science to inform their decision-making to restore forests to resiliency. At the outset of collaborative processes, stakeholders should decide on how to identify and declare an impasse. At that point, the agency with jurisdiction over the area in question should step in to make a science-based decision, with disagreeing stakeholders being encouraged to utilize their rights through environmental review processes. Forest restoration cannot be allowed to come to halt, however, due to disagreement or indecisiveness.

Beyond immediate planning, however, California's forests and the people who depend on them – anyone who breathes the air or drinks the water – need farsighted leaders. In the long run, investments in forest management will pay off. As forests are treated to become more resilient, they should be able to better weather stresses, such as drought, without posing enormous threats to public safety. Wildfires – which have been and always

will be a part of California – should not as frequently turn into catastrophic events that threaten lives and property and emit a year's worth of pollution in a matter of days. Over time, proactive investments in forest should reduce the need for expensive reactive emergency funding. State leaders should begin drafting a long-term plan to make proactive investments a larger priority, and they must consider the full range of beneficiaries when making these decisions. However, with the backlog of forest management work that needs to be done, it will take time to get there, and California cannot ignore its public safety threats now and in the near future. The state needs leaders who will make these funding decisions right now knowing that they very likely will not see a reduction in catastrophic wildfires or disease- and insect-related die-offs in the short term. The state needs leaders who will make these investments anyway, for the well-being of California's children and grandchildren.

Summary

Millions of acres of California's forests need to be treated to promote resiliency. The scale of work to be done further is complicated by forest ownership mostly lying outside of the state and the need to account for multiple forest uses. Landscape-level collaboration is widely acknowledged as the best way to accomplish this work, but it faces logistical challenges. State leaders must be prepared to build trust, provide staffing and funding resources, implement the recommendations of these collaborative efforts and invest in the future. Given financial constraints at the federal level, the state must be prepared to conduct work on federal land through the Good Neighbor Authority. Finally, it must provide incentives and remove hurdles for private landowners to invest in good forest stewardship.

Recommendations

Recommendation 1: Led by CAL FIRE, the State of California must engage in collaborative landscape-level forest management for long-term forest resiliency. This planning process should include stakeholders at all levels of government, Native American tribes, scientists, environmental and environmental justice groups, private industry representatives and local residents. Because forest health impacts Californians in urban and coastal areas, efforts should be made to include representatives

from non-forested regions to elevate the importance of California's forests to the entire state's wellbeing. Leaders also should review existing forestry practices and procedures, including the state's Forest Practice Rules, to assess whether they facilitate forest resiliency in a changing climate.

- Over time, funding gradually should be shifted from reacting to the consequences of poor forest management to preventative treatments that promote forest health and resilience. This should include spreading the costs among a greater array of beneficiaries of healthy forests statewide.
- State agencies should plan to make greater use of the Good Neighbor Authority to perform treatments on federal land.
- State leaders should continue to remind federal lawmakers and policymakers of federal obligations to its forests within California.

Recommendation 2: On CAL FIRE funds that have time constraints for encumbrance and liquidation, the Department of Finance should allow longer timelines to facilitate collaborative large-scale forest management planning.

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CAL FIRE L.A. Moran Reforestation Center (LAMRC)

Tour



Stewart McMorrow, deputy chief of forestry assistance, describes the process of evaluating a cone harvest.

After fire ravaged swaths of forests this year, communities looked to a one-of-a-kind facility for help. Northern California for example, needed seeds for 25,000 Douglas firs and 10,000 sugar pines, fast. A state-run seed bank stepped in, helping to bring charred areas back to life. Tucked away in Davis, the seed bank is a botanic treasure house, with 33 species of tree seeds, including the endangered Torrey pine.

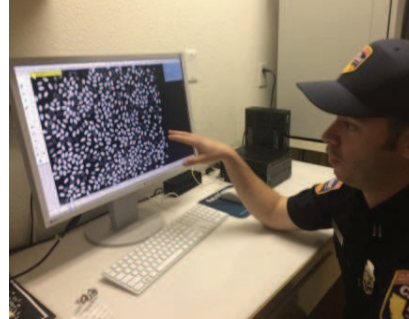
“No other facility has the breadth of species that we have,” said Helge Eng, deputy director for resource management for the California Department of Forestry and Fire Protection (CAL FIRE).

Little Hoover Commission staff toured CAL FIRE’s L.A. Moran Reforestation Center (LAMRC), created to meet demand for seeds throughout the state. Its primary objective is to help reforestation efforts in the wake of wildfires and the tree mortality crisis. The center also maintains genetic diversity and integrity of seeds to supply seed demands estimated to be in the millions.

The process of obtaining seeds is both time sensitive and labor intensive. Cones and the seeds inside are viable for only a short period, so timing the harvest is critical.



Giant Sequoia cones await tumbling for removal of seeds. Conifers such as sequoias produce viable seed about once every seven to 15 years.



Dorus Van Goidsenhoven examines x-rays to select viable seeds. Seeds displayed white are most viable, while darker seeds are considered less viable due to insects consuming the embryo or withering because of the drought.

Organizations collaborate on which cones to target and when. At one time, cones were shot out of the trees, but now CAL FIRE contracts with private climbers to do the difficult work.

After cones are collected, a multi-step process begins. Seeds are separated from the cones and put through intensive cleaning and testing.

In some cases a final hand cleaning is done with the assistance of inmate crews. The process varies depending on the type of seed. For example, LAMRC simulates fire conditions by manipulating temperatures for Coulter pine cones, which adapt naturally to fire and depend on heat to open up. Different seeds may require adding moisture to simulate rain and seasonal conditions. Knowledge obtained over years and custom-built equipment developed through trials has helped LAMRC reach 99 percent seed purity.

LAMRC engages in speculative selling, taking into consideration wildfire-affected areas and rare species. A seed zone map divides the state in 85 geographic areas varying by the amount of sunlight, elevation and weather to which a seedling might be exposed. Seed zones tell forest managers



LHC staff members toured the seed bank that holds 40,000 seeds. Pine species can remain viable if stored properly for 20 to 30 years.

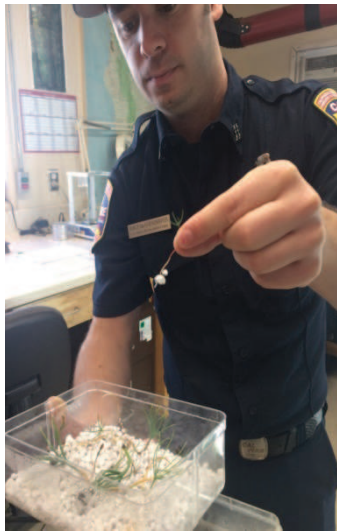


whether a seedling will survive conditions in the region it is planted. Seeds from a ponderosa pine grown in Fresno, for instance, should not be planted in Placerville.

Ninety percent of seeds stored at LAMRC are conifers. CAL FIRE aims to host a variety of California's native plant species, including weeds. They aspire to stock all native conifers, even the bristlecone pine, the longest-living tree.

The state currently is partnering with researchers to remap seed zones last updated in 1970 to consider necessary modifications due to climate change. The seed bank fills a gap that private nurseries cannot.

Officials said the intent of LAMRC is not to compete with private business and it is prohibited from doing so by state law. Consequently, the center stores and processes seeds for the U.S. Forest Service, private industry and landowners, in addition to other organizations. The price of seeds for purchase and costs of seed-processing services are set by the State Board of Forestry and Fire Protection. CAL FIRE and the U.S. Forest Service also share seeds with each other.



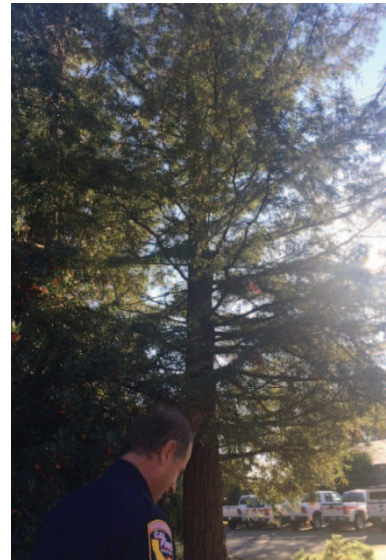
California Redwood seedling.

Commission staff also toured the future site of the nursery at LAMRC. Much of the facility fell into disrepair after closing in 2003 due to budget reductions. But funding was allocated in fiscal year 2017-18 to reopen the nursery; the tree mortality crisis and severity of California's wildfires convinced the Brown Administration of the need



The shade house at L.A. Moran Reforestation Center.

to resume nursery operations in the state. CAL FIRE intends to develop a state-of-the-art-facility with the capability to simulate multiple climates. The nursery's goal is to provide seedlings to the public by 2019.



The seed that sprouted this coastal redwood was part of a NASA experiment to measure the effects of space on tree seeds during Apollo 14's mission.

Sources: Helge Eng, Anthony Lukacic, Stewart McMorrow, Matthew Reischman and Dorus Van Goidsenhoven, Department of Forestry and Fire Protection. November 30, 2017. Davis, CA. Commission staff site visit. Also, Department of Forestry and Fire Protection. Winter 2013. "Call to landowners: find the cones." [Forestland Steward](#). Page 6.

Embracing Fire as an Essential Tool for Forest Resiliency

For 100 years, a culture of fire suppression in California's forests has had disastrous results. Tinder-dry brush, shrubs and seedlings blanket the ground while trees increasingly crowd each other, creating thickets of smaller, unhealthy trees competing with each other for water and sunlight.

The consequences of fire suppression are severe. This overcrowding may be reducing water supply to Californians.⁹⁷ Shade-tolerant species that are less fire tolerant are more abundant. Forest fuels continue to build up unabated. As a result, forests are less resilient; they are less able to recover from threats presented by fire, disease and insects.⁹⁸ One need only look at the more than 120 million dead trees in the Sierra Nevada to see the devastating consequences of losing resilience. Moreover, these impacts are predicted to worsen over the next century as California becomes hotter and drier. If the trend continues, California could find itself in the position of losing its hard-fought gains made toward its climate goals.

Frequent low-intensity fire is a critical component of California's forest ecosystems. Returning that type of fire to the landscape will be essential in restoring California's forests to resiliency. There are very real challenges to the use of prescribed fire, however. Lives, homes and the livelihoods of those who live and work in forests can be threatened and air quality can be impacted, particularly in communities already suffering from pollution. Cost and logistical factors also provide obstacles.

Officials already recognize the importance of fire as a tool and have declared their commitment to increasing the number and duration of prescribed burns. "CAL FIRE supports the combination of thinning and prescribed fire to restore more open and resilient forest conditions," testified Director Ken Pimlott in January 2017. "The use of prescribed fire mimics natural processes, restores fire to its natural role in wildland ecosystems, and provides significant fire hazard reduction benefits that enhance public and firefighter safety."

The Commission learned that there are no simple solutions to creating a resilient forest, and tradeoffs accompany every form of fuels treatment. There will be a role for

mechanical thinning in forest management, but it cannot replicate some of the ecosystem processes performed by fire. The benefits of prescribed fire are too important to ignore, but significant challenges exist. Still, policymakers must make putting more prescribed fire on the landscape a priority. Beyond the burns themselves, this entails staffing relevant agencies appropriately, investing in and deploying new technologies to develop better data on smoke impacts and working with the public to get buy-in for prescribed fire. As noted in the previous chapter, the state must be prepared to do prescribed burning on federal land under the Good Neighbor Authority if it is truly committed to forest resiliency.

The scientists who shared their work with the Commission cautioned that fuels treatments in general should not be expected to put a complete end to wildfire, and it would be a mistake for decision-makers or members of the public to walk away with that expectation. Within communities located in forests, fire suppression is a reasonable goal. However, in more remote areas, success should be considered a return to frequent low-intensity fires that benefit, not destroy, forests – and consequently all of the Californians who rely on the benefits provided by those forests.

For too long, fire has been treated as a threat to California. It is not enough for agency leaders, scientists and advocates to recognize the benefits of fire as a tool; the bureaucracy of state government and public sentiment as a whole must undergo a culture shift to embrace fire as a tool for forest health.

California's Fire-Adapted Forests

Sierra forests are fire adapted, meaning they evolved with frequent lower-intensity wildfire and need those conditions to stay healthy.⁹⁹ Historically, fire-tolerant trees – such as ponderosa pine with its thick bark, open crown and fewer limbs near the forest floor¹⁰⁰ – populated the forests. Frequent fires resulted in gaps in the tree canopy, allowing sunlight and snowfall to reach the forest floor. Forests were uneven-aged and patchy, characteristics that provide habitat for many different species and enable the forest to better withstand drought, insects and disease.¹⁰¹ Frequent lower-intensity fires prevented the accumulation of

the ladder fuels that allow flames to climb into treetops and devastate forests. They reduced the buildup of duff, or decomposing organic matter that tends to smolder at high temperatures when set alight, which can penetrate even fire-tolerant tree bark.¹⁰²

When Natural Fire Regimes Reign

As noted in the previous chapter, 100 years of fire suppression has resulted in a more than 90 percent reduction in forest burning from pre-European settlement. To understand the effects on forest resiliency when fires are allowed to burn naturally, one need only look at a mountain range straddling the Californian/Baja Californian border, testified U.C. Berkeley researcher Scott Stephens. Called the Peninsular Mountains on the northern side of the border and the Sierra San Pedro Martír on the southern side, this mountain range contains forests similar to those in the Tahoe basin, eastern Sierra Nevada and other parts of Southern California. Fire suppression and logging did not begin in the Sierra San Pedro Martír until the 1970s due to a lack of road access. As such, Dr. Stephens testified, they “represent the largest relatively intact Mediterranean-climate forest system in the Northern Hemisphere.”¹⁰³

Drought struck the entire mountain range on both sides of the border in the late 1990s and early 2000s. Dr. Stephens’ research found that on the Mexican side – where natural fire regimes historically remained largely intact – tree mortality averaged 0.5 trees per acre. Yet on the U.S. side, with the same drought conditions but different management policies, between 20 and 50 trees died per acre. The year following the drought, a severe wildfire swept through the Sierra San Pedro Martír. Dr. Stephens found that 80 percent of the trees survived both the wildfire and the drought, leading him to call the forest “incredibly resilient.”¹⁰⁴ It is this resiliency that California forests have lost with more than 100 years of fire suppression. And, it is this resiliency that the state’s forests need as California becomes more parched.

To restore resiliency, California must see frequent lower-intensity fire reintroduced into its forests. This can be accomplished through prescribed fire, an intentionally-set fire that follows a number of regulatory guidelines, or managed fire, in which naturally-ignited fire is allowed to burn to achieve certain objectives. The Commission primarily is concerned with prescribed fire, as this falls

Managed Fire

Managed fire is a forest treatment in which naturally-occurring fires (usually started by lightning) are used to improve forest conditions. Managed fire is most commonly used on federal land in the more remote parts of the state.

Managed fires differ from prescribed burns due to greater fire intensity than is usually called for in a prescribed burn. They can create high-severity burn areas that kill most or all trees in a stand. Managed fires are generally bigger, burn larger areas and burn longer than prescribed burns. Typically, they are only disrupted when conditions create risk for people and property.

For 40 years managed fire has been used in Yosemite National Park’s Illilouette Creek Basin (ICB), which previously experienced a century of fire suppression. Granite walls surround the nearly 100 square-mile basin within the Upper Merced Watershed. This naturally prevents fires from growing outside the basin and accounts for the ICB’s selection for a managed fire strategy. Studies of the ICB show that managed fire has reduced tree mortality rates and made forests more resilient to drought. Similar, untreated watersheds experienced up to 52 times more drought-related tree deaths.

Researchers also have determined that managed fire increases the variety of vegetation and makes forests more resilient when larger, uncontrolled wildfires occur. Managed fire reduced forest cover by 22 percent, eliminating much of the fuel that sustains wildfires. In the wake of managed fire, land area in moist meadows grew by 200 percent and shrublands increased by 24 percent, providing natural firebreaks to prevent the spread of wildfires and reduce the likelihood of catastrophic fires. Altogether, the use of managed fire has limited the spread and intensity of subsequent wildfires and mimics the behavior of historical fires that shaped Sierra forests.

Sources: Robert Sanders. October 24, 2016. “Wildfire Management Versus Fire Suppression Benefits Forest and Watershed.” Berkeley News. <http://news.berkeley.edu/2016/10/24/wildfire-management-vs-suppression-benefits-forest-and-watershed/>. Also, Gabrielle Boisramé, Sally Thompson, Brandon Collins and Scott Stephens. October 13, 2016. “Managed Wildfire Effects on Forest Resilience and Water in the Sierra Nevada.” <https://link.springer.com/article/10.1007/s10021-016-0048-1>.

within the domain of state agencies, but encourages the state’s involvement in activities promoting managed fire.

The sidebar on the previous page contains a discussion on managed fire.

Benefits of Using Prescribed Fire

There are numerous advantages to prescribed fire. It can return forests to their natural fire-adapted state. It can remove the buildup of forest fuels, further decreasing the risk of catastrophic wildfire. Fires that burn in areas that already have been burned become naturally self-limiting, testified Dr. Stephens, because fuel loads are very low. Ninety percent of fires that try to burn in an area burned nine or fewer years ago extinguish on their own, he said.¹⁰⁵ Similarly, lighter fuel loads and reduced crown consumption result in fewer emissions, noted U.S. Forest Service and UC Davis scientists in a 2017 research paper. If the 2013 Rim Fire, among the largest in California history, had burned in areas with recent prior fires, its emissions would have been reduced by an estimated 48 percent.¹⁰⁶ Intentional fire can be used strategically to help fight catastrophic wildfires; decades of managed fire in Yosemite National Park provided opportunities to suppress the Rim Fire, for example.¹⁰⁷ Finally, there are drought resilience and water supply implications associated with using prescribed fire: Dr. Stephens testified that managed fire within Yosemite resulted in less tree mortality and higher or unchanged stream output from the watershed. Three control watersheds with no managed fire showed less stream output during that time.¹⁰⁸

Many leaders, such as CAL FIRE Director Pimlott, believe that in some areas, it would be appropriate to mechanically thin fuels before reintroducing fire.¹⁰⁹ But while mechanical thinning can help reduce fuels, there are ecological processes it cannot replicate, note scientists Malcolm North, Brandon Collins and Scott Stephens, such as nutrient cycling and understory and microclimate diversity, among many others.¹¹⁰ Dr. Stephens cautioned the Commission, however, that strategic mechanical treatments still represent an improvement over no treatments at all.

Without action, the problem only will worsen. Not only will the status quo continue, with forests continuing to crowd themselves and fuels continuing to build, but because of climate change, wildfires are expected to grow in size and intensity. The threats to forests will be greater. Already an expensive problem, waiting to take action

will only increase the costs – and the consequences to Californians.

What the State is Doing to Increase the Use of Prescribed Fire

Both the federal and state governments have recognized the importance of prescribed fire. The U.S. Forest Service is revising its plans for national forests, and has adopted a planning rule that directs officials to “consider opportunities to restore fire-adapted ecosystems and for landscape scale restoration.”¹¹¹ A recent U.S. Environmental Protection Agency update to its wildfire smoke policy recognized that more frequent fire regimes need to be restored and maintained.¹¹² These are important developments for California since the state will need to conduct some forest restoration work on federal land under the Good Neighbor Authority, as discussed in the previous chapter.

To increase the use of managed and prescribed fire for ecological and other benefits, CAL FIRE, the Sierra Nevada Conservancy and California State Parks have joined the U.S. Forest Service, U.S. Bureau of Land Management, two local air districts as well as environmental and forestry associations and private entities in signing a Memorandum of Understanding for the Purpose of Increasing the Use of Fire to Meet Ecological and Other Management Objectives, developed by conservationist organization Sierra Forest Legacy. The parties involved in the Fire MOU Partnership have been working with scientists to evaluate the barriers to burning on available burn days to help develop solutions to maximize the use of those days.¹¹³ And, a working group has developed a draft communication strategy to provide consistent messages when talking to media and others about the benefits of prescribed and managed fire. Additionally, it works with scientists to present to media and policymakers recent study results that illustrate the reduced impacts from smoke when using managed and prescribed fire versus catastrophic wildfire.¹¹⁴

The California Air Resources Board (CARB) is working with land management agencies and forest advocacy groups to develop an improved framework for monitoring and communication, and to identify the tools and resource needs to better monitor and predict smoke impacts, testified CARB Deputy Executive Officer Edie Chang.¹¹⁵ Further, the agency coordinates at the policy and techni-

Fuels Treatments at Blodgett Forest

In April 2017, the Commission visited Blodgett Forest within the El Dorado National Forest to learn more about fuels treatments and forest resiliency. Led by UC Berkeley Professors Scott Stephens and Rob York and UC Forestry/Natural Resources Advisor Susie Kocher, the Commission was able to see firsthand the difference between untreated forests and forests treated with prescribed fire, mechanical thinning and a combination of prescribed fire and mechanical thinning.



100 Years of Fire Suppression. Blodgett's forest reserves are characterized by being untouched except for fire suppression, and are dark and crowded with smaller trees. They are full of ladder fuels that would allow fire to climb from the ground into the tree canopies. In addition to fire risk, these unhealthy conditions leave trees more vulnerable to disease and pests.



Prescribed Fire. Apart from the younger trees, this is how California forests would have looked before European settlement when they were regularly exposed to low-intensity fire. The gaps between the trees allow sunlight, and snowfall in winter, to reach the ground. There are not many low-hanging limbs or fuels on the ground, though maintenance burns will be needed.



Mechanical Thinning. This section of the forest has been mechanically thinned. Some of the new trees will need to be removed to maintain the benefits of a less-crowded forest.



Mechanical Thinning Combined with Prescribed Fire. This section of the forest was first thinned mechanically, followed by the introduction of prescribed fire.

cal level with other land management agencies and local air districts to remove impediments to increasing the number and duration of prescribed burns. Joint Air and Land Managers meetings are important for policy-level coordination, and the Interagency Air and Smoke Council works on technical tools.¹¹⁶

California's Prescribed Burn Programs

CAL FIRE plays the critical role in planning, implementing and permitting prescribed burns on non-federal land in California. For fiscal year 2016-17, CAL FIRE's goal was to complete 20,000 acres of prescribed burns statewide; it reached 70 percent of its goal, a 372 percent increase in acres burned from the previous year. Director Pimlott cited the wet winter and subsequent heat waves as reasons the goal was not reached. CAL FIRE's prescribed burn goal for 2017-18 is again 20,000 acres.¹¹⁷ The department plans to ramp up the amount of acreage treated (which can include activities outside of burning) to 60,000 per year statewide by 2030.¹¹⁸

Most prescribed fires on non-federal lands are conducted through CAL FIRE's Vegetation Management Program (VMP) or through two permits issued by CAL FIRE. The VMP is the more common vehicle for prescribed burns. Started in 1981, the program has averaged about 22,000 acres per year in prescribed burns. This cost-sharing program allows landowners to enter into a contract with CAL FIRE to use prescribed fire for fire protection and natural resource management goals. The state is liable for the project and indemnifies the landowner in return for CAL FIRE being in charge of the project.¹¹⁹

Director Pimlott noted that the acres treated under the program have declined in recent years. Some of the reasons for this include:

- A move from long-range management burns primarily on grassland to projects in the wildland-urban interface (discussed in greater detail shortly), where projects are smaller and less likely to use fire due to the proximity of homes, livelihoods and other assets. Similarly, population growth and associated infrastructure in the wildland-urban interface is a reason for the reduction in prescribed burns through the program.
- Budget and personnel constraints, including

the re-tasking of program personnel to other work and the loss of experienced practitioners, primarily due to retirement.

- Increased air quality and other environmental resource restrictions that limit days available for burning.
- A move to mechanical and hand treatments from fire.
- Plant and wildlife species considerations under the state and federal Endangered Species Acts.¹²⁰

One way to use more prescribed fire would be for organizations outside of CAL FIRE to conduct their own controlled burns. A mechanism exists to do this through two permits CAL FIRE can issue under the Public Resources Code to other state and local agencies and non-government entities. When there is an interest in these permits, CAL Fire will meet with the applicant to go over filing instructions and the terms of the permit, then will review the completed application and project plan to determine if it can be completed safely and successfully. This includes a site visit, during which CAL FIRE outlines how the site must be prepared as well as precautions the applicant must take. The applicant is responsible for controlling the fire and is liable for the costs of suppression and all damages if the fire gets out of control.

These permits currently are not often used, largely because the landowner is liable for the fire and few landowners have the knowledge, experience and equipment to conduct a prescribed burn. However, organizations like The Nature Conservancy conduct their own prescribed burns and should be a partner in creating a path for more.

Director Pimlott raised a number of concerns regarding implementing prescribed burns. CAL FIRE administrative units have many priorities that take time, funding and personnel, he stated, and in some cases prescribed fire has not been prioritized. Further, non-VMP fires could require CEQA analysis – environmental review to identify the impacts of the burns on the ecosystem and a plan to mitigate those impacts – and the department is not staffed to provide CEQA and other review for this purpose. This analysis often is cost-prohibitive for the party wanting to conduct the project. VMP contracts are limited to three years, which limits the ability to carry

California Conservation Camp Program Allows Volunteer Inmates to Fight Fires

As the California wildfire season continues to become a destructive, year-long battle, an unlikely but able-bodied group serves as the state's frontline force: prison inmates. The Conservation Camp Program, operated jointly by CAL FIRE and the California Department of Corrections and Rehabilitation (CDCR), allows volunteer non-violent, minimum-custody offenders to work on meaningful civic projects and respond to fires and emergencies, including search and rescue operations, floods and earthquakes.

While some convictions—such as arson and sexual offenses—automatically disqualify offenders for a conservation camp assignment, nearly 4,300 offenders work at 39 camps due to eligibility based on behavior, previous criminal record and physical, emotional and intellectual aptitudes. Once approved, offenders receive rigorous classroom, physical and field training, including fire safety and attack, use of hand tools, teamwork and crew expectations. Inmate fire crews have responded to all of California's major disasters during the past few years, providing cost savings to the state, protecting citizens and property and allowing inmates to engage in socially beneficial activities. The budget for a typical camp, including payroll and operating costs, is \$2.35 million. Offenders provide approximately 3 million hours annually responding to fires and other emergencies, saving the state and taxpayers an estimated \$100 million in firefighting costs. When not responding to emergencies, offenders contribute 7 million hours to community service jobs each year. Specific projects include repairing and maintaining levies, clearing debris from streams, removing roadside litter and constructing hiking trails.

For their service, offenders learn new life-long skills and receive two days off their sentence for each day of good behavior (2-for-1). A New York Times article has described the conservation camps as “bastions of civility” that may contain barbeque areas, small cabins for relatives to stay for up to three days, softball fields and libraries. Many inmates appreciate the opportunity to stop fires and save lives. But the number of eligible and available inmate firefighters has decreased due to recent criminal justice reforms that reduced the state prison population.

These reforms have unwittingly created a shortage of inmate firefighters in the Conservation Camp Program, particularly since adoption of the state's realignment law in 2011. Under the initiative, mandated by a federal court order to reduce overcrowding, offenders convicted of non-serious, nonviolent and non-sexual crimes must serve their sentence in county jails rather than state prisons. County jails now oversee offenders considered low-risk and eligible to volunteer for the Conservation Camp Program, while state prisons contain a higher proportion of offenders convicted of serious and violent crimes. While CDCR has contracted with several counties to recruit firefighting inmates from county jails, it has not been able to fill all the vacancies. California has filled approximately 3,800 of the 4,300 budgeted inmate firefighting positions since realignment took effect.

Sources: California Department of Forestry and Fire Protection. “CAL FIRE Conservation Camp Program.” http://www.fire.ca.gov/communications/downloads/fact_sheets/CampProgram.pdf. Accessed December 8, 2017. Also, Jaime Lowe. August 31, 2017. “The Incarcerated Women Who Fight California's Wildfires.” New York Times. <https://www.nytimes.com/2017/08/31/magazine/the-incarcerated-women-who-fight-californias-wildfires.html?mtrref=t.co&mtrref=undefined>. Accessed December 8, 2017.

out the full project within prescription on approved burn days. Narrow burn windows further impede the project, and can be impacted by weather and fuel conditions, personnel availability and obtaining permits in a timely manner. Finally, liability issues are not necessarily clear on non-VMP burns. Generally, liability should fall to the landowner – a discouraging factor for many who otherwise would be interested in conducting prescribed burns, testified experts at a February 2017 legislative hearing¹²¹ – but CAL FIRE likely has deeper pockets. Director Pimlott stated that it is unclear where the liability threshold actually is; if CAL FIRE participates in any way, it could end up assuming some or all of the liability.

CAL FIRE is taking steps to help overcome these challenges. It is working on a statewide programmatic environmental impact report that would reduce the time and effort of environmental review for prescribed fire projects.¹²² It has an internal prescribed fire working group and participates in collaborative efforts to reduce barriers to prescribed burning, including:

- **Staffing changes.** These include increasing support of unit staffing levels during fall and winter to complete burns, creating preparational and/or operational strike teams and redeveloping qualifications and training curricula to educate more qualified prescribed fire personnel

internally (which is already in progress).

- **More time to burn.** The department is investigating expanding VMP contracts from three years to up to 10 years, which would require the support of the Department of General Services, and allowing the flexibility for prescribed fires under certain circumstances during burn bans.
- **Financial incentives.** The department is exploring eliminating the cost-share requirement for landowners, increasing the reimbursement rates to administrative units when burns are completed to prescription and contracting out prescribed fire projects, which would transfer CAL FIRE's liability.¹²³

The Commission commends CAL FIRE for its commitment to prescribed fire and for exploring ways to increase the utilization of its prescribed fire programs. Many of these ideas cost money, and many of them would require administrative investments. Though policymakers should understand that running effective programs requires adequately-resourced administrators, funders often like to see action in programmatic areas and balk when they see administrative expenses.

California's leaders must support CAL FIRE in its efforts to create more resilient forests, and it must support CAL FIRE at the aspirational scale outlined in the draft Forest Carbon Plan. Toward this end, the state should support the creation of dedicated prescribed fire teams, and ensure these teams are compensated in a way to attract the highest caliber of fire officials. During a catastrophic fire siege, these teams could be temporarily assigned to fire suppression, but should be dedicated to fuels reduction for the remainder of the time. Additionally, CAL FIRE and other departments should identify what resource needs they have to meet the ambitious goals outlined in the draft Forest Carbon Plan, and the Legislature should work with them to develop a funding plan so that these goals can become reality.

Challenges to Using Prescribed Fire

Beyond the impediments outlined by CAL FIRE, there are safety, financial and environmental challenges to increasing the number and duration of prescribed fires.

Human Encroachment on Forests

As of 2010, California had about 4.5 million homes located in wilderness areas. These populated forest areas are called Wildland-Urban Interface, or WUI. Experts acknowledge they are particularly vulnerable to wildfire.¹²⁴ A map on the next page shows the distribution of homes and wilderness areas in California.¹²⁵

The home-building expansion into the state's wildlands has greatly increased in recent years; the population within the Sierra Nevada doubled between 1970 and 1990, and it is expected to triple between 1990 and 2040.¹²⁶ Many residents of these settlements have concerns about intentional burning near their homes. Prescribed fire in these areas is restricted, testified Director Pimlott, and allowing natural fires to burn is a nonstarter due to the threat to life and property.¹²⁷ Fire experts state that the goal of burning in or near these populated areas could not be replicating California's historic fire ecosystem, but instead must focus on containing and suppressing catastrophic fires.¹²⁸

Ms. Britting noted that fears of fire escaping prescribed burns are not backed up with data. While it occasionally happens, she testified, it is rare. Between 1996 and 2004, there were only 30 escaped fires or near misses on national forest lands, for example. Another study looked at the 16,626 prescribed fires treating 1,971,823 acres nationwide in 2012, and found only 14 escaped fires.¹²⁹ The best way to prevent a prescribed fire escape, Ms. Britting testified, is to ensure there are well-trained and experienced practitioners in charge and a prescribed fire support team that effectively uses weather and other biophysical data to evaluate fire in real time.¹³⁰

On-the-Ground Conditions

On a practical level, land managers face many on-the-ground conditions that can determine whether or not a prescribed fire happens. This includes workforce availability, fuel moisture and weather and safe burn conditions.¹³¹

As noted above, there are a number of groups working to identify barriers to burning on available burn days. These include working groups within the Fire MOU Partnership, Air and Land Managers meetings and the Prescribed Fire

California

Pacific Southwest Region



Wildland-Urban Interface (WUI) of California. There are two types of communities within the WUI: intermix and interface. Intermix, indicated in orange, refers to communities that sit within wildland vegetation; these communities have a minimum of one house per 40 acres in an area with more than 50 percent wildland vegetation. Interface, indicated in yellow, refers to communities that are near wildland vegetation; they have a minimum of one house per 40 acres in an area that is less than 50 percent wildland vegetation but are within approximately 1.5 miles of a large area with at least 75 percent vegetation cover. The WUI poses difficulties in conducting prescribed burns, as human populations feel threatened by fire.

Source: Sebastián Martinuzzi, Susan I. Stewart, David P. Helmers, Miranda H. Mockrin, Roger B. Hammer, and Volker C. Radeloff. The 2010 Wildland-Urban Interface of the Conterminous United States. https://www.fs.fed.us/nrs/pubs/rmap/rmap_nrs8.pdf.

Working Group within the Tree Mortality Task Force. The Commission urges the state to encourage its personnel to participate in these efforts to the fullest, and for policy-makers to implement the recommendations that these groups develop.

Costs Associated with Prescribed Burning

One deterrent to prescribed fire is the cost. Quite simply, prescribed burns cost money to plan and implement and they do not result in a product that can be sold to offset those costs. However, policymakers must consider the other alternatives before deciding not to invest in prescribed fire.

Researchers found that prescribed burns on U.S. Forest Service and National Park land averaged approximately \$145 an acre and \$206 an acre, respectively.¹³² In contrast, without considering the long-term costs to the state's greenhouse gas reduction goals or to public health, they found that controlling unmanaged wildfire averaged approximately \$830 an acre on the Forest Service land in their study area and \$496 an acre on National Park land.¹³³

Further, though mechanical thinning can result in a saleable product, conducting it in a way that promotes resilient forests – that is, removing small-diameter trees and other plants – is not always profitable. In the study noted above, the researchers found that mechanical thinning contracts on U.S. Forest Service land averaged 3.5 times more than prescribed fire largely due to the removal of small biomass that could not be sold.¹³⁴ Further, land must be maintained after initial treatments, which means that mechanical treatment costs can increase because the larger high-value trees have already been removed.¹³⁵

Strategic planning can reduce the cost of prescribed burning in some instances, however. Projects can be designed so prescribed burns are paired with profitable mechanical harvesting, with the income from the harvesting offsetting the cost of the burns, at least in part.¹³⁶ Doing that at the landscape level, experts noted, would allow for a predictable supply of forest materials for mills and bioenergy plants, solving one of the impediments to investment in wood processing infrastructure.¹³⁷ However, the fact remains that prescribed burns by themselves are a costly activity – and one in which the state should invest, given

the benefits to forest resiliency.

Carbon Sequestration

Trees pull carbon dioxide from the atmosphere as part of the process of photosynthesis, consequently playing an important role in carbon sequestration. Forests are California's largest carbon sink, or area that absorbs and stores more carbon than it emits.

Some are concerned about prescribed fire because burning fuels results in the loss of stored carbon. But as with other impediments to prescribed fire, it is important to look at the tradeoffs. The disturbances to California's unhealthy forests threaten to turn them into net carbon emitters. In 2010, California's above-ground plants contained about 898 million metric tons of carbon, with forests accounting for 892 metric tons of that stored amount.¹³⁸ Approximately 1,603 million metric tons are stored in other carbon pools, such as root systems.¹³⁹ Between 2001 and 2010, wildfire accounted for approximately 120 million metric tons of an estimated 180 million metric tons of carbon loss due to disturbances during this timeframe.¹⁴⁰ Further, post-wildfire emissions can be up to five times greater than those released during the fire.¹⁴¹

Wildfires are not the only threat to forests, however. In his testimony to the Commission, Mr. Branham stated that his agency estimates that in 2016, 53 million metric tons (equivalent 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, meaning it will be released as the tree decomposes.¹⁴²

In the past, the state counted on tree regrowth to once again boost carbon sequestration. However, scientists now observe that some areas burned in high-severity fires are growing back as shrublands or grasslands, which store less than 10 percent of the carbon than their predecessor forests.¹⁴³ Forests killed by the bark beetle take longer to return to a carbon sink than forests killed by other disturbances.¹⁴⁴

Even without disaster, overcrowded forests can stunt tree growth rates, which slows rates of carbon sequestration.¹⁴⁵ This matters because large trees actively sequester more carbon on an annual basis than smaller trees; one recent study in the Sierra Nevada found that

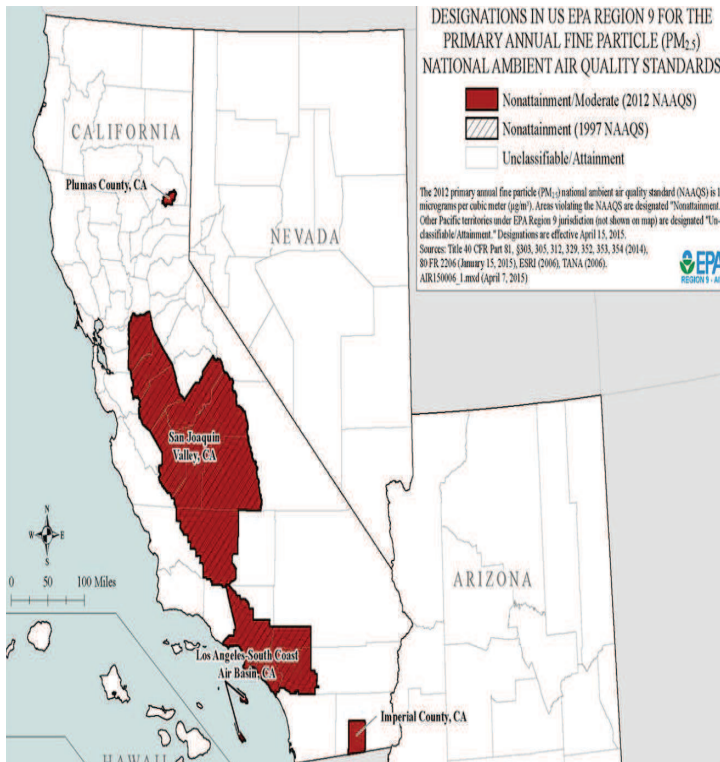
over a 10-year period, areas of forests that were treated sequestered more carbon while the untreated areas lost carbon.¹⁴⁶

In short: California has taken enormous strides to reduce its greenhouse gases and sequester carbon, and it could lose all of that work by continuing to neglect its forests. So while prescribed burns could result in some carbon loss in the short term, creating resilient forests will have long-term gains for Californians.

Air Quality Concerns

Air quality concerns are among the biggest impediments to prescribed burning because smoke contains particulate matter that is especially harmful because of its small size. Called PM_{2.5}, this particulate matter is less than 2.5 micrometers in diameter, allowing it to penetrate the body's defense system and infiltrate the respiratory system.

In areas already struggling with poor air quality, a prescribed burn can seem particularly burdensome. Currently, 12 million Californians breathe air that does not meet federal air quality standards, testified CARB Deputy Exec-



Source: U.S. Environmental Protection Agency. Annual Particulate Matter (Annual PM-2.5) Attainment Designations in Region 9. https://www3.epa.gov/region9/air/maps/r9_pm25-annual.html.

utive Director Edie Chang. They are subject to increased and higher severity asthma attacks, bronchitis, other lung and cardiovascular disease and reduced ability to fight infections.¹⁴⁷ Children, the elderly, those already suffering from respiratory problems and those exerting themselves outdoors are particularly vulnerable to the effects of this smoky particulate matter.

Additionally, there is an economic impact from smoke. Many Californians use forests as a vehicle for recreation, and smoke from prescribed fires impacts visibility as well as health. This can negatively affect recreation and tourism.¹⁴⁸

Public education will be an important tool in increasing the number of acres burned. At a basic level, CARB, air district and public health officials can expand on current efforts to teach people how to protect themselves from smoke. New technology can help officials pinpoint more precisely which communities are more likely to be affected.

California Air Pollution Control Officers Association Executive Director Alan Abbs testified that air districts face immense federal and state pressure to meet air quality standards.¹⁴⁹ While wildfires do not count against air quality standards, prescribed fires do. Many air districts have enacted regulations to reduce emissions from other sources, such as limiting the use of wood stoves and fireplaces when air quality is poor, or providing incentives to replace older wood heating devices, said Mr. Abbs. Still, with many air districts still struggling to meet particulate matter regulations, he said, increasing both the number and duration of burns likely will require increased monitoring and modeling.¹⁵⁰

Monitoring Air Quality

One obstacle to prescribed burning is the current inability to make burn/no-burn decisions on a small geographic basis. California has an extensive stationary monitoring network, meaning that high quality monitors reside in fixed locations. The majority of these monitors are near heavily populated areas; this set-up may not adequately reflect the areas impacted by prescribed burning.¹⁵¹ Adding smaller, portable monitors to the monitoring network could give air quality officials a more nuanced picture of potential smoke impacts. CARB has 30 high quality portable monitors, called Environmental Beta Attenuation

Monitors or EBAMs for short. These provide hourly data for smoke monitoring, and often are deployed in wildfire emergencies.¹⁵² Further, CARB received a U.S. Environmental Protection Agency grant to buy six more EBAMs that can be shared with local air districts to support prescribed burning.¹⁵³

In addition to the current air monitors, CARB is evaluating a variety of new-generation mobile instruments on their ability to measure PM2.5. This technology can allow for better burn management, assess modeling validity and develop best management practices, noted Mr. Abbs.¹⁵⁴ These instruments must be tested in a smoke chamber to determine their accuracy and precision compared to official monitoring standards before being used in real world scenarios.¹⁵⁵ As with the use of EBAMs, these additional instruments could be used to provide a more detailed portrait to inform forecasting and identify areas at risk.¹⁵⁶

How do Air Regulators Authorize Prescribed Burns?

A land manager planning a prescribed burn will create a smoke management plan and submit it to the air district for approval. If the plan is approved, the land manager tentatively plans a window of time to burn. The land manager and air district have access to 96, 62, 48, and 24 hour air quality and meteorology forecasts to determine the likelihood of receiving a burn authorization.

The California Air Resources Board's meteorology section issues daily burn or no-burn determinations for each air basin. Local air districts can further refine burn determinations based on local conditions; air district staff plays a significant role on marginal burn days when it is less clear whether burns should or shouldn't happen.

Sources: Alan Abbs, Executive Director, California Air Pollution Control Officers Association. August 24, 2017. Written testimony to the Commission. Also, Edie Chang, Deputy Executive Officer, California Air Resources Board. August 24, 2017. Written testimony to the Commission.

Better monitoring and model data already has led to increased prescribed burns, Ms. Chang testified, citing the Goliath prescribed burn as an example. Conducted in June 2016 by the Sequoia and Kings Canyon National Park in coordination with the San Joaquin Valley Air Pollution

Control District, the burn totaled 806 acres. Previously, said Ms. Chang, the district would have limited the acreage per day to meter the emissions released. However, in this case, the district allowed the park a multi-day burn window and did not limit acreage. Both parties jointly monitored the smoke, air quality and visibility, which minimized the smoke and public health impacts, she said. This effort would have been nearly impossible without CARB's and the air district's support and the enhanced monitoring and monitoring of resources, Ms. Chang concluded.¹⁵⁷

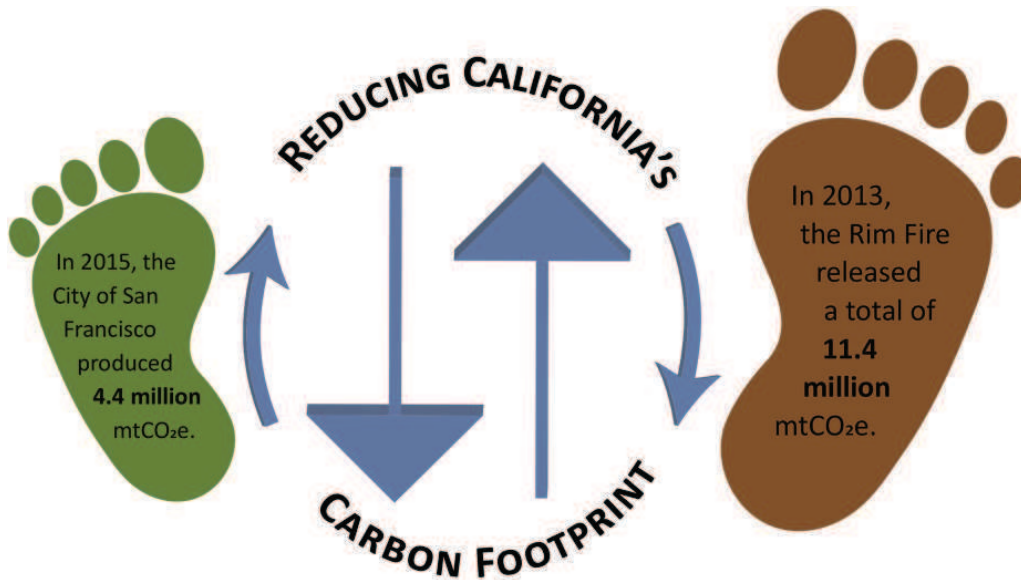
The steps CARB and other agencies, such as the South Coast Air Pollution Control District, which also is testing portable monitors in its AQ-Spec Lab, to put new technology out in the field are important. However, as more data flows in, there must be conversations about what it means and how to incorporate that data in decision-making. CARB leaders acknowledged and expressed a commitment to this.¹⁵⁸

Public Messaging

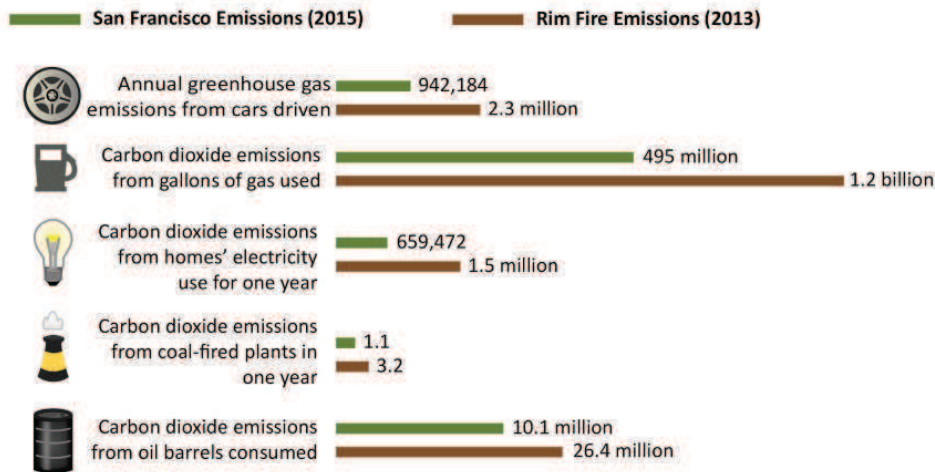
The threat of losing the state's air quality gains to the consequences of unhealthy forests is a bigger-picture educational component that must be addressed. Prescribed fires may result in short-term effects on air quality, but – carefully managed to mitigate the impact on communities – they can create a long-term public benefit.

The public must be educated about the tradeoffs between prescribed burns and the loss of forest resiliency. In a conversation about smoke impacts, the discussion largely will revolve around the effects of wildfires. While prescribed fires do result in emissions, catastrophic wildfires have more, and unlike prescribed burns, humans do not get a say on their timing and location. The 2013 Rim Fire, for example, produced as many greenhouse gas emissions in its smoke plume as the city of San Francisco produces in a year – and that's only 15 percent of what will be released from the burn footprint as dead trees decay, testified Mr. Branham.¹⁵⁹

Researchers found that wildfire PM2.5 emissions can vary wildly, ranging from 17,068 tons one year to 529,821 tons a different year.¹⁶⁰ They caution that this is likely to get worse in the future, as higher temperatures and more fuels are likely to lead to more large fires.¹⁶¹ By one estimate, wildfire emissions in California are expected to



The Rim Fire released greenhouse gases nearly **three times** as much as San Francisco produced in 2015. Below is an equivalencies chart that compares these emissions in terms of everyday activities.



Sources: Sierra Nevada Conservancy. June 2014. "Rim Fire Greenhouse Gas Emissions & Air Quality Impacts." Also, San Francisco Department of Environment, Climate Program. October 2017. "2015 San Francisco Geographic Greenhouse Gas Emissions Inventory." Also, U.S. Environmental Protection Agency. "Greenhouse Gas Equivalencies Calculator."

Impact at the Local Level

Increasing the number and duration of prescribed burns, enhancing the use of new technology and modeling, participating in conversations on how to use that data and significantly increasing public outreach is a tall order with real impacts on those charged with protecting the state's air quality, particularly at the local level. There are 35 local air districts in California, with jurisdictions ranging from a single county to multiple counties or portions of counties, with similarly variable staffing. Lassen County Air Pollution Control District, for example, has 1.5 Full Time Equivalents, while the South Coast Air Quality Management District has approximately 850.¹⁶³ These smaller air districts have numerous other functions to perform with their limited staff aside from regulating prescribed fires, Mr. Abbs testified, such as district stationary source regulation, incentive work, public meetings and complaint and nuisance investigations.¹⁶⁴

The state cannot and should not expect these districts to take on additional work without additional resources.

increase by 50 percent before 2100 unless policymakers make drastic changes to fire use.¹⁶²

Commission witnesses widely acknowledged that there must be a shift in culture regarding fire, but for that to happen, the public – statewide, not just in rural areas – must be educated about the tradeoffs between prescribed burns and catastrophic wildfires in California's forests and other wildlands. The public's buy-in is critical for policymakers to make these decisions and investments.

And this work is too critical to not take on. The state must ensure that local air districts receive the funding they need to increase the number and duration of prescribed burns, that they can fully participate in conversations about how to better use technology and streamline regulations to make this happen, and that they can fulfill their charge to protect the air that their constituents breathe.

Conclusion

In their paper on using fire as a fuels reduction treatment, Drs. North, Collins and Stephens note that the air quality impacts from “unmanaged” wildfire often are treated as “acts of God.” But these are actually the consequences of decisions and actions (or inaction) that policymakers have made, they contend.¹⁶⁵ California’s leaders must take this message to heart. California faces the threat of completely reversing progress on its air quality goals by neglecting its forests, and that would be the consequence of decisions made by people, not something that “just happened” to the state.

The Commission was heartened to see that agency leaders understand this and that there are commitments to begin to restore some of California’s historic fire regime to foster forest resiliency and ecosystem health. But this support needs to come from the highest levels of government – the Administration and the Legislature – to ensure departments have the resources they need to go beyond what they’re doing and restore California’s forests at the landscape level.

Recommendations

Recommendation 3: The State of California should lead a policy shift from fire suppression to using fire as a tool.

- This should include creating dedicated prescribed fire crews. These job classifications should be designed to attract the state’s top talent, with pay comparable to non-prescribed fire crews.

Recommendation 4: Treating the land at the scale outlined in the draft Forest Carbon Plan will require more resources. CAL FIRE, local air districts and other affected agencies should develop a list of positions they will need to meet the draft Forest Carbon Plan goals of treating 500,000 acres of nonfederal land per year, 500,000 acres of USDA Forest Service land per year and 10,000 to 15,000 acres of acres of Bureau of Land Management land per year. State agencies should assume that at least part of the federal lands acreage treated will be by state entities working under the Good Neighbor Authority, and predict their staffing needs accordingly. The Legislature should then fund these extra positions, including the positions at the local level.

- As more funding – such as the jump from \$40 million to more than \$200 million in Greenhouse Gas Reduction Funds between FY 2016-17 and 2017-18 – is allocated for forest management to CAL FIRE and other agencies, these entities must be responsible for properly planning for its use, including an adequate number of staff with necessary skills. If new positions are necessary, CAL FIRE and other agencies and departments should not be penalized for developing the resources needed to successfully administer the forest management program.

Recommendation 5: The California Air Resources Board, land managers and other stakeholders should continue to actively work to find ways to increase prescribed burning through better use of technology, including modeling software, traditional portable air quality monitoring and new low-cost sensor monitoring.

- State agencies and other stakeholders should continue to participate to the extent possible in the Fire MOU and Air, Land and Water meetings, as well as other collaborative cross-jurisdictional efforts to overcome the barriers to prescribed fire. Pertinent agencies that currently do not participate in these efforts should participate.

California's Wood-Processing Infrastructure

With 129 million trees hard-hit by the mortality crisis in the Sierra Nevada, California faces a practical conundrum: What can be done with all of the dead wood? Beyond navigating logistical nightmares that accompany removal, working groups are looking into possible ways to profitably manage the material and evaluating whether it can be utilized in ways that would help revitalize rural forested communities.

Hazard trees that threaten people, infrastructure and other resources present an obvious public safety risk. Felled trees also present a problem, however, in that there is nowhere to put them. With sawmills and other wood-processing plants at capacity, logs are being stored in driveways, by the side of the road or wherever there is room. Landfill disposal is not a viable option, because decaying wood produces methane, a greenhouse gas. And because CalRecycle must significantly reduce organic waste going to landfills, the only workable alternatives for dead tree disposal are composting, converting to renewable energy or recycling – choices that also have limitations, according to Evan Johnson, Co-Chair of the Tree Mortality Task Force's Market Development Working Group and science and policy advisor for CalRecycle. Mr. Johnson testified that only a limited amount of woody waste can be processed at compost facilities, and, with the decline of biomass energy infrastructure statewide, there are few other outlets for it.¹⁶⁶ Some opt to open-pile burn their woody biomass, which negatively affects air quality.¹⁶⁷

When declaring a State of Emergency for the tree mortality crisis, Governor Brown issued several directives to utilize the dead wood and increase capacity within the state to process the wood. These directives primarily are focused on responding to the immediate crisis, not long-term forest management, and can roughly be divided into increasing wood products markets and using bioenergy to respond to the crisis:

Expanding Wood Products Markets

- Identifying state facilities and highways where woodchips from dead wood could be used as mulch.
- Determining the feasibility of expanded wood product markets in California.



The black-and-white icons represent wood product facilities that have closed since 1971.

Source: SB 859 Wood Products Working Group. October 2017. Recommendations to Expand Wood Products Markets in California. Page 17.

Expanding Bioenergy

- Extending contracts on existing forest bioenergy facilities receiving feedstock from high hazard zones.
- Increasing capacity for forest biomass generation by expediting actions for qualifying facilities in the California Public Utilities Commission's (CPUC) biomass-oriented programs.
- Reducing delays between utilities and facilities in agreeing on interconnection terms for new and expanded biomass energy facilities.
- Prioritizing grant funding from the California Energy Commission's Electric Program Investment Charge (EPIC) for woody biomass-to-energy technology development and deployment.
- Estimating biomass feedstock availability, storage location and volumes that may be available for use as bioenergy feedstock at existing and new facilities.
- Identifying potential funds to offset higher feedstock costs.¹⁶⁸

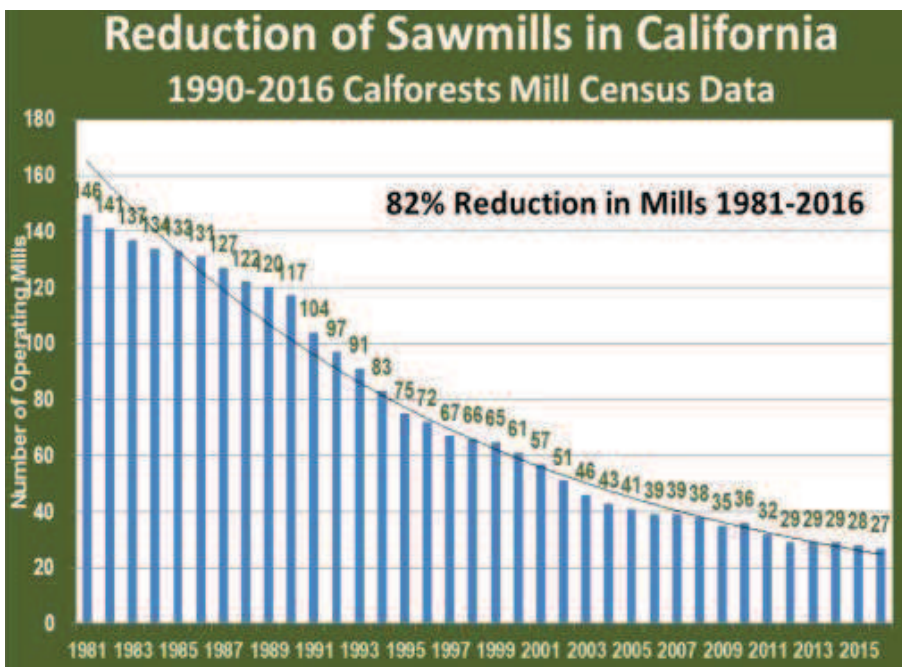
The Commission heard from government officials, industry representatives and environmental groups about the state's efforts to meet the Governor's directives. Expanding California's wood products industry is a complicated charge, particularly since there is not enough capacity within the state to utilize the wood generated from increased forest management and restoration activities.¹⁶⁹ A key problem state officials must work around is that of supply: the supply from USFS has decreased over the past decades, and private industry needs a consistent supply in order to expand operations. Bioenergy presents an even more complicated problem. The industry is decentralizing with the expansion of Community Choice Aggregation, which allows local governments to buy or generate energy for their constituents. Bioenergy costs more than other forms of renewable energy; it is

not zero emission; and energy companies do not need it to meet their renewable energy requirements. The key questions about extending the use of bioenergy in the long-term rest on how the state defines the public benefit bioenergy could provide and how to fairly disseminate the higher costs of bioenergy.

The Commission was encouraged to see the state addressing the wood products industry in the long-term, and would like to see the state continue this momentum. Consequently, the Commission will return to this topic with additional public meetings. Additionally, it found that the state's bioenergy efforts heavily focused on responding to the tree mortality crisis. It would like to see the state address the larger long-term bioenergy planning issues.

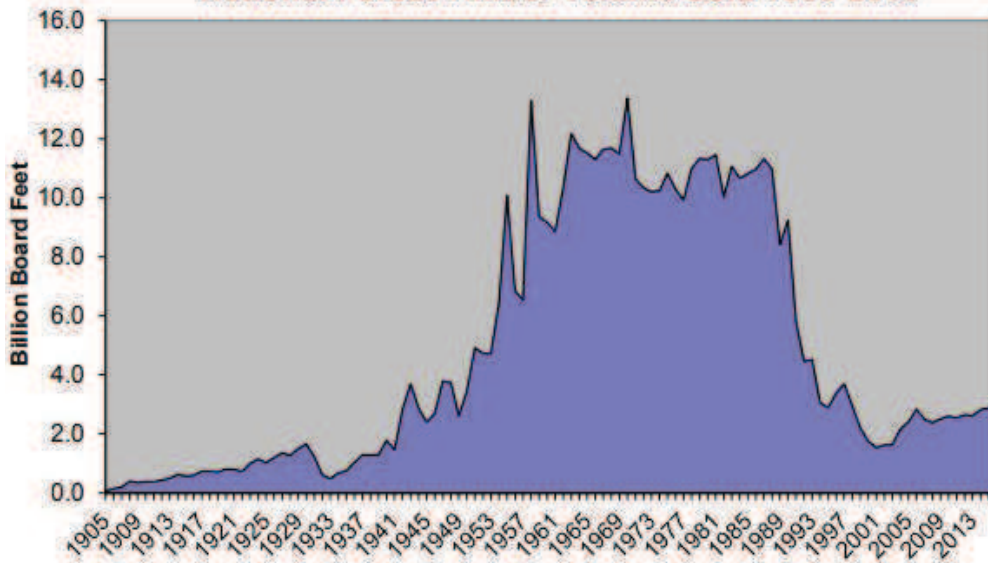
Declining Sawmill Capacity

California's wood products industry is on the decline, testified Claire Jahns, California Natural Resources Agency assistant secretary for natural resources climate issues. Sawmill capacity decreased by about 70 percent between 1980 and 2012 and wood processing facilities have decreased from 262 in 1968 to about 77 today, she stated. Employment in California's forest products industries today is approximately half of what it was in 1990.¹⁷⁰



Source: Cedric Twight, California Regulatory Affairs Manager, Sierra Pacific Industries. April 27, 2017. Written Testimony to the Commission. Page 10.

National Forest Timber Volume Sold 1905-2016



The amount of timber from national forests sold nationwide has steeply dropped since the 1980s. Industry officials say that current infrastructure capacity meets current supply; increasing capacity would require assurances of a consistent increased supply.

Source: Cedric Twight, California Regulatory Affairs Manager, Sierra Pacific Industries. April 27, 2017. Written Testimony to the Commission. Page 9.

There are so many dead trees from the crisis, and so few options, that it would take 100 years with California's current sawmill, biomass energy and other wood utilization facilities to process all the dead material, concluded a private consulting firm contracted by the Tree Mortality Task Force to outline options for the state.¹⁷¹

Because there is not enough capacity to respond to the crisis does not mean that there is not enough capacity to process the amount of wood normally removed from the forests, testified Cedric Twight with Sierra Pacific Industries, California's largest private and industrial forest owner.¹⁷² Existing operations match what is supplied through harvests from private timberlands and the U.S. Forest Service.¹⁷³ Consequently, increasing wood-processing capability for California forest products ultimately will require a steady, reliable supply of product from the forest to give private industry confidence to expand operations. Because so much of California's forestland is owned by USFS, Mr. Twight testified, California's wood products infrastructure is heavily influenced by its supply of raw materials.¹⁷⁴

From the state's perspective, there is more at play than just removing dead trees; it has to consider long-term forest management. It would be beneficial to be able to pay for that management – at least in part – with wood products from the forest. Further, the state contends that this wood should be utilized in a way that helps the state achieve its greenhouse gas reduction and black carbon

emissions goals.¹⁷⁵

When confronting supply and demand questions to help pay for forest management, the state faces some constraints. Increasing the supply of wood products from USFS forests falls outside of its jurisdiction. What the state can do, however, is encourage demand for higher value California wood products, especially small-diameter biomass, or trees and shrubs too thin for traditional lumber products. Here the state is taking steps.

SB 859 Working Group

In 2016, the Legislature passed and Governor Brown signed SB 859, which required the California Natural Resources Agency to create

a working group on expanding wood product markets to utilize woody biomass. The legislation put a particular emphasis on wood removed from High Hazard Zones.¹⁷⁶

In October 2017, this working group released its recommendations to the Legislature. The working group developed its recommendations around three goals: utilizing material removed from High Hazard Zones; promoting forest health and carbon sequestration; and facilitating rural economic development.¹⁷⁷

The working group noted the challenge provided by the lack of demand for the smaller diameter wood that would be removed from the forest during forest management activities. Consequently, the working group focused on increasing demand for higher-value products and promoting localized manufacturing instead of increasing the supply of raw material.¹⁷⁸ This includes engineered wood products, such as cross-laminated timber, which can be used to replace steel and concrete in some building structures. As steel and concrete can account for up to 10 percent of a building's greenhouse gas emissions, there are potential environmental benefits.¹⁷⁹ Further, these products are especially promising because they can be created with smaller-diameter material, creating a potentially profitable use for historically unwanted material.¹⁸⁰ California is the biggest user of engineered wood west of the Mississippi, yet it imports 100 percent of the engineered wood it uses from out of state.¹⁸¹ Using California forest products to meet the state's needs could create a profitable use from

SB 859 Wood Products Working Group Recommendations

Remove Barriers to Market and Create Pathways for Success. The working group views the methods to implement this strategy as redevelopment and innovation and financing. To remove barriers to redevelopment and innovation, the working group recommends:

- Improving the process for remediation and redevelopment by creating an interagency team to identify and navigate state barriers to the redevelopment of former sawmill and industrial sites.
- Accelerating the use of mass timber construction, particularly through building code outreach to let local and county planning offices and builders know that the California Building Standards Code has been updated to allow the use of mass timber systems in buildings and encouraging low-carbon building statewide, including in state facilities.

To remove financing barriers, the working group recommends:

- Creating a finance information clearinghouse on financial resources and incentives for the wood products industry.
- Identifying resource gaps that exist in state and federal financial assistance program.

Promote Innovation. To innovate and expand into new markets will require addressing financial challenges and creating an environment that promotes innovation to mitigate risks. The working group recommends:

- Supporting businesses and academic institutions performing early-stage research and development in nascent materials and industries such as cellulosic nanotechnology.
- Incentivizing investment in any necessary seismic, fire and other material testing for mass timber construction, including utilizing academic institutions and third-party organizations to perform product testing that accelerates these goals.
- Promoting California-grown and California-manufactured wood products to increase the competitiveness of the industry.
- Strengthening partnerships among the wood products industry, rural economic and community development organizations and academic institutions to accelerate market growth.

Invest in Human Capital. The working group designed these recommendations to create a workforce pipeline necessary to expand wood markets that additionally will provide economic development opportunities for forested communities. The working group recommends:

- Assessing workforce potential in the forestry and wood products sectors.
- Expanding accredited associate degree and certificate programs to create a larger pipeline of students entering the field.
- Strengthening career pathways through:
 - ✓ Creating career pathway roadmaps through all levels of education and into jobs.
 - ✓ Partnering with the California Conservation Corps
 - ✓ Expanding scholarships for training and higher education for low-income students.
 - ✓ Investing in youth programs.
 - ✓ Fostering apprenticeship programs, especially for populations such as veterans and recent high school and community college graduates.

Source: SB 859 Wood Products Working Group. October 2017. Recommendations to Expand Wood Products Markets in California. Pages 4-10.

Utilizing Dead Wood Within the State



The state is creating opportunities to use beetle-kill wood within state government. Staff from the Governor's Office of Business and Economic Development have worked with the Department of General Services to obtain mulch from High Hazard Zones for state facilities, testified the Tree Mortality Task Force's Market Development Working Group Co-Lead Evan Johnson. Caltrans is exploring using beetle-kill wood for sign posts, guardrail posts and blocks. The state even is working with the air districts around the Salton Sea, pictured below from a 2015 Commission visit, to test utilizing beetle-kill wood for dust suppression and dust barriers.

Source: Evan Johnson, Co-Lead, Utilization – Market Development Working Group, Tree Mortality Task Force. August 24, 2017. Testimony to the Commission. Photo credit: Jim Wasserman

fuels buildup.

The working group developed three strategies to achieve its goals: remove barriers to markets and create pathways to success; promote innovation; and invest in human capital.¹⁸² Its recommendations, summarized in the box on page 49, are designed to further those strategies. Additionally, the group recommended four cross-strategy pilot projects. It recommended the creation of a steering committee, called the Rural Economic Development Steering Committee to be established by the Governor's Office of Planning and Research – to implement the recommendations, as well as an academic institute, the Joint Institute for Wood Products Innovation, to align academic centers and integrate disciplines for research, development and testing, as well as promoting innovation.¹⁸³

Regional Approach

The communities of the Sierra Nevada and other California forestlands should not be viewed uniformly by policymakers. Community resources, challenges and needs vary dra-

matically, giving rise to the need for a localized approach to wood-processing infrastructure development. The draft Forest Carbon Plan calls for a regional approach to better determine where operations should be located and to lower the transportation costs of the wood. Further, the plan continues, regional approaches are conducive to conversations on localized impacts of operations, economic development and climate resilience.¹⁸⁴

The Commission saw firsthand what a community could accomplish with financial and technical support during a site visit to North Fork, California, where staff learned about the redevelopment of a former sawmill site. With significant technical assistance, particularly in the form of grant writing from the Sierra Nevada Conservancy, the North Fork Community Development Association was able to win an Electric Program Investment Charge (EPIC) grant from the California Energy Commission to build a small biomass electricity plant on the site. The site also housed a small sawmill that works with beetle-kill wood, and will house a pallet-making facility. Though this effort will only create a few dozen jobs, community members believe they will make a noticeable impact on a community with a population of approximately 3,500 while also providing the benefit of utilizing wood removed from High Hazard Zones.

As the state takes a leadership position in creating demand for California wood products, it must ensure that local communities have a say in creating economic development solutions that work for them as well as for the long-term resiliency for California's forests. Toward that end, the state should continue providing grants and technical assistance for environmentally-sustainable economic development in rural communities.

Sustainable Harvesting and Environmental Impact

California imports from other states and countries approximately 80 percent of its lumber and 90 percent of all wood products (which includes plywood, pulp products and other items made from wood).¹⁸⁵ While the state has regulations that control the environmental impact of in-state wood harvesting and the emissions created in obtaining and transporting that wood within the state, some places from which the state imports wood have weaker or nonexistent regulations, causing harm to the environment and surrounding residents – not to mention the emissions costs in transporting it to California. Many Californians are proud of the state's reputation as an environmental leader, but environmental gains are not made by pushing negative impacts outside of the jurisdiction of the environmentally

The Commission visited North Fork, CA, in May 2017 and saw steps the community was taking to utilize forest materials while boosting the local economy. **Left:** The future site of a small biomass electricity plant. **Right:** Beetle-kill wood at Crossroads Lumber.



conscious. Sourcing more wood used within California from California would encourage greater participation in the conversation about sustainable wood harvesting and allow Californians to better control the negative externalities of their wood use.

The Commission's Next Steps

The Commission applauds the efforts taken by the SB 859 Working Group and the Tree Mortality Task Force's market utilization groups in creating pathways to reduce barriers to the utilization of the wood removed from California's forests. As the working group only released its recommendations to the Legislature in October 2017, the Commission intends to invite back representatives to discuss the progress made in implementing these recommendations.

Biomass Electricity

Biomass electricity has the potential to be one of several strategies to utilize wood removed from the forest. It can use smaller-diameter wood. It can create some jobs – expectations should be realistic – in economically-disadvantaged regions. Biochar can be created as a byproduct of the process, which has interesting potential applications to carbon sequestration and could benefit forest health. Using forest fuels to create electricity can be less environmentally harmful than some of the alternatives, such as open-pile burning or wildfires, particularly when processed in newer, cleaner facilities.

Much like sawmills, California's biomass electricity plants are declining. Biomass electricity initially took hold in California in response to federal alternative-energy mandates enacted in response to the 1970s energy crisis.¹⁸⁶ In the 1980s, more than 60 woody biomass plants in

California converted 10 million tons of woody waste into about 2 percent of the state's electricity, according to the National Renewable Energy Laboratory. But by 2000, the industry had contracted by more than a third, amid deregulation of California's energy grid.¹⁸⁷

By 2011, long-term contracts and key subsidies paid by ratepayers were about to expire. New purchase agreements became more closely tied to the sharply declining pricing of natural gas.¹⁸⁸ This along with the prevalence of cheaper, subsidized solar and wind energy led to fewer, shorter and less-lucrative power purchase agreements being signed. Many of California's biomass facilities began shutting down their operations as they were unable to reduce operational costs amid transportation and technology upgrade challenges.

Currently, there are 22 operational biomass energy plants in California that accept woody feedstock.¹⁸⁹ In 2016, all types of biomass facilities contributed to 2.26 percent of the total electricity in the state, equivalent to 6,553 gigawatt hours of electricity for the year.¹⁹⁰ This is a decline from 2.4 percent in 2010, a year before many facility contracts were due to expire.¹⁹¹ This decline also may be observed through the percentage of biomass relative to other renewable energy sources in the state's power mix. In 2010, 17.2 percent of all renewable electricity in California's power mix was from biomass.¹⁹² In 2016, just 8.86 percent was from biomass.¹⁹³

In response to the Governor's declaration of a state of emergency, the CPUC passed Resolutions E-4770 and E-4805. Resolution E-4770 required the Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE) and San Diego Gas & Electric Company (SDG&E) to hold a solicitation for facilities that utilize biofuel from High Hazard Zones using the Renewable Auction Mechanism procurement process and standard

The Potential of Biochar

Some people see promise in biochar, a charcoal-like substance created from organic materials, such as dead trees, that store carbon. Biochar itself can store carbon, and when used as a soil amendment, can potentially improve plant growth to sequester and store still more carbon. Among other potential uses, it is thought to improve resilience to drought in regions with poor soils and high water use.

Biochar can be a byproduct of bioenergy creation through the gasification process. Gasification breaks down organic matter at high temperatures in the near absence of oxygen to release a mixture of gases. Biochar also can be created through pyrolysis, the gradual heating of organic matter at high temperatures in almost the entire absence of oxygen. Pyrolysis typically is used when biochar is intended to be the primary product.

Significant research remains to be done on biochar. There are multiple types of biochar, and using the wrong type for the wrong application can have negative results. There are further questions about how long biochar stores carbon, and what happens to the existing stored carbon when biochar can no longer store any more. This is of great interest to the state, and the Governor's Office of Planning and Research is evaluating scientific literature to prepare future policy recommendations through its Biochar Research Advisory Group.

Source: Michael Maguire, Governor's Office of Planning and Research. August 8, 2017. Meeting with Commission staff.

contract; this often is referred to as bioRAM.¹⁹⁴ It also allowed PG&E and SDG&E to enter into bilateral contracts with existing forest bioenergy facilities receiving forest feedstock from High Hazard Zones during their 2015 Renewables Portfolio Standard solicitation cycle. Resolution E-4805 required PG&E, SDG&E and SCE to procure additional capacity from biomass facilities using specific forest fuel stocks.¹⁹⁵ It also permits the utilities to use specific processes for this procurement, recover costs and allocate these costs to all customers.

As a result, biomass facilities and investor owned utilities (IOUs) agreed to five-year power purchase agreements in which IOUs would buy power from biomass facilities utilizing woody feedstocks from High Hazard Zones. The percentage of required feedstock from High Hazard Zones would increase on a yearly basis. Facilities have to report the amount of high-hazard wood they are using to the IOUs. In turn, the IOUs report these amounts to the CPUC. If facilities do not meet the required percentages each year, they will be paid a lower rate per megawatt. In September 2016, the Legislature passed SB 859 as a budget trailer bill. The bill, among other measures, requires retail sellers of electricity (IOUs as well as the large municipal utilities) to purchase a total of 125 megawatts of power from biomass facilities that generate electricity from forest materials removed from specific High Hazard Zones.¹⁹⁶

Little Hoover Commission Advisory Committee Meeting on Biomass

The Little Hoover Commission held an advisory committee meeting to explore the role of biomass in long-term forest management. The Commission found that the current strategy of five-year purchase agreements has been flawed and incomplete. The state is missing a long-term bioenergy strategy. Meeting participants outlined a number of concerns to be addressed in that strategy:

Who Pays?

Should bioenergy costs be footed by ratepayers or should they be disbursed among a wider array of beneficiaries? Due to feedstock collection and plant operations, as well as interconnectivity requirements, biomass is more expensive than other renewables such as wind or solar, and has not received the same subsidies as zero-emission renewables.

Central to the discussion was the meaning of least cost, best fit. The state's renewable portfolio standard (RPS) statute directs utilities to select renewable resources that are least cost and best fit; costs include the expense (direct and indirect) of the renewable energy generation counted against the benefits of the energy and capacity value. "Best fit" criteria address system and RPS portfolio

needs. Julee Malinowski-Ball, representing California Biomass Energy Alliance, told the Commission that procurement of biomass energy has evolved from least cost, best fit to just least cost. She continued that the statute says environmental and public benefit must be considered in energy procurement decisions.¹⁹⁷

Matthew Plummer, regulatory relations representative from PG&E, responded that IOUs look at the least cost, best fit principle through the context of serving customers, and from that perspective, it's hard to do biomass for three reasons: IOUs don't need more energy in general, consumer prices would rise and customers are departing. He pointed out that IOUs have borne the brunt of supporting these contracts, but that energy is increasingly becoming decentralized. Old procurement models may not be as important with new providers, he said.¹⁹⁸

Because biomass costs are higher and utilities don't need the energy, best fit would be based on other public benefits that biomass energy can bring, noted CPUC Senior Analyst Cheryl Cox.¹⁹⁹

The discussion made clear that least cost, best fit was crafted in a way that did not incorporate the benefits of different sorts of renewable energy. These elements have not been ironed out and there is a need for vigorous conversation about what the elements of best fit mean.

Decentralization of Energy

As noted above, the model of energy provision is changing in California. Increasingly, Community Choice Aggregates, called CCAs, are taking up a greater market share. CCAs are localized nonprofit agencies that assume the decision-making role about sources of energy for electricity generation. Technically, they are not utilities but electric service providers. In a CCA service territory, the original utility company continues to own and maintain the transmission and distribution infrastructure, metering and billing infrastructure. Currently there are nine operational CCAs in California.²⁰⁰ As utility companies can be locked into long-term higher-rate contracts for energy sources that have declined in price in recent years, CCAs' ability to procure cheaper contracts, often with a higher proportion of renewable resources, for their customers makes the model desirable for many consumers. A University of California, Los Angeles, study found that California IOUs could see between 50 and 80 percent of their

load departing for CCAs by 2025 or 2030.²⁰¹

The departing customer load makes requirements like those outlined in the Governor's State of Emergency more onerous for those utilities, representatives told the Commission. In short, higher-cost contracts are spread among fewer people. They worry that similar requirements in the future, directed at IOUs and the largest publicly-owned utilities, as CCAs continue to spread, will increasingly place the costs of forest management on a shrinking group of people.

CCAs can choose to incorporate more bioenergy into their mix if their customers desire. For example, the Redwood Coast Energy Authority in Humboldt County aims to increase biomass to more than 50 percent of its energy mix by 2030.²⁰² However, cheaper electricity costs and the ability to choose cleaner energy mixes are primary motivating factors for consumers to support purchasing CCA power, which may not make bioenergy the most desirable option for many CCA customers. The success of CCAs in incorporating a greater percentage of biomass energy into their energy mix depends on their ability to negotiate contracts that will result in cheaper prices for customers, or else develop buy-in among those customers to accept a higher cost for the public benefits that bioenergy could provide.

High-Hazard Feedstock Availability

Participants in the Commission's advisory committee meeting said meeting the High Hazard Zone feedstock requirements for the five-year bioRAM contracts was a challenge. The contracts require the amount of High Hazard Zone material used to start at 40 percent the first year and ramp up to 80 percent by the end. If facilities do not meet the required percentage each year, they will lose their preferential pricing and revert back to a standard price that is significantly less, which could lead to some plants going offline.²⁰³

Rick Spurlock, director of operations for IHI Power Services Corporation, which has three facilities receiving bioRAM contracts, said his company did not think it would be able to meet the 80 percent requirement. There are plenty of dead trees, he said, but many of them are located on USFS land and there isn't enough funding to get the material down and out.²⁰⁴ Angie Lottes, the lead for the Tree Mortality Task Force Bioenergy Utiliza-

tion Group, said that her group hears similar complaints from many other plants, and that some are worried about running out of fuel as early as next year. The contracts are for five years, she said, but they're not a guaranteed five years.²⁰⁵

Displacement of Other Types of Biomass

High-hazard feedstock requirements can set off a troublesome chain reaction by displacing other types of biomass previously burned in those facilities. Morgan Lambert, deputy air pollution control officer for the San Joaquin Valley Air Pollution Control District, discussed this requirement within the context of his district's mandate to reduce agricultural burning. Growers use biomass facilities to dispose of cuttings as opposed to open burning, a cost-effective alternative, he said. However, the introduction of the High Hazard Zone feedstock requirements can dramatically decrease the amount of agricultural waste that can be consumed by these facilities. When a high percentage of feedstock is required to come from high hazard trees, the facility services a lower percentage of other types of fuels, resulting in those other types of biomass having to be disposed of by other methods. Mr. Lambert noted that open-pile burning of agricultural waste is back to 2003 levels and that growers are being issued abatement orders.²⁰⁶ Mr. Spurlock concurred. He said that that one of his company's facilities in the San Joaquin Valley primarily was fueled by agricultural waste feedstock. It used to process annually around 150,000 tons of agricultural waste he said, but that amount this year is closer to 70,000 tons, while next year is predicted to be 65,000 tons due to the feedstock requirements.²⁰⁷ As part of a long-term bioenergy plan, the state must address how agricultural waste and other types of biomass should be handled if not through bioenergy.

Air Pollution and Environmental Justice Communities

Another concern raised is the environmental impacts created by trucking in trees and burning them in biomass facilities located in areas already burdened by poor air quality. Ms. Lottes said her group hears that environmental problems are being moved, not solved.²⁰⁸ Members of the public added that environmental groups additionally are worried that biomass will provide an excuse to build more roads in environmentally-sensitive areas, and that it

would lead to more clearcutting.

A Biomass Energy Policy is Needed, Along with Education

The Commission concluded from its advisory committee meeting and other stakeholder conversations that the state lacks a long-term biomass energy policy that goes beyond responding to the tree mortality crisis. A policy should address key questions: What role should biomass energy play, not just within the state's renewable energy goals, but within its air quality and land management goals in general? Is it a positive if Californians turn to open-pile burning because biomass facilities are processing beetle-kill wood? What is the role of larger, older biomass facilities that can take advantage of economies of scale, versus smaller plants created with newer, cleaner technology located near the source material? How should the state incorporate a regional approach and the increasing decentralization of energy into its biomass approach?

The plan should consider how much existing assets are worth. Erik White, air pollution control officer for Placer County Air Pollution Control Districted, noted that High Hazard Zones often are in or abut ozone non-attainment areas – which don't meet federal standards – where building a large power station would be challenging, if not impossible. If existing facilities shutter, he cautioned, there is a strong likelihood they won't reopen, not just because of the economics involved, but because they will have difficulty getting air permit permissions. This stems from federal requirements that all air districts must follow.²⁰⁹ Would there be incentives in subsidizing retrofitting these facilities with newer technologies to reduce emissions?

A comprehensive bioenergy policy must take a painstaking look at alternatives and be honest with Californians about the effects of the policy on stakeholders and how it will mitigate those effects for those who are negatively impacted by the policy. As with every policy decision, there will be compromises. If the cost and emissions impact from transporting materials to biomass facilities are considered to be too high, what steps will the state take to reduce forest fuels and increase rural economic development? Alternatively, if growing the biomass industry is considered a viable strategy for forest management

and rural economic development, what measures will be taken to protect environmental justice communities?

At the crux of such a policy is an exploration of what “best fit” in “least cost, best fit” means. The Commission understands this is a difficult discussion; there is a reason there is still uncertainty about the definition. However, the state can no longer afford to avoid these tough questions. Following this discussion, education will be required to explain why a particular bioenergy strategy is best-suited for California’s needs and elicit public buy-in.

The welcome news is that the state recognizes the importance of linking air quality and land management, including forest management, goals and actions. The draft Forest Carbon Plan as the implementation document for the AB 32 Scoping Plan illustrates this. The Commission would, however, like to see fewer general discussions about the importance of bioenergy in forest management and a more specific bioenergy plan that discusses best fit, how different models and scales of bioenergy will be used, how it fits in with energy decentralization, how the state will or will not invest in those models, how costs will be distributed among the beneficiaries of the plan, how negative impacts will be mitigated and a communications plan put in place to educate Californians about bioenergy’s role in meeting the state’s goals.

The state does have a history of bioenergy plans. Most recently, the Bioenergy Interagency Working Group, composed of representatives from at least 11 state agencies and departments, released the 2012 Bioenergy Action Plan. That document updated previous plans and outlined actions to increase environmentally and economically sustainable bioenergy production; develop diverse bioenergy technologies; create jobs and economic development in rural areas; reduce fire danger; improve air and water quality; and reduce waste.²¹⁰ The Commission learned that at first, interagency meetings were regularly held to implement the plan, but that the group stopped meeting a few years ago. The 2012 Bioenergy Action Plan may be a reasonable place for the state to start when crafting a broad bioenergy plan. As noted above, a new bioenergy plan must acknowledge conditions following the tree mortality crisis and fully explore the idea of least cost and best fit. That plan must acknowledge the valid arguments for and against bioenergy, and designate actions to mitigate the negative consequences from the path the state chooses. And this time, the political will

must be there to implement the plan in the long run.

Recommendation

Recommendation 6: The State of California should encourage the development of additional infrastructure to utilize material removed from the forests as part of long-term forest management.

- The California Natural Resources Agency, along with members of the steering committee and the interagency leads for each recommendation, should report back to the Commission on the implementation of the SB 859 working group’s recommendations.
- The state should issue grants to small communities so they can develop infrastructure according to their needs.
- The state should develop a statewide biomass policy that takes into account the needs of different parts of the state. All stakeholder communities, including environmental justice, should provide input into this policy.
- Part of this plan should explore the potential of biomass near forested communities with newer, cleaner facilities vis-à-vis the economies of scale provided by larger facilities.
- Additionally, this should include research on the public benefits provided by biomass energy within the context of the Renewables Portfolio Standard policy of “least cost best fit,” and whether those benefits qualify biomass energy as the best fit in certain situations. Further, analysis of public benefits should give consideration to whether biomass should receive subsidies to lower costs in certain cases, particularly in facilities developed or retrofitted with cleaner technology.

Outreach and Education

During the Commission’s hearings and meetings, a frequent theme was repeated: The public needs better education about the importance of forests. Often, people aren’t aware of the role trees play in the state’s overall ecological health, including their drinking water and air quality.

Because current generations of Californians have grown up with overcrowded forests and believe them to be healthy, making them understand that healthy forests are less dense will take effort. Similarly, too, many Californians are used to thinking their water comes from the tap without considering from where that water originates. It is important they learn where the headwaters that sustain them are located. Policymakers, too, will need to adjust their thinking when selecting appropriate forest treatments, which could include fire and thoughtful cutting.

A cultural shift will require education, investment and a champion from the highest echelons of state government. Education is critical in achieving the buy-in from Californians, and should be strategically planned with measurable indicators and revised if those ventures are not leading to the desired outcome. The Commission sees opportunities to educate the public at large, as well as specific subsets of the population, such as forest owners, water users and policymakers, among others.

The State Needs a Comprehensive Public Awareness Campaign on Forest Health

The Commission sees the need for a forest health campaign directed at the general public. One potential model is the “Save our Water” campaign. Started in 2009, the campaign is a partnership between the Department of Water Resources (DWR) and the Association of California Water Agencies (ACWA) designed to help Californians make water conservation a part of their everyday routine. As California entered its historic drought, the campaign evolved to bolster the public messaging and outreach needed to implement the directives of the Governor’s April 2015 Declaration of a Continued State of Emergency for drought.²¹¹ Costing about \$16 million since inception, with roughly \$14 million coming from the state and the balance supplied by ACWA and its partners, the campaign’s organizers have saturated the state with public awareness messages.²¹² In 2016 alone, Save our Water messages, in multiple languages, were shared 160 million times through radio advertisements, television and gas pump commercials, billboards and other displays, website visits, toolkit downloads, and via social media outlets. People engaged with the latter in more than 300,000 instances.²¹³

An April 2017 survey found that the state’s efforts seemed to be paying off. Californians were aware of the long-term water challenges faced by the state and were committed to long-term changes: Despite feelings that



The Save our Water campaign, a partnership between the Department of Water Resources and Association of California Water Agencies, could serve as a model for a mass-audience forest health campaign.

a wet winter compensated for water supply shortages during the drought, more than 90 percent of respondents believed that the state still needed to conserve water. Further, two-thirds of respondents indicated they were carrying the water conservation habits they developed during the drought into the future.²¹⁴

Key components of the Save our Water Campaign include:

- **Extensive public polling to guide messaging.** Save our Water organizers consistently poll Californians to understand what they know, what they don't know and the best way to present their message. Every outreach effort is based on this research, and the campaign's messages have evolved according to polling results. For example, since the end of the drought, the message has changed from urging extreme conservation measures to thanking Californians and encouraging them to keep up the good work.
- **A unique partnership between a state agency and media-savvy organization.** The partnership between DWR and ACWA pairs policymakers with professionals who understand marketing and how to garner large headlines. The two organizations combined have been able to successfully put on events with a large media presence in which top officials provide briefings and then are available to media outlets for individual interviews. This successfully has stimulated widespread coverage. ACWA also was able to use its network in ways that might not be available to a state agency, enlisting A-list celebrities such as Lady Gaga and Conan O'Brien to promote the conservation message in a way that has mass appeal to Californians.
- **High-level champion.** A high-level champion for the initiative is important both in ensuring financial and logistical support for the initiative, and in being a public face for the message. Governor Arnold Schwarzenegger supported the initial Save our Water campaign. Governor Jerry Brown grew the program upon entering office by increasing the budget and personally appearing at media events.

A forest health campaign should utilize these components to help ensure success. The state should contract with a well-connected media-savvy organization experienced in tailoring messages to data. Governor Brown has been invested in the tree

mortality crisis and forest health and should continue this leadership role; his successor also will need to lend prominent support to the cause. Messages should be based on research that analyzes what Californians know about forest health and how to best convey messages to them about the need for healthier forests.

Targeted Campaigns on Forest Health

There are opportunities for the state to target campaigns to subsets of the population:

- **Private Forest Owners.** CAL FIRE is charged with important public outreach work to landowners on fire preparedness and bark beetle response, among other issues. CAL FIRE should continue to be funded to provide more targeted campaigns, in addition to the role it might play in a larger initiative with the general public. The state's forest owners are California's first line of defense in managing forests for resiliency, and it is critical they are educated not just on the value of resilient forests, but how to understand the condition of their forests. This is much more specialized information than a general outreach campaign.
- **Schoolchildren.** A network of educators and state agencies should collaborate to promote forestry curricula for children. The California Department of Education, California Environmental Protection Agency, California Natural Resources Agency and California Department of Food and Agriculture collectively have created an initiative called the California Environmental Education Interagency Network. The network aims to respond to the state's environmental education needs and aid educational reform. It also assists a network of educators working to increase students'



CAL FIRE runs important outreach campaigns for landowners on fire and forestry topics, such as responding to the tree mortality crisis.

environmental literacy. It has made available a list of environmental literacy resources spanning many topics.²¹⁵ While there are numerous resources available on water topics, currently there is only one forestry curriculum: California Project Learning Tree.²¹⁶ The Department of Natural Resources Agency should work with the Department of Education and the rest of the network to evaluate more forestry health education resources and make them easily available to create a menu of options from which educators can choose.

- **Forestry Programs.** State colleges and universities offering forestry programs or employing forestry technical advisors can continue their role in educating surrounding communities. Technical advisors should be consulted on where they are encountering educational gaps to help identify where efforts should be targeted. This could even serve as a recruitment tool for their forestry programs.
- **Water Users.** The Commission heard overwhelmingly during its study that many water users, particularly outside of the Sierra Nevada, do not know from where their water originates and why watershed restoration is critical to protecting their water. The state should take another page from the Save our Water playbook and work with a marketing organization to develop toolkits that water agencies easily can customize for their constituents to learn about the source of their water.
- **Lawmakers and Policymakers.** It is particularly important that the people in charge of funding forest management and setting the strategic direction for California’s forests are well-versed in the benefits forests provide and the detrimental effects of forest neglect and mismanagement. This includes lawmakers and policymakers from urban and coastal parts of the state. Unfortunately, the Commission heard repeatedly that it is very difficult to bring decision-makers out to the forest. In many respects, this is understandable, as much of the state’s forestland is not easily accessible and lawmakers in particular desire to spend time in their districts when not in Sacramento – a

laudable commitment. However, given that these individuals wield considerable power over a natural resource so crucial to Californians’ wellbeing, the Commission recommends investing in a program that would bring decision-makers into California’s forests. Pragmatically, this would entail working with organizations with expertise in designing trips for specific populations that could tailor trips to meet the unique needs of policymakers. For example, such tours likely would need to convey a lot of information in a very short amount of time.

Measuring Attitudes

It is not enough to simply saturate the state with educational messages; when the state makes these investments, it should know what results it is getting for its money. Goals for the campaign should be set beforehand, and its effectiveness measured throughout. Strategies should be adjusted if outcomes are not being achieved.

Recommendation

Recommendation 7: To better educate Californians about the suite of benefits healthy forests provide to the state, the state should consider the following:

- The state should invest in a long-term forest health campaign similar to Save our Water by contracting with an organization that can use its expertise to raise public awareness of forest health issues. A high-ranking person within the Governor’s Administration – preferably the Governor – must champion this effort. Outreach messages should be based on research.
- The Legislature should fund extensive statewide public outreach campaigns for CAL FIRE to continue to educate the public on the benefits of healthy forests and prescribed fire.
- The California Natural Resources Agency should work with the Department of Education to catalog existing educational resources on resilient forests, the history of fire in California’s ecological development and from where pupils’ water originates to allow teachers to easily access and

incorporate the information into their curricula. Additionally, the California Natural Resources Agency should advertise this collection to teachers to spread awareness of these resources.

- The California Natural Resources Agency should collaborate with state colleges and universities offering forestry programs to increase awareness of forest health concerns in their communities, to both educate the public and increase enrollment in these programs. Forestry technical advisors affiliated with universities should be consulted on where they are encountering educational gaps to help identify where efforts should be targeted.
- Water districts should play a greater role in educating their customers on the sources of their water. To facilitate this, the state should provide funding for an organization to create educational toolkits that water agencies easily can customize.
- The state should provide grant funding for an educational organization to bring lawmakers, policymakers and their staff to forests to teach them about the benefits provided by forests, the consequences of forest neglect and the different forest treatment outcomes. The organization should work closely with the Legislature and other appropriate bodies to overcome logistical hurdles.
- Californians' knowledge levels and attitudes toward forest health should be measured at the onset of educational campaigns, and policymakers should set clear goals for the changes they would like to see in those attributes. These should be measured throughout the campaigns, with course corrections designed as necessary if the state does not meet its outcomes.

Looking Forward: Turning Plans into Action

Accountability, including planning and goal setting, is essential for an effective forest management program. Resources are limited and the work needed is substantial. As plans turn into actions, tracking progress toward desired outcomes and correcting course as necessary will be equally important, and will require the participation of stakeholders.

In its public process, the Little Hoover Commission learned about some elements of the planning process already in place, particularly around the draft Forest Carbon Plan. This is the implementation document for the 2030 Scoping Plan Update, the state's blueprint for reducing carbon emissions by 2030. The final Forest Carbon Plan is anticipated to be released in February 2018. Overall, the Commission was encouraged by the content of the draft Forest Carbon Plan, but found that there was no requirement for state agencies to report

their progress to the Legislature, Administration and the public toward meeting the goals outlined in the plan. The Commission recommends that this progress be shared on a regular basis not just with the Legislature and Office of the Governor, but with the public on a website to provide transparency for the many Californians who care about the health of their forests.

The Commission found that the state has an asset in the Tree Mortality Task Force, which has allowed multiple agencies across different levels of government to collaborate with each other and non-government stakeholders in responding to the tree mortality crisis. The Commission sees the potential for a scaled-down version of the task force to evolve into a steering committee for forest management to work through some of the challenges that inevitably will occur when strategically managing the forests within the state.

Remote Sensing: Investing in Technology for Planning and Measuring Progress Toward Desired Outcomes

How can the state determine whether resiliency efforts have led to a healthier forest? While it's easy to track individual management efforts, such as how many acres are treated through prescribed burns, it's much more difficult to assess longer-term health outcomes. Experts said that understanding forest ecosystems and establishing a baseline of information is the necessary first step. The Commission heard from numerous state, federal, university and nonprofit scientists who have devoted careers to measuring forest resiliency, and learned that it often is a labor- and time-consuming process. Despite excellent research from the country's top institutions, there are still opportunities to develop more comprehensive and nuanced pictures of California's forests and measuring the success of forest treatments within them.

One such opportunity is investing in technology to develop a complete statewide picture of forest health and how it changes over time. Remote sensing technology, such as Light Detection and Ranging (LiDAR) and hyperspectral imaging, can provide detailed data covering large areas to scientists. They, in turn, can process, analyze and explain the data in ways to help policymakers make decisions about forest management.

The state already plans on creating a carbon monitoring program using remote sensing technology. The Commission urges the state to work with leading forest ecologists on the best ways to measure other indicators of forest resiliency and progress toward outcomes, and to follow up on those conversations with investments in technology.

Source: CAL FIRE, California Natural Resources Agency and Cal EPA. January 20, 2017. California Forest Carbon Plan – Draft for Public Review. Page 148. http://www.fire.ca.gov/fcat/downloads/California%20Forest%20Carbon%20Plan%20Draft%20for%20Public%20Review_Jan17.pdf. Accessed October 9, 2017.

The Evolution of the Tree Mortality Task Force: Multi-Jurisdictional Planning and Measuring for Long-Term Forest Resiliency

California lacks a system to comprehensively track forest management and conservation activities. Individual agencies report tracking their forest treatments, but no one is responsible for statewide monitoring. CAL FIRE and the California Department of Fish and Wildlife track some information in four different databases, while the California Natural Resources Agency is responsible for “grant-specific information associated with bond initiatives” and the U.S. Forest Service utilizes “regional and national databases.”²¹⁷ State leaders acknowledge this in the draft Forest Carbon Plan: The California Natural Resources Agency is tasked with creating a centralized forest management database or an automated system that collects and standardizes data from different databases, for which the draft calls to be deployed by December 2018.²¹⁸

The database will be designed to accommodate federal and local efforts to implement the state’s Forest Carbon Plan. However, it is unclear whether the tool will receive contributions from local and federal agencies to help link policies, programs and funding to outcomes. This matters because understanding the impact of forest treatments on the state’s overall forest resiliency will require input from all forest owners. It is critical for the state to establish a mechanism to receive that input, both for planning and measuring progress.

One method that has worked well in connecting state, local, federal and private stakeholders in response to the tree mortality crisis has been the Tree Mortality Task Force. Led by the Office of the Governor, CALFIRE and the Governor’s Office of Emergency Services, the Tree Mortality Task Force includes an additional 74 state, federal and local agencies, tribal governments, private companies, conservationist groups and other stakeholders.²¹⁹ These entities work together to respond to the 19 directives Governor Brown outlined when declaring a state of emergency for the tree mortality crisis. They comprise a number of working groups to address specific topics, such as prescribed fire.

The Commission consistently heard praise for the way the

task force has approached and accomplished its work. This can be attributed to Governor Brown’s signaling the priority of this group’s work by housing leadership within the Office of the Governor and the Governor’s Office of Emergency Services in addition to CAL FIRE. Its success also is due to the caliber of leadership, giving the task force specific charges and creating an atmosphere of information-sharing and collaboration. Additionally, the development of working groups that allow some stakeholders to focus on certain topics of interest without having to be involved in every component also has been instrumental in its success.

A Potential Steering Committee

The composition of the task force and the process it followed in response to dangers posed by the tree mortality crisis could serve as a model for forest management planning. Measuring implementation of the state’s Forest Carbon Plan will go far beyond simply tracking actions taken. Goal- and benchmark-setting and measuring requires that definitions and terms across agencies are aligned and agreement on metrics and standards of data collection and monitoring.

Over time, a scaled-down version of the Tree Mortality Task Force could serve as a steering committee for the California Natural Resources Agency on the larger process of planning the implementation of the Forest Carbon Plan and determining how to measure its success. The California Natural Resources Agency would own responsibility for creating a much-needed central database to track forest health metrics and outcomes, operating it and reporting as necessary. The task force could add value by setting a strategic direction for forest management, identifying measureable goals, deciding how to track results and recommending course corrections to better achieve the goals.²²⁰ Additionally, it could play a role in determining how to use technology to measure forest health (see the box on the previous page). Further, this collaboration could identify and resolve duplicative efforts and other redundancies that could save the state time and money in managing its forests.

Accountability in Implementing the Forest Carbon Plan

During the course of the Commission’s public process, many witnesses spoke about the draft Forest Carbon Plan. It describes forest conditions, projects future forest conditions in a changing climate and identifies forest health goals, then details the actions the state and other entities will take to reach those goals.²²¹ One set of forest management objectives includes carbon sequestration and reducing black carbon and greenhouse gas emissions. Additionally, California will manage its forests for wildlife habitat, watershed protection, recreation, tribal uses, public health and safety, forest products and economic development at the local and regional levels.²²² The plan’s summary of its goals and actions can be found in Appendix D.

The draft Forest Carbon Plan is promising. Its findings, goals and actions are informed by science. State leaders are balancing meeting the state’s greenhouse gas reduction goals and promoting forest resiliency with utilizing forest wood products and encouraging rural economic development. It recognizes research gaps and calls for increased funding to meet those gaps, and it requires centralized implementation tracking so that state officials can understand the relationship between inputs and outcomes. It establishes timelines and deadlines for actions to meet its goals.

What the plan lacks, however, is a built-in mechanism to ensure accountability. Most of the plan’s goals have target dates of 2030, but significant preliminary work, such as developing regional carbon plans, remains to be done to ensure the state stays on track to meet its goals. To ensure progress, the California Natural Resources Agency, its relevant departments and California Environmental Protection Agency should regularly report to the Legislature and post online progress on their progress in implementing the plan. This should include the plan’s proposed actions to initiate implementation:

- Progress on developing a centralized database or automated system that can pull and standardize data from disparate sources to link policies, programs and funding sources to outcomes; track implementation activities identified in the Draft Forest Carbon Plan across its boards,

departments and offices; and accommodate additional inputs from local and federal agencies and organizations to build a complete picture of statewide implementation activities.

- Progress on developing regional implementation of the Forest Carbon Plan, including which organizations will be leading which regions and a status update on the development of regional forest carbon plans.
- Progress on working collaboratively at the landscape- or watershed-level.
- Progress on identifying and cultivating sources of funding.
- Progress on identifying regulatory and policy changes to streamline the implementation of the forest carbon plan, including:
 - Increased use of prescribed and managed fire.
 - Restoration activity permitting.
 - Reducing financial barriers to land management for small landowners.
 - Development of wood product markets, including biomass.
 - Modifying restrictions on exports of wood from public lands.²²³

These status updates will allow policymakers and stakeholders additional opportunities to engage and course correct, if necessary.

Additionally, the Commission will be interested in seeing how the final Forest Carbon Plan compares to the draft. It may ask representatives from these agencies to update the Commission on the status of implementing the Forest Carbon Plan, as well as the Commission’s recommendations.

Governor Brown announced in his 2018 State of the State address that he was creating a task force on how the state manages its forests. The task force will consider how forest management can reduce the threat of wildfires and increase forest resiliency and carbon storage. The Commission looks forward to seeing the task force in

action and learning about its goals, action plan and how it will hold the state accountable to its forest resiliency outcomes. The Commission may invite task force representatives to future meetings to update the Commission on their work.

Recommendations

Recommendation 8: The Tree Mortality Task Force should evolve into a forest management planning entity, with dedicated funding.

- It should help set a strategic direction for forest management, identify measureable goals, decide how to track results and recommend course corrections to better achieve those goals.
- It should advise on how to incorporate technology in assessing and improving forest health.
- This should include reviewing the planning process and developing recommendations on where streamlining can occur.

Recommendation 9: The California Natural Resources Agency, its relevant departments and the California Environmental Protection Agency should regularly report to the Legislature and post online progress on the metrics listed in the Forest Carbon Plan, as well as the steps it is taking to begin implementing the plan. The Commission may hold a follow-up hearing on these steps as well as the progress made on its recommendations.

Appendices

Appendix A

Public Hearing Witnesses

The lists below reflect the titles and positions of witnesses as the time of the hearing.

Public Hearing on Forest Management

January 26, 2017

Sacramento, California

Jim Branham, Executive Officer, Sierra Nevada Conservancy

Mark Ghilarducci, Director, California Governor's Office of Emergency Services

Karen Buhr, Executive Director, California Association of Resource Conservation Districts

Ken Pimlott, Director, California Department of Forestry and Fire Protection

Ashley Conrad-Saydah, Deputy Secretary for Climate Policy, California Environmental Protection Agency

Scott Stephens, Professor, Fire Science and Chair, Division of Ecosystem Science, University of California, Berkeley

Malcolm Dougherty, Director, California Department of Transportation

Public Hearing on Forest Management

April 27, 2017

Sacramento, California

Mike Albrecht, RPF, Project Coordinator, Tuolumne County Tree Mortality Task Force; President & Co-owner, Sierra Resource Management, Inc.

David Eggerton, General Manager, Calaveras County Water District

Susan Britting, Executive Director, Sierra Forest Legacy

Joel Laucher, Chief Deputy Commissioner, California Department of Insurance

Eric Coyne, Deputy County Administrative Officer, Economic Development, Film & Tourism, County of Tulare

Jadwindar Singh, Director, Electric Compliance, Quality, and Vegetation Management, Pacific Gas & Electric Company

Brittany Dyer, District Chief of Staff, Supervisor Tom Wheeler, District 5, County of Madera

Cedric Twight, Manager, California Regulatory Affairs, Sierra Pacific Industries

David Edelson, Sierra Nevada Project Director, The Nature Conservancy

***Public Hearing on Forest Management
August 24, 2017
Sacramento, California***

Alan Abbs, Executive Director, California Air Pollution Control Officers Association

Barnie Gyant, Deputy Regional Forester, Pacific Southwest Region (Region 5), United States Forest Service

Susan Britting, Executive Director, Sierra Forest Legacy

Claire Jahns, Assistant Secretary, Natural Resources and Climate Issues, California Natural Resources Agency

Van Butsic, Assistant Specialist and Adjunct Professor, Department of Environmental Science, Policy and Management, University of California, Berkeley

Evan Johnson, Science and Policy Advisor, Department of Resources Recycling and Recovery and Service Co-leader, Utilization – Market Development Group, Tree Mortality Task Force

Edie Chang, Deputy Executive Officer, California Air Resources Board

Matthew Reischman, Assistant Deputy Director, Resource Protection and Improvement, California Department of Forestry and Fire Protection

Appendix B

Advisory Committee Meeting Participants

The lists below reflect the titles and positions of participants at the time of the meeting.

***Advisory Committee Meeting on on Forest Bioenergy
August 23, 2017
Sacramento, California***

Daniel Barad, Biomass Campaign Organizer/
Representative, Sierra Club California

Matthew Plummer, Regulatory Relations
Representative, Pacific Gas & Electric Company

Cheryl Cox, Senior Analyst, Energy Division,
Renewable Portfolio Standard, California Public
Utilities Commission

Rosemarie Smallcombe, Supervisor, Mariposa County

Steven Kelly, Director of Policy, Independent Energy
Producers

Courtney Smith, Deputy Director, Renewable Energy
Division, California Energy Commission

Morgan Lambert, Deputy Air Pollution Control Officer,
San Joaquin Valley Air Pollution Control District

Rick Spurlock, Director of Operations, IHI Power
Services Corporation

Angie Lottes, Tree Mortality Task Force Bioenergy
Utilization Lead

Erik White, Air Pollution Control Officer, Placer
County Air Pollution Control District

Julee Malinowski-Ball, Public Policy Advocates,
Representing California Biomass Energy Alliance

Appendix C

PROCLAMATION OF A STATE OF EMERGENCY

WHEREAS the State of California is experiencing record drought conditions, which have persisted for the last four years; and

WHEREAS on January 17, 2014, I proclaimed a State of Emergency to exist throughout the State of California due to severe drought conditions; and

WHEREAS a lack of precipitation over the last four years has made trees in many regions of California susceptible to epidemic infestations of native bark beetles, which are constrained under normal circumstances by the defense mechanisms of healthy trees; and

WHEREAS these drought conditions and resulting bark beetle infestations across broad areas have caused vast tree mortality in several regions of the state, with the United States Forest Service estimating that over 22 million trees are dead and that tens of millions more are likely to die by the end of this year; and

WHEREAS recent scientific measurements suggest that the scale of this tree die-off is unprecedented in modern history; and

WHEREAS this die-off is of such scale that it worsens wildfire risk across large regions of the State, presents life safety risks from falling trees to Californians living in impacted rural, forested communities, and worsens the threat of erosion across watersheds; and

WHEREAS such wildfires will release thousands of tons of greenhouse gas emissions and other harmful air pollutants; and

WHEREAS the circumstances of the tree die-off, by reason of its magnitude, is or is likely to be beyond the control of the services, personnel, equipment and facilities of any single county, city and county, or city and require the combined forces of a mutual aid region or regions to combat; and

WHEREAS under the provisions of section 8558(b) of the California Government Code, I find that conditions of extreme peril to the safety of persons and property exist within the State of California due to these events; and

WHEREAS under the provisions of section 8571 of the California Government Code, I find that strict compliance with various statutes and regulations specified in this order would prevent, hinder, or delay the mitigation of the effects of the drought.

NOW, THEREFORE, I, EDMUND G. BROWN JR., Governor of the State of California, in accordance with the authority vested in me by the State Constitution and statutes, including the California Emergency Services Act, and in particular, section 8625 of the California Government Code, HEREBY PROCLAIM A STATE OF EMERGENCY to exist within the State of California.

IT IS HEREBY ORDERED THAT:

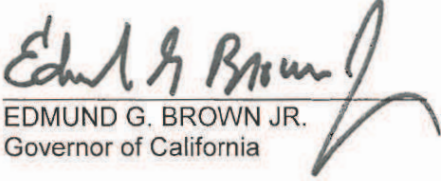
1. The Department of Forestry and Fire Protection, the California Natural Resources Agency, the California Department of Transportation, and the California Energy Commission shall immediately identify areas of the State that represent high hazard zones for wildfire and falling trees using best available science and geospatial data.
2. State agencies, utilities, and local governments to the extent required by their existing responsibilities to protect the public health and safety, shall undertake efforts to remove dead or dying trees in these high hazard zones that threaten power lines, roads and other evacuation corridors, critical community infrastructure, and other existing structures. Incidental vegetation such as shrubs that restrict access for safe and efficient removal of the dead and dying trees also may be removed. The Department of Forestry and Fire Protection shall issue emergency guidelines setting forth the relevant criteria, and the California Conservation Corps shall assist government entities in implementing this directive to the extent feasible.
3. The Department of Forestry and Fire Protection shall identify potential storage locations for removed trees across impacted areas in partnership with federal agencies and local jurisdictions.
4. The California Department of Transportation shall formally request immediate assistance through the Federal Highway Administration's Emergency Relief Program, Title 23, United States Code section 125, in order to obtain federal assistance for removal of dead and dying trees that are adjacent to highways.
5. The Department of General Services will identify state facilities, and the California Department of Transportation shall identify highway and road corridors, where woodchips produced from dead trees can be used as mulch.
6. The Governor's Office of Emergency Services and the Department of Forestry and Fire Protection shall work with impacted counties to distribute portable equipment across high hazard zones so that isolated communities can remove and process wood waste locally where appropriate.
7. The California Air Resources Board and the California Department of Forestry and Fire Protection shall work together and with federal land managers and the United States Environmental Protection Agency to expand the practice of prescribed burns, which reduce fire risk and avoid significant pollution from major wildfires, and increase the number of allowable days on a temporary basis to burn tree waste that has been removed in high hazard areas.
8. The California Public Utilities Commission shall utilize its authority to extend contracts on existing forest bioenergy facilities receiving feedstock from high hazard zones.
9. The California Public Utilities Commission shall take expedited action to ensure that contracts for new forest bioenergy facilities that receive feedstock from high hazard zones can be executed within six months, including initiation of a targeted renewable auction mechanism and consideration of adjustments to the BioMat Program defined pursuant to Public Utilities Code section 399.20. No later than six months after the BioMat program begins, the California Public Utilities Commission shall evaluate the need for revisions to the program to facilitate contracts for forest bioenergy facilities.
10. The California Public Utilities Commission shall prioritize facilitation of interconnection agreements for forest bioenergy facilities in high hazard zones, and shall order the use of expedited mediation or other alternative dispute resolution processes when conflicts delay development of projects.

11. The California Energy Commission shall prioritize grant funding from the Electric Program Investment Charge for woody biomass-to-energy technology development and deployment, consistent with direction from the California Public Utilities Commission.
12. The California Department of Forestry and Fire Protection, the California Energy Commission, and other appropriate agencies shall work with land managers to estimate biomass feedstock availability, storage locations, and volumes that may be available for use as bioenergy feedstock at existing and new facilities.
13. The California Department of Forestry and Fire Protection and the California Energy Commission shall work with bioenergy facilities that accept forest biomass from high hazards zones to identify potential funds to help offset higher feedstock costs.
14. The California Department of Resources Recycling and Recovery and the California Department of Forestry and Fire Protection will work with affected counties and existing wood product markets to determine the feasibility for expanded wood product markets in California.
15. For purposes of carrying out directives 1, 2, and 5 through 8, Division 13 (commencing with section 21000) of the Public Resources Code and regulations adopted pursuant to that Division are hereby suspended. This suspension applies to any actions taken by state agencies, and for actions taken by local agencies where the state agency with primary responsibility for implementing the directive concurs that local action is required, as well as for any necessary permits or approvals required to complete these actions.
16. In order to ensure that equipment and services necessary for emergency response can be procured quickly, the provisions of the Government Code and the Public Contract Code applicable to state contracts, including, but not limited to, advertising and competitive bidding requirements, are hereby suspended as necessary to carry out this Proclamation. Approval by the Department of Finance is required prior to the execution of any contract entered into pursuant to these directives.
17. For purposes of this Proclamation, Chapter 3.5 (commencing with section 11340) of Part 1 of Division 3 of the Government Code is suspended for the development and adoption of regulations or guidelines needed to carry out the provisions in this Order. Any entity issuing regulations or guidelines pursuant to this directive shall conduct a public meeting on the regulations and guidelines prior to adopting them.
18. The Office of Emergency Services shall provide local government assistance as appropriate under the authority of the California Disaster Assistance Act, California Government Code section 8680 et seq. and California Code of Regulations, title 19, section 2900 et seq.
19. State agencies shall actively monitor tree removal efforts directed by this Proclamation to assess their effectiveness in protecting forest health and strengthening forest resilience.

This Proclamation is not intended to, and does not, create any rights or benefits, substantive or procedural, enforceable at law or in equity, against the State of California, its agencies, departments, entities, officers, employees, or any other person.

I FURTHER DIRECT that as soon as hereafter possible, this proclamation be filed in the Office of the Secretary of State and that widespread publicity and notice be given of this proclamation.

IN WITNESS WHEREOF I have hereunto set my hand and caused the Great Seal of the State of California to be affixed this 30th day of October 2015.



EDMUND G. BROWN JR.
Governor of California

ATTEST:

ALEX PADILLA
Secretary of State

Source: Governor Edmund G. Brown Jr. See endnote 168.

Appendix D

Summary of Forest Carbon Plan Goals and Actions

1. Significantly increase the pace and scale of forest and watershed improvements on nonfederal forest lands:
 - CAL FIRE estimates that the rate of treatment on nonfederal lands would need to be increased to approximately 500,000 acres per year to address the forest health and resiliency needs. This is currently in excess of what CAL FIRE considers operationally feasible. It should be considered a target to work toward, and is achievable pending increased resources.
 - By 2020, increase the rate of fuels treatment from the recent average of 17,500 acre/years to 35,000 acres/year; by 2030, further increase the rate of fuels treatment to 60,000 acres/year.
 - By 2030, increase the area reforested annually by 25 percent.
 - By 2025, expand areas of high priority habitat by 5 percent above current levels, as provided in the State Wildlife Action Plan.
 - Ensure that timber operations conducted under the Forest Practice Act and Rules contribute to the achievement of healthy and resilient forests that are net sinks of carbon.
 - By 2030, lead efforts to restore 10,000 acres of mountain meadow habitat in key locations.
2. Support Federal goals and actions to improve forest and watershed health and resiliency:
 - By 2030, increase forest resilience through treatments resulting in resource benefits to approximately nine million acres on National Forest System Lands in California.
 - By 2030, bring resource benefits to approximately 1.2 million acres of forests and woodlands on Bureau of Land Management lands in California through national landscape conservation networks, landscape mitigation strategies, native seed rehabilitation and restoration, and vegetation treatments. Forestry and fuel reduction targets will expand from a current average of 9,000 acres/year to 20,000 acres/year.
 - By 2020, on lands managed by the USDA Forest Service, increase treatments from the current approximately 250,000 acres/year to 500,000 acres/year, and on BLM managed lands increase from approximately 9,000 acres/year to 10-15,000 acres/year.
 - By 2020, eliminate the current USDA Forest Service Reforestation Need balance and sustain future treatments at levels where annual additions are matched by treatments.
 - By 2030, the USDA Forest Service will restore 10,000 acres of mountain meadow habitat and target reliable funding for such activities on National Forest System lands in California.
3. Prevent forest land conversions through easements and acquisitions, as well as land use planning:
 - By 2030, increase the acreage of forestland protected by conservation easements by 10 percent.
 - Promote the adoption of regional transportation and development plans, such as SB 375 Sustainable Communities Strategies and Climate Action Plans, and recognize the climate change mitigation impacts of land use and forest conditions in those plans.
4. Innovate solutions for wood products and biomass utilization to support ongoing forest management activities.
 - Expand wood products manufacturing in California, and take actions to support market growth scaled to the longer-term projections of forest productivity.

- Increase the total volume of carbon stored through greater use of durable wood products from California forests, particularly in buildings.
 - Continue public investment to build out the 50 MW of small scale, wood-fired bioenergy facilities mandated through Senate Bill 1122 (Rubio, 2012).
 - Maintain large-scale bioenergy capacity in the short term at a scale necessary to meet the public safety and tree disposal needs stemming from widespread tree mortality in the central and southern Sierra Nevada.
 - Continue to support research into the potential to convert woody biomass into transportation fuels both statewide and regionally.
 - Develop and support the generation of and markets for compost from forest biomass for agricultural, rangeland, municipal, and residential soil amendments.
5. Support key research, data management, and accountability needs.
- Centralize and standardize tracking of implementation activities to meet Forest Carbon Plan targets to fully account for all efforts; quantify carbon sequestration and GHG and black carbon emission outcomes; identify areas of underperformance; and effectively work toward the ultimate performance objective of maintaining California's forests as net sinks of carbon. Develop a centralized database or other information management system to track implementation.
 - Complete forest carbon inventories (stocks and emissions), accounting methodologies at multiple scales, and GHG emissions projections for both a reference case and scenarios that include increased management and conservation activity.
 - Standardize methods, data, and modeling across state agencies (and federal agencies, where possible) to facilitate planning for forest health and resilience management activities across ownership boundaries.
 - Develop and disseminate tools to assist landowners and local and regional land use planners and forest managers in assessing current forest conditions and desired future conditions.
 - Develop a better understanding of how different fire types and different forest fuels affect black, brown, super-aggregate, and GHG carbon emissions.
6. Protect and enhance the carbon sequestration potential and related co-benefits of urban forests.
- Protect the existing tree canopy through policies and programs targeting ongoing maintenance and utilization of industry best management practices.
 - By 2030, increase total urban tree canopy statewide by one-third above current levels, to 20 percent coverage of urban areas.
 - Assist local governments and others in locating optimal sites for early green infrastructure solution implementation.
 - Provide resources and technical assistance to local governments as they assess local policies and regulations in regard to urban forestry and green infrastructure.

Source: CAL FIRE, California Natural Resources Agency and Cal EPA. See endnote 46. Pages 3-5.

Notes

1. California Department of Insurance. December 6, 2017. October Wildfire Claims Top \$9.4 Billion. <https://www.insurance.ca.gov/0400-news/0100-press-releases/2017/release135-17.cfm>. Accessed January 10, 2018. Also, Scott McLean, Information Officer, Department of Forestry and Fire Protection. January 23, 2018. Phone call with Commission staff. As of January 19, 2018, CAL FIRE had spent \$701,899,869 on fire suppression.
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Little Hoover Commission Members

Chairman Pedro Nava (*D-Santa Barbara*) Appointed to the Commission by former Speaker of the Assembly John Pérez in April 2013 and reappointed by Speaker of the Assembly Anthony Rendon in 2017. Government relations advisor. Former state Assemblymember from 2004 to 2010. Former civil litigator, deputy district attorney and member of the state Coastal Commission. Elected chair of the Commission in March 2014.

Vice Chairman Sean Varner (*R-Riverside*) Appointed to the Commission by Governor Edmund Brown Jr. in April 2016. Managing partner at Varner & Brandt LLP where he practices as a transactional attorney focusing on mergers and acquisitions, finance, real estate and general counsel work.

David Beier (*D-San Francisco*) Appointed to the Commission by Governor Edmund G. Brown Jr. in June 2014. Managing director of Bay City Capital. Former senior officer of Genentech and Amgen. Former counsel to the U.S. House of Representatives Committee on the Judiciary. Serves on the board of directors for the Constitution Project.

Iveta Brigis (*D-Los Gatos*) Appointed to the Commission by Governor Edmund G. Brown Jr. in April 2017. Open Sourcing People Operations Program lead at Google Inc. since 2014, and looks after re:Work, Google's initiative to open source data-driven HR practices.

Senator Anthony Cannella (*R-Ceres*) Appointed to the Commission by the Senate Rules Committee in January 2014. Elected in November 2010 and re-elected in 2014 to represent the 12th Senate District. Represents Merced and San Benito counties and a portion of Fresno, Madera, Monterey and Stanislaus counties.

Joshua LaFarga (*NPP-Wilmington*) Appointed to the Commission by Speaker of the Assembly Anthony Rendon in June 2017. Director of public and government affairs and as recording secretary and executive board member at LiUNA! Local 1309.

Assemblymember Chad Mayes (*R-Yucca Valley*) Appointed to the Commission by former Speaker of the Assembly Toni Atkins in September 2015. Elected in November 2014 to represent the 42nd Assembly District. Represents Beaumont, Hemet, La Quinta, Palm Desert, Palm Springs, San Jacinto, Twentynine Palms, Yucaipa, Yucca Valley and surrounding areas.

Don Perata (*D-Orinda*) Appointed to the Commission in February 2014 and reappointed in January 2015 by the Senate Rules Committee. Political consultant. Former president pro tempore of the state Senate, from 2004 to 2008. Former Assemblymember, Alameda County supervisor and high school teacher.

Assemblymember Bill Quirk (*D-Hayward*) Appointed to the Commission by Speaker of the Assembly Anthony Rendon in 2017. Elected in November 2012 to represent the 20th Assembly District. Represents Hayward, Union City, Castro Valley, San Lorenzo, Ashland, Cherryland, Fairview, Sunol and North Fremont.

Senator Richard Roth (*D-Riverside*) Appointed to the Commission by the Senate Rules Committee in February 2013. Elected in November 2012 to represent the 31st Senate District. Represents Corona, Coronita, Eastvale, El Cerrito, Highgrove, Home Gardens, Jurupa Valley, March Air Reserve Base, Mead Valley, Moreno Valley, Norco, Perris and Riverside.

Janna Sidley (*D-Los Angeles*) Appointed to the Commission by Governor Edmund Brown Jr. in April 2016. General counsel at the Port of Los Angeles since 2013. Former deputy city attorney at the Los Angeles City Attorney's Office from 2003 to 2013.

Helen Torres (*NPP-San Bernardino*) Appointed to the Commission by Governor Edmund Brown Jr. in April 2016. Executive director of Hispanas Organized for Political Equality (HOPE), a women's leadership and advocacy organization.

“Democracy itself is a process of change, and satisfaction and complacency are enemies of good government.”

Governor Edmund G. “Pat” Brown,
addressing the inaugural meeting of the Little Hoover Commission,
April 24, 1962, Sacramento, California