

Fire and Water: An Emerging Nexus in California



A Report by the
2019 Water Education Foundation Water Leaders



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List of Abbreviations

ATCM	Airborne Toxic Control Measures
bhp	brake horsepower
BAER	Burned Area Emergency Response
BLM	Bureau of Land Management
BMP	best management practice
CalEPA	California Environmental Protection Agency
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CalRecycle	California Department of Resources Recycling and Recovery
CCI	California Climate Investment
CDFW	California Department of Fish and Wildlife
CI	compression ignition
CNRA	California Natural Resources Agency
Commission	Commission on Catastrophic Wildfire Cost and Recovery
CWPP	Community Wildfire Protection Plan
DWR	California Department of Water Resources
FMTF	Forest Management Task Force
FPA	Forest Practice Act
g	gram
IRWM	Integrated Regional Water Management
LSAA	Lake and Streambed Alteration Agreement
LVMWD	Las Virgenes Municipal Water District
Modified THP	Modified Timber Harvest Plan for Fuel Hazard Reduction
MRP	Monitoring and Reporting Program
MOU	memorandum of understanding
NFPA	National Fire Protection Association
NPS	National Park Service
NREP	National Resource and Environmental Protection
O&M	operations and maintenance
OPR	Governor's Office of Planning and Research
PCWA	Placer County Water Agency
PGC	public goods charge
RPF	registered professional forester
RWQCB	Regional Water Quality Control Board
SAWPA	Santa Ana Watershed Project Authority
SB	Senate Bill
SOW	Save Our Water Campaign
SWRCB	State Water Resources Control Board
THP	Timber Harvest Plan
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WERT	Watershed Emergency Response Team

Executive Summary

One of California's most cherished assets, its rich and mature forested watersheds, is turning into a dreaded liability. It is an unfortunate new reality that California has become known for yet another natural disaster: large and severe wildfires. In just the past nine years, more than 40 large wildfires plagued California, each burning, on average, nearly 15,000 acres of land, displacing many families and resulting in billions of dollars in property damage. Equally devastating is the damage that wildfires are causing to the state's already strained water supply and its quality.

California's wildfire season has reached a new normal of severity and destructiveness, borne by hotter temperatures, drier fuel conditions, and the legacy of past forest management. Many trace the origin of the new paradigm to the 1991 Oakland Hills firestorm that killed 25 people and destroyed more than 3,000 homes. More recently, the 2018 wildfire season was the worst in California history, with more than 100 people perishing in blazes that swept through more than 2,800 square miles of land.

One reason cited for the more intense burns is that our forested lands have most recently been managed for fire suppression, allowing the accumulation of dense fuel loads. Furthermore, climate change is contributing to longer and more severe droughts and more flashy precipitation patterns. The elevation at which snow falls is increasing, with more precipitation falling as rain versus snow, on average.

All of this points to the need to implement forest restoration and watershed resilience projects and activities, improve interagency collaboration, and amend and streamline state regulations that would allow communities to better prepare for and respond to wildfires. Wildfires may be anticipated, the frequency of their occurrences reduced, and their impacts mitigated through improved governance, regulations, planning, implementation and educational outreach. The proposed policy recommendations that follow are specifically aimed at improving planning prior to catastrophic wildfires and addressing the negative impacts post-wildfire on California's water supply and water quality.

Specifically, our top recommendations include:

- **Recommendation A:** Reassess the roles and responsibilities of the various agencies tasked with wildfire prevention and water resources management and allow them to work together more efficiently to better address the impacts of wildfires on water resources. Recommend that the State Water Resources Control Board, through its respective Regional Water Quality Control Boards (RWQCBs) and the California Department of Fish and Wildlife (CDFW), be active participants in Watershed Emergency Response Teams and Burned Area Emergency Response (BAER) teams to provide more comprehensive assessments after wildfires. Strengthen the Forest Management Task Force by requiring a regional consortium for engagement with federal, state, regional and local agencies to identify and prioritize pre- and post-wildfire management projects and funding. Revamp agreement between the California Department of Forestry and Fire Prevention (CAL FIRE) and federal wildfire response agencies to consider impacts to water resources and provide for a commitment of up to three years for CAL FIRE and the California Office of Emergency Services to continue restoration projects following a massive wildfire.
- **Recommendation B:** Require Integrated Regional Water Management (IRWM) policy to include wildfire stakeholders and groups, including academia, nonprofit or non-governmental organizations, wildfire victims and other stakeholders. Require each IRWM region across California to address wildfire and water-related impacts in their IRWM plan and develop regional projects to prioritize for future implementation.
- **Recommendation C:** Modify Timber Harvest Plans for Fuel Hazard Reduction to require CAL FIRE, the implementing agency, to collaborate with RWQCBs and CDFW on long-term planning and development of region-specific requirements for moderate size tree-thinning projects, while streamlining agency review, so permit applicants can more easily manage their land.
- **Recommendation D:** Modify the fuel reduction timber harvest exemption, thus allowing projects to be larger than 300 acres and expanded to thin more areas like shaded fuel

breaks and ridgelines, to protect and enhance watersheds and water quality and reduce wildfire risk.

- **Recommendation E:** Revise air quality regulations to allow adequate testing of emergency backup generators that provide power to critical water systems. Ensure adequate water pressure is available during a fire, thus reducing life-safety risks to first responders and the public.
- **Recommendation F:** Increase multi-stakeholder participation and local agency collaboration in areas prone to wildfire by hosting public workshops statewide to understand the wealth of information and data available at the local level and develop a state framework.
- **Recommendations G and H:** Create a legislative strike force dedicated to developing long-term funding policies and mechanisms. Consider a suite of potential funding solutions to fund projects that restore forest and watershed health and reduce wildfire risk.
- **Recommendation I:** Launch a statewide public awareness campaign highlighting the recognition that modern wildfire prevention encompasses a broad set of proactive management activities and measured human intervention to improve the health of forests and watersheds. Develop a successful campaign to help people understand that although wildfires may be miles away, their drinking water could be impacted for years to come. Create public awareness and support for funding to preserve and protect the state's watersheds before and after a wildfire, much like the Save Our Water Campaign during the last drought.

1 Background

California wildfires have increased in frequency and size over the past half century (Figure 1.1). In 2018, Californians experienced the deadliest and most destructive wildfires on record (Jeffery, 2019). Prolonged periods of drought, driven by climate change, have resulted in extended wildfire seasons and tree mortality, generating fuel for larger wildfires (Public Policy Institute of California [PPIC], 2018). Recent forest management practices have interrupted the natural cycle of the forest ecosystem and resulted in overly dense vegetation that also contributes to catastrophic wildfires (PPIC, 2018).

California's forests supply more than 65% of the state's drinking water (Swaffar, 2016). Impacts from wildfires on water quality and quantity have been well documented, but because conditions are site- and event-specific, modeling and predicting these impacts are challenging and, as a result, are rarely incorporated into water supply management plans (Hallema et al., 2018). Floods and land erosion increase after

wildfires due to decreased infiltration rates, hydrophobic soils and reduced post-fire vegetation coverage that would normally absorb and slow overland flows (Hallema et al., 2018).

Contaminants and sediment entering the water supply system negatively impact water management, supply operations, storage and treatment (Martin, 2016).

Wildfires, floods and debris can damage water, power, communications and transportation infrastructure and contaminate water supplies (Martin, 2016). The 2014 King Fire dumped millions of cubic yards of debris, logs and silt into the Rubicon River, a tributary of the American

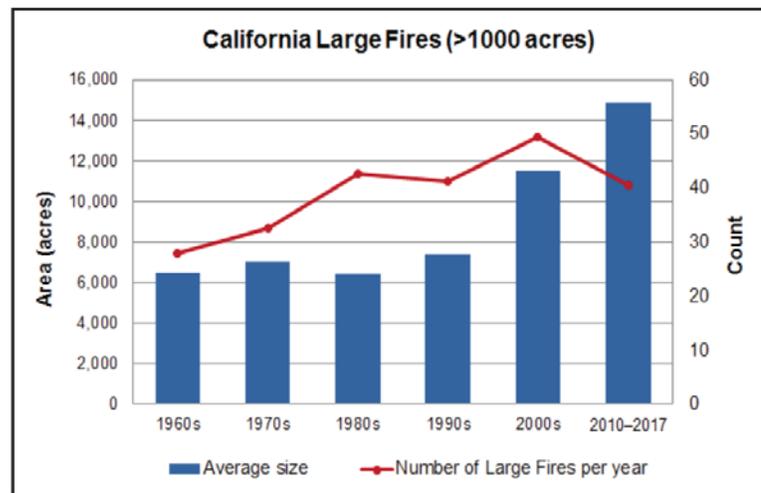


Figure 1-1: California large wildfires (>1,000 acres) and average size by decade (1960–2017)
(CAL FIRE et al. 2018)

River and contributor to Placer County Water Agency's (PCWA's) water supply, negatively impacting PCWA's infrastructure (U.S. Department of Agriculture (USDA), 2018). In 2018, extreme heat from the Camp Fire in Paradise, California, caused harmful chemicals to leach into water pipes that were depressurized from firefighting activities, leaving drinking water supplies contaminated (Bizjak, 2019).

The U.S. Forest Service (USFS) budget has increasingly allocated funding for nationwide wildfire response and suppression activities. In 2015, more than 50% of the budget was dedicated to wildfire suppression, up from 16% in 1995, and is projected to increase to 64% by 2025 (USFS, 2015). Shifting funding and human resources to fire suppression has limited the ability to plan for and prevent wildfires through management activities.

The occurrence and severity of wildfires is expected to increase as global temperatures rise and episodes of drought extend over longer periods of time (Union of Concerned Scientists, 2013). Action is needed to improve interagency collaboration, and amend and streamline state regulations to allow communities to better prepare for and respond to wildfires. This report provides policy recommendations aimed at helping California communities and government institutions become more resilient in the face of anticipated wildfires, specifically in relation to impacts on water resources. The recommendations are focused under: Governance and Collaboration; Regulations; Planning; Implementation; and Outreach/Education. Each section provides contextualizing information and specific policy recommendations that can be enacted to protect California's water supply – both quality and quantity.

2 Governance & Collaboration

2.1 Introduction

Governing California's natural resources is complex. Coordination among the federal, state and regional governing agencies is critical to the success of natural resource management ("U.S.C. 4321–4347," n.d.).

2.1.1 Federal Land Management

The U.S. Forest Service (USFS), the largest federal public landowner in California, works to establish interagency standards and guidelines for the overall management and decision-making to achieve the desirable future conditions for national forests (Figure 2-1). The Bureau of Land Management (BLM) manages 15 million acres of public land nationwide and about 15% of the land in California. The National Park Service (NPS) controls 7.6% of the land in California and works to preserve natural resources with a strong fire and ecology program. These federal agencies work with state, regional and local agencies as well as recognized tribes that are sovereign nations to manage natural resources.

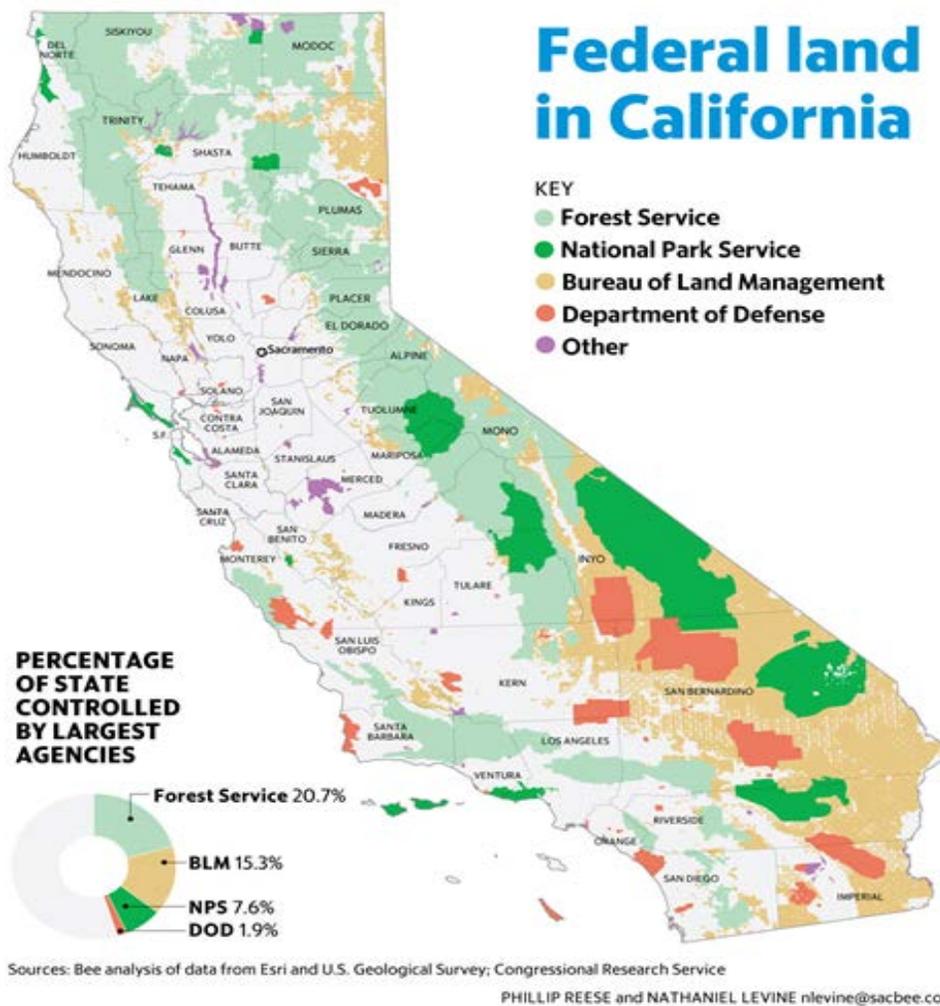


Figure 2-1: California map displaying federal land ownership

(Sacramento Bee)

2.1.2 State Natural Resources Management

The California Environmental Protection Agency (CalEPA) develops, implements and enforces laws that regulate air and water quality, soil contamination, use of pesticides and waste disposal. The State Water Resources Control Board (SWRCB) has permitting authority at both a regional and state level and is one of the departments under CalEPA. It includes nine Regional Water Quality Control Boards (RWQCBs) that regulate separate jurisdictions throughout the state. The federal Clean Water Act of 1972 and the state's Porter-Cologne Water Quality Control Act establish that the SWRCB and the RWQCBs have regulatory authority over water use and quality of nearly 1.6 million acres of lakes, 1.3 million acres of bays and estuaries, 211,000 miles of rivers and streams, and approximately 1,100 miles of coastline in California (SWRCB, 2019). The SWRCB protects water quality by setting statewide policy and coordinating and supporting regional efforts. The SWRCB also examines post-fire impacts on water quality and treatment, and monitors erosion and sedimentation. Also, under CalEPA is the California Department of Resources Recycling and Recovery (CalRecycle), which is tasked with organizing, managing, implementing, and overseeing debris removal operations, especially after wildfires.

The California Office of Emergency Services (Cal OES) focuses on response to emergency disasters by assisting local governments and coordinating the state agency response.

The California Natural Resources Agency (CNRA) oversees several departments including the Department of Forestry and Fire Protection (CAL FIRE), the California Department of Fish and Wildlife (CDFW) and the California Department of Water Resources (DWR). CAL FIRE focuses on fire prevention and regulating fire prevention strategies in wildland areas and buildings. CDFW establishes and enforces water resource management rules, regulations, and permits to protect the long-term sustainability of California's fish and wildlife resources. (DWR et al., 2018). The Governor often requests CNRA to coordinate with other state agencies. For example, in Executive Order (EO) B-52-18, CNRA was instructed to work with CAL FIRE, the Department of Parks and Recreation, CDFW, the SWRCB, state conservancies and all other relevant agencies to reduce barriers to accomplish forest health and fuel reduction projects (Executive Department, State of California, 2018).

To implement EO B-52-18 and the California Forest Carbon Plan, the Forest Management Task Force (FMTF) was formed in July 2018. The FMTF coordinates among agencies to facilitate permitting in all of California's forest and land ecosystems. The FMTF is currently focusing on minimizing regulatory barriers for forest health and fuel reduction projects aimed at protecting the benefits that healthy forests provide to California.

In addition to agency coordination, the Governor's Office established several workgroups and initiatives to address the state's wildfire risk. In late 2018, Senate Bill (SB) 901 created the Commission on Catastrophic Wildfire Cost and Recovery (Commission) within the Governor's Office of Planning and Research (OPR) to study issues related to catastrophic wildfires associated with utilities infrastructure and liability. (OPR, 2019) .

2.1.3 Regional and Local Management

At the regional level, various entities, including the RWQCBs and Integrated Regional Water Management (IRWM) groups, have different roles in watershed management.

IRWM is a regional effort led by DWR that began in 2002. There are 48 regional water management groups made up of cities, counties, water districts, tribes and community-based nonprofit groups that collaborate to implement water management solutions. These groups adopt and implement IRWM plans that address various aspects of water management.

This section explores the role of governance in the intersection of water and fire management in California. Recommendations to improve upon the existing roles of governance are summarized below.

2.2 State Coordination

A key step in post-wildfire response is a quick and effective site assessment so that damage to critical infrastructure can be determined and available funding for recovery prioritized. As most wildfires occur in late summer and fall, there is a short window of opportunity to implement emergency measures before winter rains arrive and erosion, debris flows and acute surface water contamination become an issue.

For wildfire response at the state level, Cal OES coordinates the California Fire and Rescue Mutual Aid System. Cal OES retains authority to task agencies and contractors for wildfire response,

including tasking CAL FIRE to perform

post wildfire evaluations through the Watershed Emergency Response Teams (WERTs) on state and private lands (Coe, 2018). The WERTs perform a rapid evaluation of post-fire hazards such as debris flows, flooding and rock falls and develop preliminary recommendations to mitigate identified hazards.

Recommendation A.1: Improve wildfire preparation and post-wildfire coordination and operations between state and federal agencies through clarified roles and responsibilities.



Figure 2-2: BAER team evaluates post-fire threats after the Carr Fire

(Photo by Eric Coulter, BLM)

At the federal level, the USFS implements the Burned Area Emergency Response (BAER) program. The BAER program objective is to determine the need for and implement emergency treatments on federal lands to minimize threats to life or property resulting from a wildfire (USFS, 2018). A BAER assessment usually begins before the wildfire

has been fully contained, and information collected is shared with other federal, state and local emergency response agencies to assist communities and private landowners at risk of post-wildfire damage (USFS, n.d.).

The focus of the WERT and BAER risk assessments is on human life, safety and property. The RWQCBs and CDFW should be tasked and funded to join the WERT and BAER evaluation teams to provide more comprehensive assessments that consider natural resources protection. Though this may slightly increase the time needed to complete these evaluations, it will reduce the need for additional assessments specific to natural resources. Having specific natural resources protection recommendations in hand through these evaluations will expedite funding approvals and implementation.

CAL FIRE, CalRecycle and the SWRCB often fund or implement post-wildfire reclamation activities. The RWQCBs should be tasked and funded to formally participate in the CAL FIRE wildfire incident command and Cal OES post-fire response activities. This formal participation would ensure that critical infrastructure and surface water quality concerns are considered during a wildfire incident, and during post-wildfire assessments and project prioritization. Equally important is how this active role would help provide a transition from recommendations (from a WERT or a BAER team) to identification and securing of state or federal funding and contract deployment to then begin rapid project implementation.

The RWQCBs have the responsibility, authority and various tools that can be used to reduce the impacts of wildfire on water quality. This includes the regulatory and investigation authority, policies, water quality monitoring responsibilities and assessment and technical expertise. With respect to post-wildfire actions, RWQCB staff may conduct assessments or participate in multi-agency assessments like the WERT or BAER teams (Central Valley RWQCB, 2019). Post-wildfire, RWQCB staff may make recommendations that include the installation of best management practices to mitigate sediment and pollutant runoff into waterways. Further, RWQCB staff may support, participate in or lead water quality monitoring to assess post-wildfire impacts on regional water resources (Central Valley RWQCB, 2019). The RWQCBs should be tasked and funded to expand their post-wildfire activities to long-term post-wildfire restoration actions that deal with the more chronic threats of erosion and sedimentation commonly associated with forest wildfires.

CAL FIRE is best positioned to tackle immediate on-the-ground actions, as underscored in Governor Newsom’s Emergency Proclamation on Wildfire Risk issued in March 2019, which

Recommendation A.2: Strengthen the Forest Management Task Force by requiring a regional consortium for engagement with federal, state, regional and local agencies to identify and prioritize pre- and post-wildfire management projects and funding.

tasked CAL FIRE with implementing 35 priority fuel reduction projects to help reduce wildfire risk to 200 vulnerable communities (Governor’s Office, 2019). In addition, CAL FIRE is well-

situated to coordinate post-wildfire responses with federal agencies: CAL FIRE’s cooperative programs include an agreement for the exchange of fire protection services with federal wildland fire agencies, including the USFS, BLM and NPS. This allows for a coordinated wildfire response that is incident-focused, transcending jurisdictional boundaries (CAL FIRE, 2019)

.11/21/2019 11:59:00 AM CAL FIRE programs which involve federal wildland fire agencies should be strengthened to allow for coordinated prioritization, funding, contracting and implementation of post-wildfire actions such as those identified by WERTs and BAER teams.

CAL FIRE and Cal OES should be tasked and funded to play a leading role in post-wildfire response activities for up to three years post-wildfire. This longer-term engagement by Cal OES will provide oversight and accountability to ensure high-priority recommended recovery actions are funded, contracted, implemented and



Figure 2-3: Post-wildfire impacts on a watershed

Recovery activities immediately after a wildfire are critical to avoid debris flows, erosion and surface water quality impacts (Photo by PJF Military Collection/Alamy Stock Photo).

evaluated. Cal OES can use existing Assembly Bill 1522 Cap and Trade auction revenues as a long-term funding mechanism for its oversight role, and to potentially help fund short- to

medium-term recovery actions that help reduce greenhouse gas emissions, improve air quality and provide public health benefits. CAL FIRE, through its cooperative programs, is well positioned to provide a leadership role to ensure post-wildfire activities are coordinated, funded and implemented with the best available science and monitored to ensure desired outcomes. Following the three-year post-wildfire period, Cal OES and CAL FIRE would be well situated to facilitate the transition from short-term emergency activities to long-term watershed rehabilitation efforts in terms of funding and identifying and tasking the appropriate implementing parties.

The major objective tasked to the FMTF is facilitating information flow and encouraging coordination between state, federal, tribal and local governments, utilities and non-governmental organizations. This includes developing regional strategies that prioritize achievable solutions to restoring and enhancing forest health and identifying and harmonizing cross-jurisdictional regulatory and permitting requirements for forest health, prescribed fire and fuel reduction activities. The FMTF is organized into eight thematic working groups and four regional prioritization groups.

The FMTF authority should be expanded to build a more comprehensive regional consortium dedicated to aligning wildfire prevention and post-wildfire planning and implementation activities at the regional scale, as further discussed in Recommendations B, F, and G, and funding across jurisdictional boundaries as is outlined in Recommendation H.

The following are potential ways to further expand FMTF to act as a regional consortium:

- **New Role in FMTF** - Currently, CNRA oversees CAL FIRE, which is tasked as the responsible agency to administer most of the state's forest health grants. If CNRA were the lead agency instead, it would have the authority to involve more state agencies — including agencies focused on water (e.g. SWRCB and DWR). This would allow CNRA to share funding across regional jurisdictional boundaries (Recommendation H), take the lead on regulatory alignment (Recommendations C, D, and E) and eliminate planning

inefficiencies (Recommendations B and F). This more pronounced leadership role for CNRA could manifest via the FMTF.

- **Basin Plans** - Ensure FMTF is empowered to implement state basin plan standards; plans must consider vulnerable, disadvantaged and tribal communities. FMTF will need to consider specific funding sources for these projects.
- **Regional Plan Development and Implementation** - The state and its regulatory agencies should partner with IRWM groups and local water agencies that are planning and developing local wildfire or forest management related projects for future water and watershed management policy discussions. This regional scale coordination and involvement would allow for an economy of scale benefit.
- **Coordination of Projects, Programs and Funding with federal agencies** - The state should partner with stakeholders and the scientific community to analyze the costs and benefits of prevention versus repair and cleanup of damages. The state could then support multiple-benefit, cost-shared, fire/water supply protection projects, as described in Recommendation G and Forest Management Toolbox in Table 5.1. The state should develop options for state and federal cost-sharing projects that safeguard or improve public safety or water supply.

Coordination among state agencies could be improved to adopt a more holistic perspective than a fire-related commission could provide. The commission, for example, could enhance state coordination in planning for and implementing successful post-fire recovery strategies. In 2018, SB 901 created the commission (Dodd, 2018) during one of California's worst wildfire seasons and provided the Legislature with recommendations on managing "the long-term costs and liability associated with utility-caused wildfire" (CAL FIRE et al., 2018). In the wake of the catastrophic wildfires in 2017 and 2018, the commission held several public hearings, which allowed it to hear a range of perspectives from victims, to utility and energy experts, to

Recommendation A.3: Task the Commission on Catastrophic Wildfire Cost and Recovery, and its Wildfire Vulnerability Risk and Reduction Coordinator, to share recommendations with the regional consortium and consider its feedback in developing recommendations.

local government representatives and others (OPR, 2019). The commission used this information to publish a report outlining its recommendations regarding fire management (OPR, 2019).

One recommendation made by the commission was to create a Wildfire Vulnerability Risk and Reduction Coordinator under the purview of OPR to conduct research and provide recommendations to the Legislature, governor, the California Public Utilities Commission, insurance commissioner, and local governments on optimal levels of risk mitigation spending (OPR, 2019). The coordinator should be funded and established as recommended in the report.

Under our recommendation, the coordinator would share research with the regional consortium to better inform stakeholders' decisions. In turn, state agencies would inform the coordinator of areas of research which could strengthen recommendations. This coordination would substantially enhance state coordination overall because it would help better inform stakeholders of the information gathered from fire-specific commissions. Such information would help inform how state agencies should plan for wildfire and rebuild post-wildfire.

2.3 Regional and Local Collaboration

To mitigate future catastrophic wildfire events, actions must be taken to require a structure for aligning the many actions before, during and post-wildfire among the many interests at the local, regional, state and activities levels. Proactive planning will improve overall forest management practices in California and improve water supply and water quality impacts related to wildfire. Integration, coordination and communication between levels of government will help organize the many interest groups and resources.

Recommendation B: Require wildfire and water impacts as an Integrated Regional Water Management plan standard and prioritization of regional wildfire-related projects for future implementation.

IRWM brings together local agencies and stakeholders, with a range of water-related responsibilities and interests, to address water management needs collaboratively within self-identified regions and sectors across the state. The practice of IRWM is rooted in the principle of regional control, recognizing that local and

regional water managers and other interest groups working together in a collaborative and transparent manner are best positioned to manage resources in their regions. Issues including limited groundwater and surface water supplies, drought, flooding, climate change, water quality, environmental degradation, aging infrastructure, economic constraints, recreation and cultural considerations are addressed through coordinated and integrated planning and implementation actions. However, headwaters management, wildfire and wildfire's impacts on water resources are not recognized priorities or an IRWM plan standard. Many of the expected outcomes of IRWM - providing for public safety, supporting a healthy economy and supporting ecosystem vitality - are at the cornerstone of the vast wildfire impacts that threaten public safety, public health, California's forests, water supply and water quality. Each IRWM plan should be required to address a "wildfire and water plan standard" and develop priority projects to include in each IRWM plan's project list. This new IRWM plan standard should include a discussion or reference to all relevant timber harvest plans and align with regulations, as described in Recommendations C, D, and E. This may require further legislation. The following provides a summary of how IRWM can support regional governance to address wildfire and water-related impacts through IRWM plan standards and project development for implementation.

The Integrated Regional Water Management Planning Act of 2002 established that regional water management groups (RWMGs) may prepare and adopt a regional IRWM plan that addresses a variety of water-related matters including groundwater, urban and agricultural

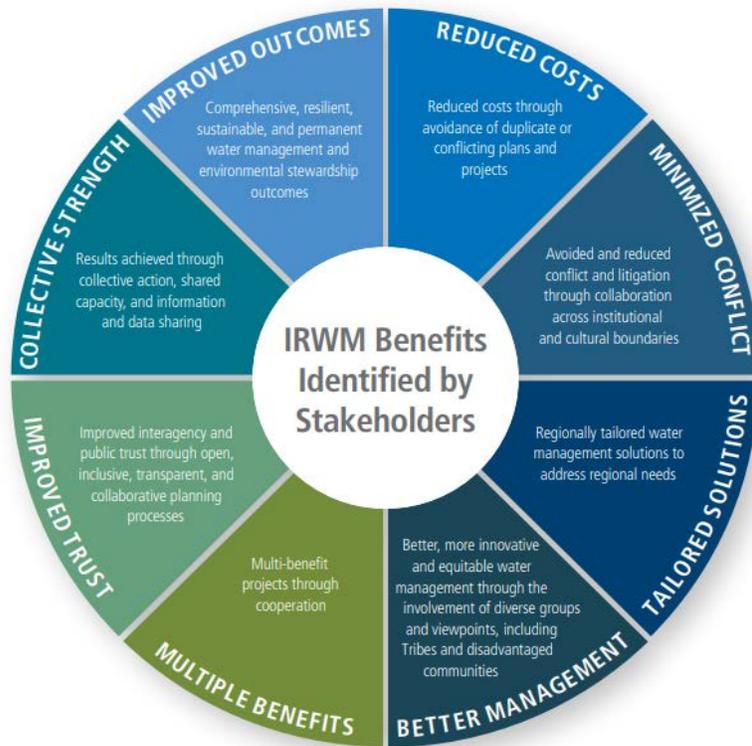


Figure 2-4: The benefits of IRWM

IRWM practitioners and other stakeholders throughout the state have expressed overwhelming support for IRWM and its principles, as shown in the benefit wheel diagram (DWR, 2017).

will help develop relationships and ensure regional proactive planning and organization of projects.

In 2017, IRWM stakeholders recommended that RWMGs “[c]ollaborate, where appropriate, with neighboring IRWM regions and DWR to share information and work toward addressing inter-regional water management issues, such as flood management, groundwater sustainability, source water protection, ecosystems, forest management, and federal land management” (Wat. Code § 10540). IRWM stakeholders should address wildfire-related planning actions within their region. RWMGs should also collaborate on an inter-regional scale to address source water

water management planning, flood management, water recycling projects and others (Wat. Code § 10540). IRWM plans are used to help guide RWMGs in planning efforts and to qualify for state grant funding for projects included in their IRWM plans. Therefore, RWMGs should be required to include projects that address water-related impacts from wildfire. Stakeholder involvement at the outset

protection, headwaters management, forest restoration and water supply and quality issues arising from fire-related impacts. These regional relationships will help to develop and prioritize fire-related projects, as further explained in Recommendation F.

While collaborating within a region or with neighboring IRWM regions, RWMGs should be required to consider the perspectives from academics, non-governmental organizations, wildfire victims and other interested stakeholders. This should be done by requiring a public input element when writing and reviewing the “wildfire and water plan standard” and throughout the implementation of the IRWM plan.

Requiring IRWM plans to include wildfire-related projects, which in turn serve as criteria for awarding grants, will incentivize RWMGs to more proactively plan for wildfire-related needs. In future funding cycles, CNRA or FMTF’s regional consortium can direct funding to the RWMGs that have plans addressing wildfire and water-related impacts and that contain related projects, as further articulated in Recommendations G and H. By using the IRWM governance structure to address wildfire and water-related impacts, the state or FMTF’s regional consortium can prioritize state and federal financial incentive for those regions that successfully collaborate regionally and/or inter-regionally, appropriately plan and develop projects to improve the health of forests and watersheds across California.

3 Regulations

3.1 Introduction

Under the governor’s leadership, the state has taken an aggressive approach to better managing watersheds by setting ambitious management goals. Executive orders have addressed the devastation caused by historic forest management protocols and created needed policy changes to achieve those goals. While the direction of California’s forest and watershed management is changing, many regulatory obstacles are still in place that inhibit fuel management to prevent catastrophic wildfires, improve community preparedness and create a resilient water supply.

This section addresses three regulatory obstacles that should be modified or streamlined to improve wildfire resiliency and protect watersheds, including a streamlined Timber Harvest Plan

(THP) review and permitting process, expanding current exemptions to timber harvest regulations, and limited revisions to air quality regulations.

3.2 Timber Harvest Plan Regulations

The California Department of Forestry and Fire Protection (CAL FIRE) regulates timber management on private lands. Due to the prevalence of private timberland in the state, CAL FIRE may be the state's largest regulatory authority over watershed lands. 40% of California forestland is owned by families, Indian tribes or private companies. Nine million acres are individually owned and 90% of owners have less than 50 acres (UC ANR, 2019).

California forest regulation began in 1945 with the Forest Practice Act (FPA). The FPA requires that private land timber harvests have a THP prepared by a state-registered professional forester (RPF) and submitted to CAL FIRE for

Recommendation C: Streamline the Timber Harvest Plan process to increase the pace and scale of fuel hazard reduction.

review and approval. The public has an opportunity to comment on THPs as do other agencies, such as the California Department of Fish and Wildlife (CDFW), the Regional Water Quality Control Boards (RWQCBs) and the California Geological Survey. Although exemptions exist, FPA compliance applies to commercial harvesting operations for landowners of small parcels to ranchers with hundreds of acres and large timber companies with thousands of acres.

CAL FIRE reviews and approves 500 to 1,400 lengthy THPs each year. Development and review are multi-step processes and can involve several rounds of comments and revisions to ensure a compliant document. These THPs should be discussed or referenced in Integrated Regional Water Management (IRWM) plans, as suggested in Recommendation B. CAL FIRE follows up on THPs with site inspections and can shut down operations, and cite or fine RPFs, licensed timber operators and landowners if illegal operations are found. THPs also are used as the "functional equivalent" of an environmental impact report (EIR) and include resource evaluations normally found in an EIR, including biological and cultural resources, soils, water quality and aesthetics (Klamath Resource Information System, 2011).

Recent studies have suggested that forest thinning that would take place under a THP and fuel reduction not only improve forest resilience but may, under some circumstances, enhance water yield (Cook, 2019; Roche et al., 2018; Saksa et al., 2017). Management activities that help to restore a more natural wildfire regime would protect water quality effects resulting from widespread erosion often seen after catastrophic wildfires, which can severely degrade instream habitat and the ability of water utilities to treat raw water effectively. Wildfire jeopardizes water storage in both man-made reservoirs resulting from post-fire sedimentation, and our headwaters reservoirs (i.e. forested lands), and reduces water supply reliability and drought resiliency for all users, from small local districts to the State Water Project.

3.2.1 Regional Water Quality Control Board Role

The RWQCBs are involved in the review process for THPs and are permitting agencies under Section 401 of the Clean Water Act. This discussion focuses on the Central Valley RWQCB, Region 5, which covers a large portion of the Sierra Nevada and foothills, the location of several recent wildfires. A standard 401 Water Quality Certification can take up to three months to receive.

For General Order compliance, THPs must include water quality protective measures beyond the requirements of the current Forest Practice Rules. Additionally, pursuant to Water Code section 13267, a Monitoring and Reporting Program (MRP) details road allowances and possible erosion sites and assists applicants with implementation and maintenance of water quality protection measures. MRPs also include an Inspection Plan and agency monitoring (direct field observations by CAL FIRE). A Notice of Intent must be sent to the RWQCB 15 days

Current multi-agency, multi-step approval process timeframe for THP development:

- Lengthy (can be over six months).
- Involves multiple rounds of review by agencies that already have exercised regulatory authority over THPs; results in double regulation of an applicant's activities.
- Requires landowner to hire specialty consultants to complete THP documents.
- Discourages landowners from managing timber and fuels in a way that protects water supply and quality and promotes overall watershed health.

before commencing activities and RWQCB staff is supposed to respond to the notice. If an applicant completes documentation and shows compliance with all General Order provisions and the MRP, the RWQCB should not also need to review the THP (Figure 3.2).

3.2.2 California Department of Fish and Wildlife Role

CDFW is involved in the THP review process and as a permitting agency. CDFW issues Lake and Streambed Alteration Agreements (LSAA) pursuant to Fish and Game Code sections 1600-1616, for activities on non-federal land that may divert, obstruct, borrow, fill or change any river, stream or lake. Approval for a standard LSAA can take three to four months to receive and applicants must complete a separate application process and redundant documentation of information already included in the THP (CDFW, 2016). CDFW may issue a Master Agreement for Timber Operations or individual LSAA's to THP applicants. Notification timelines vary depending on whether or not the THP has already been approved by CAL FIRE.

3.2.3 Modified Timber Harvest Plans (14 CCR Sec. 1051.3-1051.7)

Many types of THPs exist. This document explores the Modified Timber Harvest Plan for Fuel Hazard Reduction (Modified THP) planning option because the modified THP focuses specifically on fuel hazard reduction. Modified THPs should be included in the water and wildfire plan standard section of an IRWM plan, in alignment with Recommendation B, to be able to implement regional projects that address fuel hazards.

As mentioned previously, multiple agencies are involved in THP reviews, causing confusion and delays for necessary and beneficial timber and watershed management activities. Additionally, the current process leaves applicants subject to staffing constraints across multiple agencies and can substantially delay timely review. Processes used in other states with extensive forest resources are much less onerous than California's.

Modified THP Parameters:

- 2,500-acre maximum size
- RPF must prepare the THP
- Clear cutting not allowed - commercial thinning, rehabilitation and fuel break defensible space only
- RPF shall develop a fuels treatment plan (14 CCR § 1051.5)
- 5-year term

Because Modified THPs cover moderate-sized parcels of land, a wide range of landowners with varying land/timber management expectations (saleable timber vs. focus on fuels reduction), as well as owners with financial and regulatory knowledge constraints may be interested in implementing a Modified THP.

Over nine million acres of California forestland is owned by individuals, and the burdensome process for managing their lands can lead to a build-up of fuels, which can have profound effects on water supply (pre-fire) and water quality (post-fire). As demonstrated in Figure 3.1, there are many opportunities for the current THP review process to be streamlined.

This would save time and money for moderate-sized landowners and encourage more active management of these lands before wildfires occur.

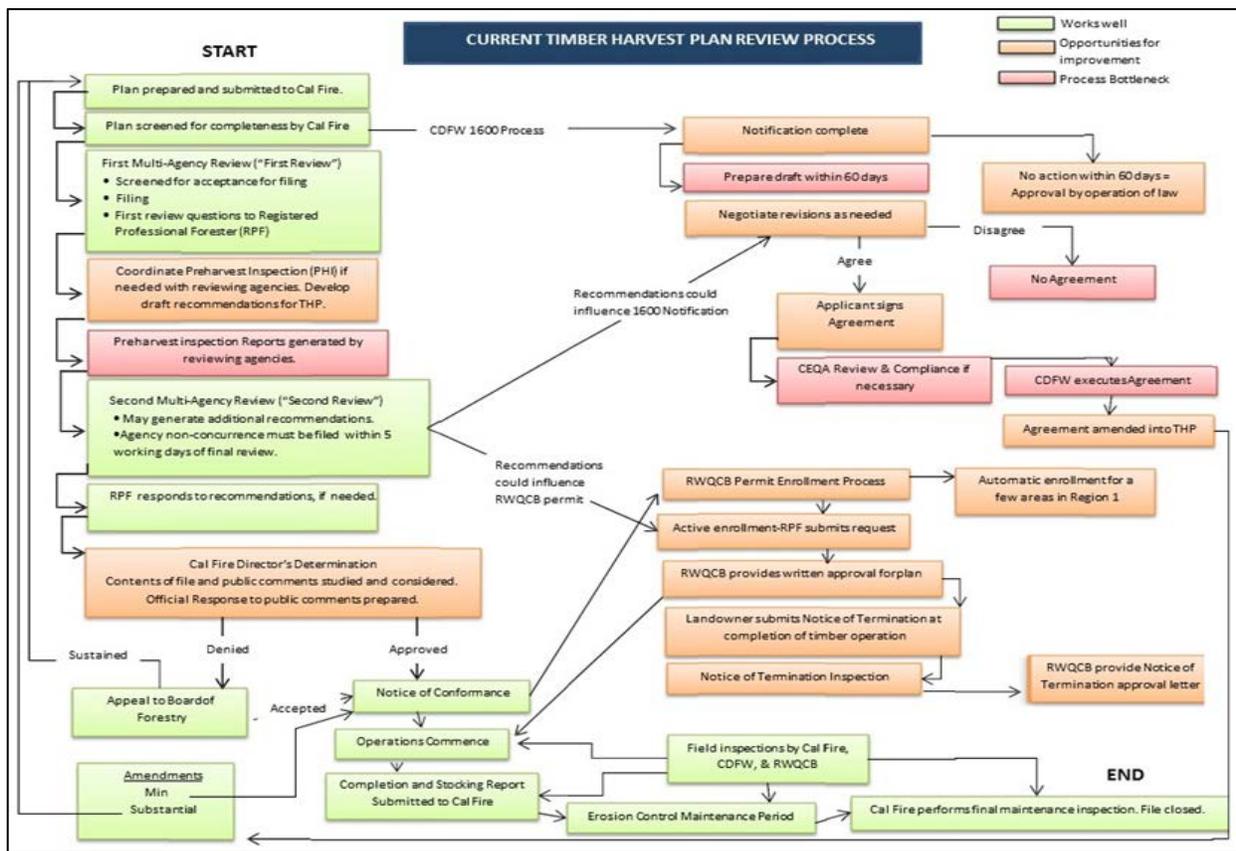


Figure 3-1: Current Timber Harvest Plan Review Process

(John Anderson/Rich Gordon)

3.2.4 Proposed Streamlined Modified THP Review Process

To encourage more active management of moderately sized parcels under the Modified THP process, it is recommended CAL FIRE implement a streamlined review process as illustrated in Figure 3.2. Additionally, CAL FIRE should incorporate more ongoing collaboration with RWQCBs and CDFW into long-term planning and development of region-specific THP requirements.

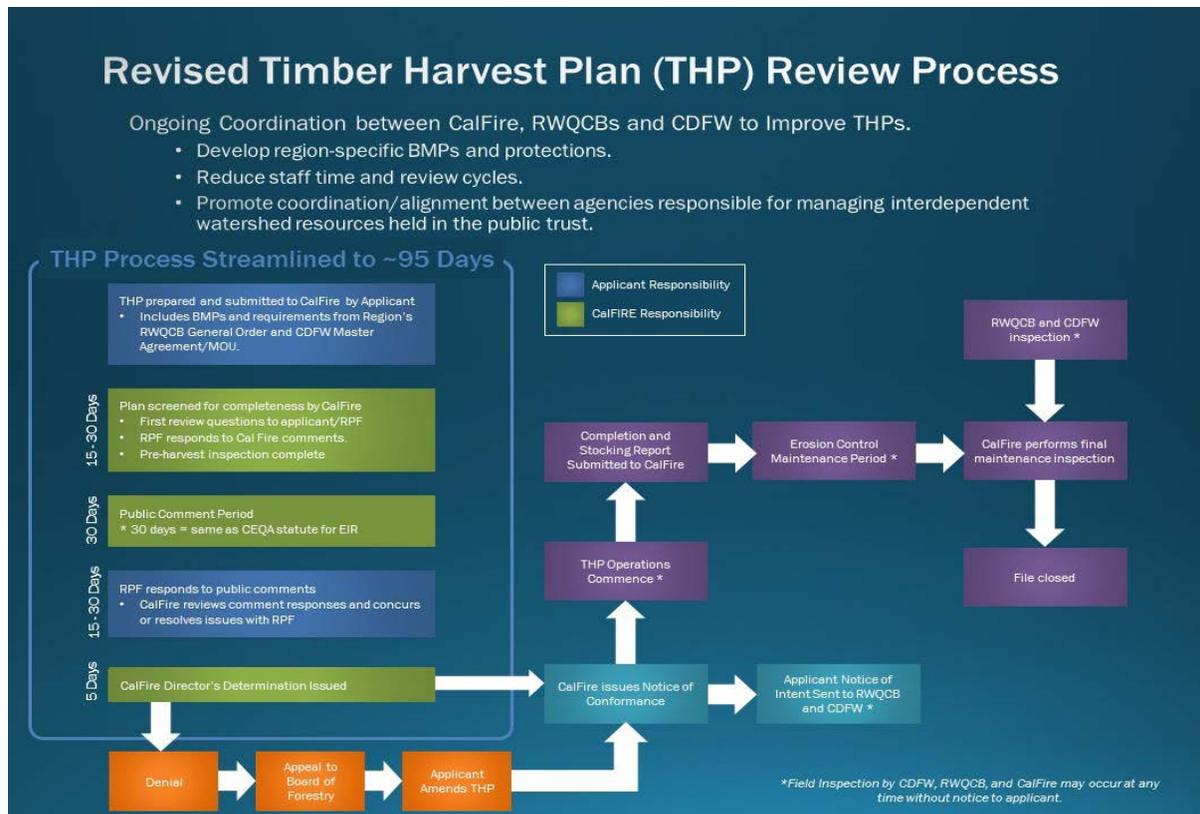


Figure 3-2: Proposed Streamlined Timber Harvest Review Process

(Created by report authors).

We propose that either a watershed-wide Master Agreement for all CAL FIRE-approved THPs be developed in coordination with CAL FIRE and CDFW, or a memorandum of understanding (MOU) be executed between CDFW and CAL FIRE. The new Master Agreement or MOU would detail allowable activities, constraints, resource protection measures and best management practices (BMPs) required by CDFW and would allow applicants to include these measures in their THPs and simply notify CDFW 15 days before work commences (Figure 3.2).

3.3 Vegetation Management Regulations

An alternative to the onerous THP is an exemption for wildfire prevention or fuel reduction issued by CAL FIRE. Exemptions can be the path for landowners, communities and local and regional management entities to more easily acquire permits for forest management efforts. Exemptions are a welcome alternative to the cost and size of a

Current exemption limitations:

- Project limited to 300 acres
- Limits on access roads that can be constructed to allow the work
- Restrictions on the types of access to do the work
- Restrictions on the size and densities of vegetation that can be cleared

THP, but actions under an exemption are limited by statute. As outlined in Recommendation B, if there are exempt activities included as a project for future implementation in an IRWM plan, those exempted activities should be expedited in receiving consideration for funding by the

Recommendation D: Expand vegetation management exemptions to achieve wildland management goals.

regional consortium administering funding through the Forest Management Task Force (Recommendation A.2).

3.3.1 Background and Context

In Governor Brown's May 2018 Executive Order B-52-18 (EO), CAL FIRE was tasked with managing 250,000 to 500,000 acres of California wildlands on an annual basis. Management goals in EO B-52-18 are largely in response to recent catastrophic wildfires but also consider the benefits of proactive forest management on watersheds and water quality, and the impacts of catastrophic wildfires on water quality and water reliability. EO B-52-18 recognized that achieving this level of management would require engaging private landowners, stakeholders and current wildland management agencies. To streamline the permit process for these parties, exemptions are available. These exemptions found in Public Resources Code section 4584(j) fill a niche that grants permits to perform fuel reduction activities under specific circumstances with less permitting effort than a THP or Modified THP. The exemptions are a better option for those

who may have smaller acreage or less marketable timber, or where the cost of a THP is not feasible. To date, CAL FIRE has treated approximately 45,000 acres since the EO was signed.

3.3.2 Proposed Changes

In the interest of achieving multi-benefit goals, the following regulation changes are proposed.

THP exemptions help small- to mid-sized landowners and stakeholders perform forest and watershed management with less permit burden. The exemptions currently permit up to 300-acre projects allowing for various management strategies, including timber harvest to achieve fuel reductions such as canopy continuity. It is recommended that the 300-acre limit be increased to allow larger projects to be eligible for the exemption. This will allow creation of managed spaces, like shaded fuel breaks and ridgeline thinning that will protect and enhance watersheds and water quality. Increased project size also will increase economies of scale, reducing per-acre costs and increasing potential offsets from timber sales. Increasing the exemption acreage also would aid communities in protecting their infrastructure at reduced costs and less burdensome permitting.

Recommendation D.1. Expand the current 'exempt project' size limitation of 300 acres to allow larger landscape projects that help accomplish mandated goals and simplify permitting to vulnerable areas and communities (Public Resources Code Sec. 4584, reducing flammable materials).

A major hurdle associated with management, even with the benefit of an exemption, is the cost associated with implementation. While costs vary greatly depending on activity, costs as high as \$2,351 per acre were noted in the University of California Fuel Reduction Guide. Some of that cost is offset if there is marketable timber that can be harvested in project areas. Guidelines for fuel orientation and continuity are included in the California Code of Regulations, BMP handbooks and the Fuel Reduction Guide for Sierra Nevada Landowners. It is recommended that if spacing and vegetation densities

Recommendation D.2. Increase the maximum diameter tree allowed for removal under THP exemptions.

in the exemption permit areas are enforced and abided by, permittees should be allowed to harvest larger diameter, more valuable timber to offset project costs.

Current exemptions include limits on constructed road lengths. The allowed length of the access road correlates to the permitted project

Recommendation D.3. Expand the length of roads and access allowed in THP exemptions to facilitate management of larger permitted project areas.

size. To accommodate larger projects, and projects in more remote areas, the allowable length of roads also will need to be increased. BMPs associated with road creation will need to be enforced to minimize erosion and impacts to watersheds and sensitive areas. Road expansion also could reduce costs by decreasing equipment mobilization and use of more specialized equipment.

3.4 Air Quality Regulations

The California Air Resources Board promulgates rules applicable to operations and maintenance (O&M) of “stationary compression ignition [CI] engines” to reduce diesel emissions and related pollutants from diesel-fueled CI engines. These regulations are known as the Airborne Toxic Control Measures (ATCM) and apply to anyone who purchases, sells or leases a stationary (as opposed to portable) CI engine with a rated brake horsepower (bhp) greater than 50 bhp. Section 93115.6 of the ATCM outlines operating requirements for emergency standby diesel-fueled CI engines. As their name implies, these are limited to use during emergency situations, and there are specific regulations for O&M. In particular, Subdivision (b)(3) limits the total hours

Recommendation E: Revise air quality regulations to help water utilities meet water supply and quality standards during wildfire emergencies.

per year for which “in-use” engines, meaning those engines installed before January 1, 2005, or which have not been reconstructed since January 1, 2005, may be tested for maintenance purposes as follows:

- Diesel emissions at a rate greater than 0.40 gram (g)/bhp per hour are limited to 20 hours/year.

- Diesel emissions at a rate between 0.15 and 0.40 g/bhp per hour are limited to 21 to 30 hours/year.
- Lower diesel emissions rates may be tested for more hours over the course of a year with permission from the local Air Pollution Control District.

Section 93115.3(n) of the ATCM provides an exemption to the requirements of Section 93115.6(b)(3) for “in-use emergency fire pump assemblies that are driven directly by stationary diesel-fueled CI engines and only operated the number of hours necessary to comply with the testing requirements of National Fire Protection Association (NFPA) 25 ‘Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems’....” (NFPA, 2019). However, that exemption does not carry over to emergency backup generators that water utility systems rely on if their primary power source becomes unavailable, and there is no similar provision for such systems.

3.4.1 Background and Context

In November 2018, the Woolsey Fire burned nearly 100,000 acres and destroyed or damaged more than 2,000 structures in Los Angeles and Ventura counties (Los Angeles County Fire Department, 2018). The wildfire burned through a significant portion of the area served by the public water utility, Las Virgenes Municipal Water District (LVMWD). During the fire, LVMWD lost power to nearly all of its facilities, and had to rely on emergency backup generators to continue operation of critical pump stations to refill water storage tanks depleted from firefighting efforts (Pedersen et al., 2019). Emergency responders rely in part on water in those tanks to combat wildfires in areas where there are limited on-site water sources (McNary, 2017). If the tanks run low, pressure in the water system decreases and water can slow or stall in the lines, causing dirt and other substances in surrounding water lines to seep through cracks and into the water (McNary, 2017). The fire itself also can cause damage to the water system (e.g. cracks or breaks in piping), compounding the struggle to sustain water supplies during the emergency. Thus, maintaining electrical power to keep pressure in the system and refill supply tanks is critical, especially the longer the fire emergency continues.

Unfortunately, while LVMWD worked to maintain flowing water through its system, the backup generators it relied on also failed during the Woolsey Fire (Pedersen et al., 2019). LVMWD staff had to traverse burn areas to make repairs, putting themselves in harm's way. The consequences of unreliable generators had rippling effects during the emergency, including a lack of reliable energy, which created significant challenges to keeping water tanks full, hindering firefighting efforts as well as LVMWD's ability to maintain water supplies to its customers. It also caused a reduction in water pressure in the infrastructure system, requiring LVMWD to issue a boil notice for a portion of its service area (Carlson, 2019; Pedersen et al., 2019).

Concerns about the reliability of backup generators is not unique to LVMWD's experience. During the Thomas Fire in 2017, the City of Ventura also experienced issues with emergency backup generators (Martinez and Carlson, 2019). The Los Angeles Department of Water and Power has reported that approximately a quarter of Los Angeles relies on electrically powered pumps to deliver water to city hydrants, which in turn rely on emergency standby diesel-fueled CI engines (McNary, 2017).

LVMWD, among other water and local agencies, maintains that if regulations allowed in-use emergency diesel-fueled generators to be tested for longer periods of time and under load conditions, critical maintenance issues could have been caught well in advance of the emergencies, and the challenges caused by the failed generators in the Woolsey or Thomas fires could have been avoided (Pedersen et al., 2019).

3.4.2 Proposed Changes

In order to ensure water supply and water quality resiliency during fire emergencies, it is recommended that ATCM Section 93115.3(n) be amended to include an additional limited exemption for emergency backup generators. The exemption would only apply to generators that are previously designated to provide emergency backup power to critical public water system facilities required for fire protection. Further, the exemption would still impose limits on the total number of hours for testing, but would follow the standards set under the NFPA 110, "Standard for Emergency and Standby Power Systems." Provisions of NFPA 110 applicable to

operational testing of emergency power systems are more flexible to the extent that they do not place a rigid maximum number of hours on maximum load testing for diesel-fueled generators (NFPA, 2019). Rather, the limits are based on the manufacturers' recommendations, and provides an alternative where no recommendation is available. In general, the NFPA standards would require weekly inspections and testing under load conditions at least monthly. Additionally, at least every 36 months, the generator would be tested under load conditions for up to four hours (NFPA, 2019).

This revision to section 93115.3 is not expected to result in a significant increase over the current 20-hour limit for maximum load testing under section 93115.6. For instance, depending on the specifications of a given emergency backup generator, compliance with the NFPA 110 recommendations could result in a total of 24 hours of load testing – only a four-hour difference with a relatively small diesel emissions output (NFPA, 2019; Pedersen et al., 2019).

Critics of the proposal may observe that agencies can simply elect to upgrade their current in-use emergency backup generators and take advantage of the more lenient testing standards applicable to "new" generators with lower emissions (NFPA, 2019). However, this is not a practical solution since upgrading costs roughly \$100,000 and agency representatives have reported long delays before these generators are received and installed (Carlson, 2019).

Water utilities are among the "first responders" to fire emergencies. Firefighters and citizens depend on continuing water services – both to protect property and for drinking supplies. Thus, water utilities urgently need reliable backup sources of power during these emergencies to ensure sustained water supply. The proposed revisions, also supported by 30 water agencies (Pedersen et al., 2019), would enable those entities to be more fire resilient in the short term.

4 Planning

4.1 Introduction

A successful regional wildfire management plan will identify regions within a watershed that are most vulnerable to wildfires in order to allow agencies to properly focus time and resources on restoring those regions. The complexity of developing a management plan requires a high level

of coordination, collaboration, and communication between agencies and groups with varying jurisdictions and spheres of influence. Existing legislation provides neither guidance for collaboration nor suggestions for plan creation.

Existing legislation includes requirements for collaboration between different groups, but this legislation rarely addresses collaboration between more than two parties. For example, Assembly Bill 2551 (Wood) authorizes private property owners to work with public agencies, like counties, to develop and implement prescribed burns. Through SB 901 (Dodd), the California Public Utilities Commission is required to enter into a memorandum of understanding (MOU) with the Department of Forestry and Fire Protection (CAL FIRE) requiring wildfire mitigation plans of electric utilities. However, legislation is critical. There is still a need for better state guidance on how to approach planning processes between broader groups like Community Wildfire Protection Plans (CWPPs), water districts, Regional Water Quality Control Boards, CAL FIRE, counties, air district boards, private landowners and tribes.

Although the Healthy Forest Restoration Act of 2003 (HFRA) resulted in CWPPs for many California jurisdictions, these CWPPs vary greatly between counties. State guidance on CWPP

Recommendation F: Expand legislation to require state guidance and public workshops to incentivize multi-stakeholder planning, in alignment with IRWM plans described in Recommendation B, in areas prone to wildfires by offering facilitation services, robust planning tools, technical assistance and funding for capacity building and collaboration.

development (Community Wildfire Protection Program Task Force, 2008) is not sufficiently detailed to give direction from which to start their plan, including who to bring to the table, the level of detail that would help them, and re-evaluation triggers. The state should hold

public workshops and expand state guidance for CWPP development. Once CWPPs are developed, these plans should be incorporated, discussed or referenced in Integrated Regional Water Management (IRWM) plans to expand the implementation activities in the CWPPs to the regional scale of an IRWM region in alignment with Recommendation B.

4.2 Facilitation Services

Building trust is a critical step in establishing long-lasting and successful multi-stakeholder collaborative processes. Often groups or agencies that have not historically worked together may have a difficult time trusting one another which can lead to a lack of transparency, including hesitation in sharing data, and can slow or halt a project. Having access to third-party facilitators allows participants to enter the discussion and planning process equally and can ensure a neutral party is helping facilitate an understanding of a common goal and the appropriate steps to accomplish that goal.

State agencies should follow the example of statewide planning processes like the Sustainable Groundwater Management Act and the IRWM program by developing a clear and implementable framework for integrated wildfire and watershed planning. As described in Recommendation B, IRWM plans should be expanded to include a wildfire and water management plan standard and priority projects to address wildfire regional and inter-regionally (between regions). State guidance should be developed to align and be incorporated into existing programs, such as IRWM, or planning processes, such as county land use management plans. This state guidance should clarify which stakeholders should be invited to the planning process, provide deference to which formation structures would be most helpful for a given region (e.g. Joint Powers Authorities, MOUs, etc.), identify data and tools stakeholders can use, and provide examples of successful multi-stakeholder wildfire/watershed collaborations (Headwaters Economics, 2016).

4.3 Data and Tools

Data and tools available for planning, including the ones proposed in Recommendation G, should guide stakeholders to select best management practices that ensure high water quality and supply reliability. The following two areas of available information could support the development of a CWPP, Timber Harvest Plan (THP) or a regional IRWM plan that includes a wildfire and water plan standard:

1. Catalog the contaminants of concern that could result from wildfire and their relationship to fire burn severity; and
2. Categorize the tools available to determine likelihood of system damage (identifying the least detailed and easiest to obtain tools versus the most complicated tools).

The stacked grid layers in **Figure 4-1: Example Data Categorization** represent available data types that link wildfire risk and water system impacts. Links between burn severity and likely contamination are primarily defined in research publications; however, no single website lists relevant data. Critical information can only be obtained currently by searching through federal and state websites.

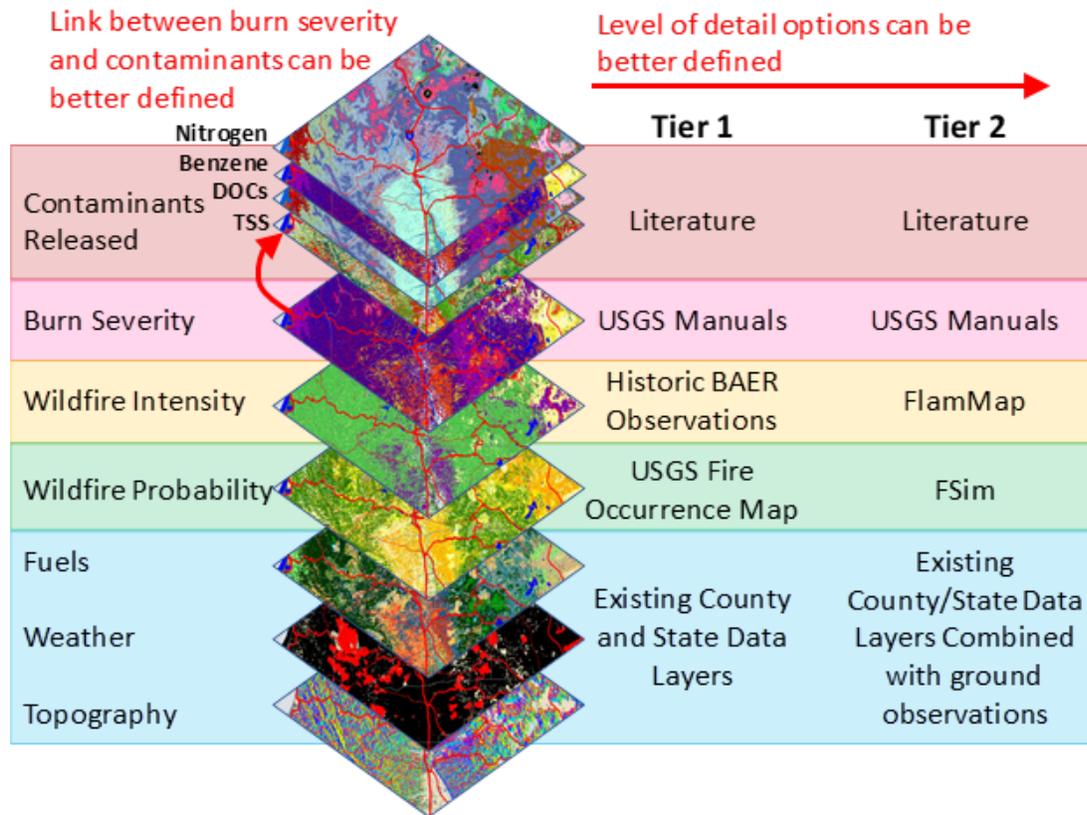


Figure 4-1: Example Data Categorization

In addition to clarifying online data and providing public workshops, facilitation services, and training on publicly available tools, state technical assistance can help stakeholders interpret results and best utilize data. (Graphic created by report authors).

4.3.1 Contaminants of Concern Database

Contaminants could be linked to burn severity within a database such as the U.S. Geological Survey's (USGS's) LANDFIRE program. A single additional grid layer for each contaminant would allow a user to click on a given cell to see the wildfire regime, burn severity and contaminants released without navigating to research papers. Grid cells in the headwaters would show an increased concentration of sediment, as well as high levels of nitrogen and dissolved organic carbon, which reacts with water purification chemicals to create toxic disinfection byproducts (American Chemical Society, 2018; Hohner et al., 2019, 2019). Burned soil also generates high concentrations of iron, arsenic, manganese and nickel (Burton et al., 2016).

Grid cells close to cities would show increased benzene and building materials. Prior to database setup, it would be beneficial to clarify the deliberated (Kavanaugh, 2019) effects of pyrolysis and benzene contamination, as well as the approximation of sediment migration pathways (Grim et al., 2019; Kean et al., 2019; Lancaster and Oakley, 2018).

4.3.2 Planning Detail

Decision-makers have many tools available to them but need a clear understanding of their purpose and use. Easily accessible websites that are intuitive to use should include data that portrays wildfire risk (CAL FIRE Fire Hazard Severity Zone Maps, USGS FireDanger Viewer) and historic wildfire perimeters (CAL FIRE, 2019b; USGS, 2019a, 2019c). The National Fire Danger Rating System (NFRDS) vegetation fuel map covers the lower 48 states at 1-kilometer resolution, while the USGS LANDFIRE site provides data at 30-meter pixels (USGS, 2019b). Weather measurements including wind conditions, storm types and historic precipitation drive wildfire probability and are publicly available from the Remote Automatic Weather Stations (RAWS), the National Oceanic and Atmospheric Administration (NOAA) and the California Data Exchange Center. The National Renewable Energy Laboratory and WindNinja also provide prevailing wind direction.

Models are necessary to determine region-specific details. Several agencies (Marin County Fire Department, 2016; San Diego County and Rohde and Associates, 2016) have created their own

fuel maps and established models to yield higher resolution forecasts. The Fire SIMulation system (Fsim) has been used to determine the probability that a given landscape grid cell would burn (Dillon et al., 2014). FlamMap and FlamMap5 (Finney, 2006) simulate potential wildfire behavior characteristics, including fireline intensity, which can be used to map burn severity. Private models also likely simulate events with wildfire ignition and spread. STOP:

However, a state website should be developed and incorporate updates to weather patterns, including atmospheric rivers that influence wildfire patterns (Albano et al., 2017), and NOAA climate change models (California Energy Commission, 2019; Crockett and Westerling, 2018).

4.3.3 Technical Assistance

State provided technical assistance services would help increase local capacity and resilience. Services can include facilitating workshops or training on how to use data, tools or modeling; supporting local and regional IRWM groups through the process of developing wildfire vulnerability assessments, or general training about how to become involved in the wildfire and watershed planning process, in alignment with Recommendation B. This is particularly important in supporting the planning participation efforts of underrepresented groups like tribes, disadvantaged communities, rural communities, unincorporated communities or any other group that may not have the technical capacity, staff or funding to meaningfully engage and participate in wildfire and watershed planning (U.S. Department of the Interior, 2001).

4.4 State Guidance with Planning Roadmaps

IRWM plans that address wildfires should be comprised of projects to be implemented at a future time. However, state guidance could better frame when to reevaluate strategies prior to the next wildfire catastrophe. For instance, changes to fuel composition of priority areas should be identified for treatment and further monitoring to consistently conduct a reevaluation.

- **Sociopolitical Factors:** New development or changes in population density may require the engagement of new stakeholders.
- **Changes in Science:** As science changes and advances, there will be, a better understanding of contaminants in relation to burn severity. More accurate sediment flow

models will also become available and should be incorporated into the planning for wildfires.

- **Changes in Road Access:** Installation or improvement of roads or new permitting in different locations will improve access to priority areas.
- **New Regulations and Recommendations:** Updated research on desirable tree-stand density (Santa Ana Watershed Project Authority [SAWPA], 2014) and vegetation near power lines (North American Electric Reliability Corporation, 20019) could provide opportunity to reevaluate land management strategies.
- **Extensive Urban Development:** Construction of new water lines and a larger urban footprint could impact wildfire planning in the wildland-urban interface zones.
- **Wildfire Occurrence:** Wildfire could lead to conversion of existing vegetation (Pedersen et al., 2019; SAWPA, 2014), which should be incorporated into planning.

4.5 Funding

It is critical to involve local agencies and stakeholders in the planning process and, as is outlined in Recommendation B, IRWM should be expanded to allow for regional and interregional collaboration. Especially in the case of a shared resource like forests or water supply, where collective action is needed to manage sustainably, the involvement of affected stakeholders is critical to successful plan implementation. Diverse stakeholders bring a wealth of information to the table, both in terms of data and experience. By increasing the level of understanding of regional issues and fostering collaboration to identify potential problems and solutions, stakeholders can mutually agree to future implementation projects and activities (International Association for Public Participation, 2018). State agencies can support stakeholder engagement in planning processes by encouraging regions to participate in the Forest Management Task Force and by funding the following incentives (Dobbin et al., 2015):

- Subsidize participation or provide travel stipends,
- Host public workshops to keep the public consistently informed and take proposals to the public before decisions are made,

- Provide interpreters at all public meetings and translate all materials into threshold languages,
- Notice all public meetings and provide meeting materials before each meeting, and
- Ensure that valuable input gleaned at meetings and public workshops is meaningfully considered and incorporated into wildfire and watershed management plan design and implementation.

4.6 Conclusion

Existing legislation provides funding for fire prevention, watershed restoration and fire emergencies, but additional resources are needed for increased capacity building in planning processes – a critical missing piece. Wildfire and watershed planning touches on multiple issues, thus it is important that the state develop clear guidance on holistic planning processes and financially invests in the success of these efforts through offering technical assistance and other financial planning support. CWPPs do not adequately address wildfire and watershed management from the regional watershed scale that is necessary. In order to better improve wildfire management processes, state agencies should invest in supporting multistakeholder collaboration building on IRWM planning (Recommendation B) and improving access to necessary data tools.

5 Implementation

5.1 Introduction

Over the past century-and-a-half, Californians invested heavily to create one of the largest integrated water infrastructure systems in the world. This infrastructure manages floods, stores water for beneficial use and conveys water from the relatively water-rich but less populous north to the arid and more populous south. However, despite the impressive infrastructure created, natural systems, especially mountainous and forested watersheds, still store and supply the majority of water in the state, primarily in snowpack and groundwater. Investing in the ecological services provided by forests and headwaters, sometimes referred to as green or

natural infrastructure, will be critical to adapt to climate change impacts and increased forest wildfire frequency and severity.

Much like California's water infrastructure, the structure and species composition of California's forests has changed largely due to human activity. Low to moderate intensity wildfires were a frequent occurrence in forested areas. However, over a century of wildfire suppression has created dense forests with higher fuel loads, making them more susceptible to larger, more severe wildfires. In addition to human management, droughts have contributed to bark beetle outbreaks and tree mortality, providing more fuel for future catastrophic wildfires.

Fires increase the susceptibility of watersheds to erosion and can impair water supplies. Storms following wildfires are known to impact local water bodies as burn areas are prone to greater rates of erosion, increasing the downstream accumulation of sediment in streams, rivers and reservoirs. In addition, severe wildfires have increased stormwater runoff and sediment generation has affected stormwater resources (Stein, 2009). The potential impacts from past, current and future wildfires on the quantity and quality of runoff are considerable and may greatly impact water used for domestic, agricultural and environmental purposes.

Forest and headwater management has emerged as a key activity in recent years, aiming to improve forest health, reduce wildfire risk and severity and maximize water supply and water quality. The long-term benefit of implementing these management actions has proven to outweigh the upfront costs. The "Mokelumne Watershed Avoided Cost Analysis" found that the economic benefit of forest and headwater management to be three or more times larger than the costs (Buckley et al., 2014). The economic benefit, types of management actions, funding availability and incentives, and opportunities differ depending on location and landowner type. As such, different solutions and complementary tools are needed for state, federal, and private lands. Such tools and illustrative multibenefit solutions are discussed in this section.

5.2 Best Management Practices Toolbox

Investing in the environmental benefits associated with forest management needs to be part of the long-term solution to California’s water and scarcity because forest vegetation has a major influence on the hydrology of a basin. While early regulatory efforts were focused on implementing best management practices (BMPs) for wildfire response and suppression, current regulatory decisions need to emphasize holistic strategies that will result in multi-benefit projects and programs while concurrently managing wildfire risk, a community’s sense of place, environmental protection, water supply management and water quality management. To help achieve this, the state Legislature should incentivize and promote forest management planning efforts that include targeted categories tailored to the agencies implementing a project. Once the probability of wildfire damage is known, the costs that an agency is willing to invest can be evaluated as a cost benefit, either due to fixing the problems ahead of time or if a wildfire has already occurred, after a wildfire.

Recommendation G: Task the California Natural Resources Agency with creating and making available a toolbox of proven forest management projects to allow local agencies flexibility in determining the best strategy to combat the threat of wildfire while improving forest and watershed health and resiliency.

Table 5.1 displays a management toolbox of planning, restoration and capital improvement actions for before, during and after a wildfire. As suggested in Recommendation A.2, if the California Natural Resources Agency (CNRA) has a lead role in the Forest Management Task Force (FMTF) in funding and implementing a regional consortium to connect federal, state, regional and local entities, this Forest Management Toolbox would help prioritize BMPs in projects for funding.

Table 5.1: Forest Management Toolbox

Item/Category	Action	Example
Power Outages	Undergrounding or hardening the grid	Undergrounding (burying) electrical lines is an option for limiting power outages during ‘red flag’ conditions.

Item/Category	Action	Example
	Generator Supply	Generator power delivery. Rolling power outages will affect water districts' ability to run their pumps and run facilities. There is a need for water districts to plan for backup power sources for longer periods of time, with backups to the backup source.
Vegetation Clearing	Pre-Fire	Shift in precipitation and temperature patterns may require lower tree density, from thinning and prescribed burns. The ideal tree density for water provision is a topic being studied.
	Post-Fire	Invasive plants often establish quickly after a wildfire. Post-fire restoration, including the removal of dead trees and invasive species, improves the health of local watersheds, thereby reducing carbon emissions and pollutants into local water bodies.
Slope Stabilization	Post-Fire	Reseeding native plants, replanting trees and shrubs to reduce erosion, landslide, and flood impacts.
Fuel Reduction (public land)	Tree Removal	Removing trees close to populated areas and transportation corridors to protect life and property. This can be aided by designating locations for future firebreaks.
	Tree Thinning	Selectively removing trees to prevent large and intense wildfires by reducing fuel loads.
	Timber Sales	Using private contractors to undertake vegetation clearances on public lands.
	Prescribed Fire	Also known as prescribed burns or controlled burns. It is the controlled application of fire under specified weather conditions to restore health to forests and watersheds and reduce the risk of wildfire
Fuel Reduction (private land)	Timber Sales	Using and incentivizing private entities to undertake appropriate vegetation clearance on private lands.
	Commercial Logging	Using private entities for vegetation clearance on private lands.
	Prescribed Fire	Also known as prescribed burns or controlled burns. It is the controlled application of fire under specified weather

Item/Category	Action	Example
		conditions to restore health to forests and watersheds and reduce the risk of wildfire
Habitat Restoration	Grasslands	Provide open habitat for natural firebreaks and groundwater recharge. Provide a public benefit.
	Meadows	Meadows absorb and hold water and release it later in the year when it is most needed.
	Shrublands	Typically, shrublands consist of dense wildfire resilient vegetation. Provides a natural firebreak and habitat for other species.
Streamflow Maintenance	Instream flows	Maintaining flows in streams in the summer months allows for riparian woodlands to retain more moisture, thus decreasing the ability for a wildfire to spread quickly.
	Recycled Water	Using recycled water to maintain creeks and streams allows urban areas to meet discharge regulations and maintain flows in winter.
Biomass Facilities	Energy Production/ Waste Reduction	Small diameter trees and woody vegetation has little value in a commercial marketplace. Biomass facilities allow for utility providers to provide electricity from a typically unused resource. Air pollution and transportation costs may be a concern for some communities.
Sedimentation and Debris Basins	Impact Mitigation	After a wildfire occurs, landslides and sedimentation become more likely. Infrastructure to combat these debris flows is necessary to protect life and property.
Water System Interconnectivity	Impact Mitigation	Water pressure needs to be maintained in a system when wildfires are near urban areas. Suggested improvements include interconnectivity to adjacent municipalities and intertie memoranda of agreement for emergency operations.
Road Improvements	Fire Access Roads	Access upgrades to wildfire-prone areas can drastically improve the effectiveness of wildfire managers in suppressing wildfires. Constructing fire roads in appropriate locations can help with future wildfire management. Construction must be done in a way that avoids erosion and sedimentation issues.

Item/Category	Action	Example
Planning	Fire Contingency Plans	Planning for wildfire is important in order to more quickly mitigate post-fire effects. A wildfire response plan should clearly identify appropriate agencies, their responsibilities and timelines before a wildfire occurs.
	Model Alternative Analysis	Provide what-if scenarios to local decision makers. These scenarios can help with fire-safe urban and rural planning and inform future development patterns.

5.3 Long-Term, Dedicated Funding

5.3.1 Background

Long-term, dedicated funding for forest and watershed management is needed to implement activities, like the ones described in Table 5.1, to restore the health and resiliency of our forests and watersheds. Unfortunately, current state funding vehicles for forest and watershed management, including periodic general obligation bonds and intermittent California Climate Investment (CCI) allocations (California Air Resources Board, n.d.), do not provide long-term, dedicated funding. Without dedicated funding, it is difficult to increase the pace and scale of this work. Both of these funding methods vary by timing and specific approval restrictions and are susceptible to periodic changes political priorities. The boom and bust cycle of bond funding may serve as an intermittent funding source for additional forest management, but is not a continuous appropriation to meet the commitment needed to manage forests, nor does it lend itself to the longer-term management required to maintain these investments (California Tahoe Conservancy and Sierra Business Council, 2019). Furthermore, these short-lived funding sources make it difficult to implement long-term, strategically planned landscape-scale forest management projects and programs and build capacity and collaboration to increase the pace and scale of headwater forest and watershed restoration.

Prior to 2016, state and federal spending on forest and watershed management was either consistent or declining in the amount allocated. Federal expenditures have slightly declined from \$80 million per year prior to 2010 to less than \$70 million per year after 2010. State expenditures during this time stayed consistent at near \$30 million per year. Meanwhile,

combined state-federal expenditures on active suppression was approximately \$2 billion per year, making active management a fraction of the amount spent on suppression (Public Policy Institute of California, 2018). With catastrophic wildfires in the most recent years, the divergence between investment in forest and watershed management and active suppression will likely continue, unless reform is taken.

Since becoming governor of California, Gavin Newsom has brought attention to the need for better forest and watershed management; however, he has not acted on the need for long-term funding. As an example, during his first week in office, Governor Newsom issued Executive Order N-05-19, which required CAL FIRE, in consultation with other state agencies, to develop a report with recommendations of the most impactful administrative, regulatory and policy changes that could prevent and mitigate wildfires (Executive Department State of California, 2019). While the final report stated “funding limitations constrain what can be achieved” in regards to forest and watershed management, it did not provide a roadmap for how to fund this management (CAL FIRE, 2019a).

Additionally, in Gov. Newsom’s 2019 State of the State Address, he directed a strike force to develop a comprehensive strategy report to address the destabilizing effect of catastrophic wildfires on the state’s electric utilities. One of the objectives of the report was to address how the state would “reduce the severity of wildfires through continued investments in wildfire mitigation, vegetation management and other strategies to reduce fuels” (Gov. Newsom’s Strike Force, 2019). The final report recommends that the state expand wildfire prevention activity by improving forest and vegetation management, accelerate fuel reduction projects on both public and private land, and train the workforce needed to increase the pace and scale of these projects (Gov. Newsom’s Strike Force, 2019). While the final report acknowledged the one-time, \$1 billion allocation of CCI funds to CAL FIRE through Senate Bill 901 for forest management

Recommendation H: Create a legislative strike force dedicated to developing long-term funding policies and mechanisms.

and fuel reduction, and the one-time allocation of \$20 million in block grants being managed by the Department of Conservation for

regional projects to improve forest health and increase wildfire resiliency, the report did not identify sources of funding to increase the pace and scale of forest management into the future.

5.3.2 Potential Funding Sources

This report does not recommend a specific source of funding, rather it outlines the potential funding sources for long-term forest management. Potential sources for a sustainable funding source include a continuously allocated CCI funding, dedicated general fund allocations, a public goods charge on recreational equipment, statewide public-private partnership investments, and a voluntary watershed assessment donation.

Dedicated, directed, and sustainable funding is urgently needed to restore the health and resiliency of the forests, watersheds, and communities. Therefore, Gov. Newsom should create a new strike force to develop a report with recommended policies for enhanced forest and watershed management, and recommendations on how to sustainably fund this management need. This report should be presented to a new select committee on water and forest management in the Legislature, which could include members of the Senate Select Committee on Wildfires. From this report, the Legislature should develop and implement policies that support an annual budget allocation specifically to fund forest and watershed restoration and management activities.

Continuously appropriated funding forest and watershed restoration and management out of CCI funds is a potential source of sustainable funding because these types of projects or activities contribute to reducing greenhouse gas emissions (California Tahoe Conservancy and Sierra Business Council, 2019). Creating a continual funding program within the CCI funding portfolio would increase the pace and scale of forest and watershed restoration activities through 2030, when cap and trade would have to be reauthorized by the Legislature (California Tahoe Conservancy and Sierra Business Council, 2019).

Debt service, including principal and interest payments, on existing general obligation bonds is paid from the state's general fund. Where an additional general obligation bond requires significant repayment from the general fund, the state could allocate continuous money from

the general fund each fiscal year that could be directed as annual funding for forest and watershed management activities (California Tahoe Conservancy and Sierra Business Council, 2019).

A tax on outdoor recreational equipment to fund land-based conservation, connectivity and wildlife conservation programs is implemented in multiple states (California Tahoe Conservancy and Sierra Business Council, 2019). Depending on the type of program, the tax could generate up to \$200 million annually (California Tahoe Conservancy and Sierra Business Council, 2019).

General obligation bonds will continue to be proposed for natural resources management. A wildfire and water resources general obligation bond will be an important funding discussion for 2020. Where general obligation bonds rely on the general fund for repayment of both principal and interest, additional bond funding could support other long-term funding sources.

Public-private partnerships could be developed to implement projects in forested areas to involve different stakeholders to be able to contribute to improved forest management. One example that has been successful regionally is the Blue Forest Group public-private partnership, where private entities are able to develop investment strategies and public agencies can help pay off the investments over time at a low interest rate. This model could be elevated to the state level to support statewide forest restoration work.

A public goods charge (PGC) or watershed assessment is a fee applied to all water users to fund public-interest programs related to water utility service (Ajami, 2012). Multiple groups have recommended that a PGC be placed on water, similar to how it has been included on electric bills since 1997 (Ajami, 2012). Whereas electricity is sometimes managed by investor-owned utilities, water is considered a publicly owned utility, which makes charging an assessment or fee more difficult due to the constitutional protections of public entities. A PGC may be seen as a sustainable source of funding that could be allocated to projects that restore watershed health, including reducing wildfire risk, however a PGC has thus far been politically and administratively infeasible. A PGC requires a two-thirds vote in both houses of the Legislature and presents a burdensome approach for implementing a statewide assessment by requiring thousands of local

entities to retrofit billing systems to charge customers a PGC that has to be transmitted to the state to redistribute to local entities. A voluntary watershed assessment donation could be a part of a public outreach or awareness campaign as is outlined in Recommendation I. A voluntary donation could be collected statewide from private or public entities or individuals that contributes to a statewide investment fund for ongoing forest management projects.

5.3.3 Potential Funding Distribution

CNRA can coordinate funding among different state agencies and departments to best meet the holistic goals of forest and watershed restoration, as the proposed lead in overseeing the FMTF regional consortium in Recommendation A.2. The agency has already been given the responsibility to coordinate the development of the Water Resilience Portfolio, in collaboration with the California Environmental Protection Agency and the California Department of Food and Agriculture. The governor's Executive Order N-10-19 identified the need to use natural infrastructure such as forests and floodplains to build a climate-resilient water system (State of California Water Resilience Portfolio Initiative: Help Shape California's Water Future, n.d.).

5.3.4 Recommended Uses of Funding

Dedicated funding from any potential funding source should be allocated to fulfill the following objectives:

Accomplishing Goals of State Plans - Healthy forests and watersheds are highlighted as a critical foundation for achieving the goals set forth in multiple state plans, and future spending should maximize statewide benefits (Taylor, 2018). Dedicated funding should contribute to achieving wildfire risk and water supply goals in the California Forest Carbon Plan, California's 2017 Climate Change Scoping Plan, California 2030 Natural and Working Lands Implementation Plan, California Water Action Plan, Safeguarding California Plan: 2018 Update, and the forthcoming Water Resilience Portfolio.

Landscape-Scale, Long-Term Planning - State planning and policy documents call for restoring forest health and resilience through collaborative efforts at a landscape scale, such as through the Integrated Regional Water Management (IRWM) planning process as described in

Recommendation B and in alignment with the Forest Management Toolbox proposed in Recommendation G. Dedicated funding should be used to develop more efficient planning and environmental review processes to implement large-landscape forest and watershed management projects on public and private lands, including the integration of IRWM plans, Community Wildfire Protection Plans and Timber Harvest Plans (Recommendations B, C, and D). Collaboration between public and private stakeholders will be necessary in order to realize these projects.

Funding can also be used to implement projects that are part of hydrologic-scale coordination programs, including the Sierra Nevada Watershed Improvement Program, the Regional Forest and Fire Capacity Program and the Tahoe-Central Sierra Initiative.

The French Meadows Project - How the State Has Helped Fund Forest Restoration

The French Meadows project is a multipartner restoration and fuel reduction project focused on forest land in the Sierra Nevada Mountains. The project was catalyzed by the aftermath of the destructive 2014 King Fire, which burned approximately 97,000 acres and damaged important water supplies for the Placer County Water Agency (PCWA). The King Fire resulted in erosion and millions of dollars of annual impacts to PCWA reservoirs, hydropower infrastructure and water treatment costs.

The project received funding from multiple sources, including the U.S. Forest Service, Placer County, PCWA, The Nature Conservancy, beverage companies, CAL FIRE, National Fish and Wildlife Foundation and the Sierra Nevada Conservancy. State agencies contributed almost 60% of the total funding. State funding was significant in financing the planning process, which is often harder to find funding for than implementation, and was a significant part of the implementation phase funding as well. Without funding by state agencies, this project might not have been successful.

Project work remains ongoing and ultimately aims to restore and reduce fuels on approximately 28,000 acres above the reservoir. This will be achieved through mechanical thinning, managed burns and aspen and meadow restoration. Although it covers only a small area within the Sierra, French Meadows provides a good example of how partners can collaborate on private and public land to implement multibenefit projects.

Implementation and Maintenance of Various Project Types - Dedicated funding is needed for implementation and long-term maintenance of projects, including the ones outlined in the toolbox, to ensure that the benefits of these projects last into the future. Allocating significant investments today will prevent higher costs in the future, even when long-term maintenance costs are taken into account (Buckley et al., 2014).

Research and Monitoring – State agencies should align research and monitoring with actions so that they can adapt their forest and watershed management activities as conditions change, as is proposed in Recommendation F. Dedicated funding should be used for baseline studies, post-project monitoring, equipment purchases and data-sharing to demonstrate the benefits of various treatment methods on water supply and quantity and reduced wildfire risk.

Capacity Building - Building capacity is essential for implementing forest and watershed restoration and management activities, but local capacity is often not adequate to conduct them (Sierra Nevada Conservancy, 2019). To bring California’s forests and watersheds to holistic health, communities will need to be supported in order to address their urgent needs, plan for the future, develop organizational capacity, and envision new tools and partnerships, as is described in Recommendations B and F. Dedicated funding should be used to assess the needs and opportunities relating to workforce and organizational capacity necessary to carry out restoration activities and support forest restoration workforce development and training. These funds can also support the continuation and expansion of technical assistance to community organizations, such as grant application development, training in grant writing, environmental compliance, and planning and project management.

Biomass Utilization - State planning and policy documents recommend utilizing woody biomass from forest management projects for bioenergy production and innovative wood products (CAL FIRE, 2019a; CAL FIRE et al., 2018; California Air Resources Board, 2017, 2017). Biomass utilization supports forest restoration work and job creation in communities near forests. More infrastructure is required to remove the biomass that harms forest health, including fuel load and dead trees, and process it to produce bioenergy and innovative wood products, as well as create jobs. Dedicated funding can be used for such biomass infrastructure,

including bioenergy and wood product facilities, long-term contracts for the transportation of forest biomass from federal and state lands to processing facilities and assessment of the needs and opportunities related to wood/biomass infrastructure necessary for restoration activities.

5.4 Conclusion

Restoring forest and watershed health and resilience must be a top state priority because restoring health and resiliency will require long-term commitment, funding and management, and they provide benefits and services that affect Californians statewide. While accomplishing these goals requires cost-sharing and interinstitutional collaboration by federal agencies, local governments, nongovernmental organizations and other stakeholders, the state at large also has a responsibility to share in the funding of forest health and make decisions about the allocation of funds and duties among its agencies. Dedicated funding from the state for headwaters forest health and watershed management activities is essential to significantly increase the pace and scale of restoration, protect California's forests, watersheds, water supply and quality and communities from the impacts of drought, wildfires and climate change and position the state government as the leader in these efforts.

6 Education and Outreach

6.1 Background

Public attention in California is focused on wildfires. While most of the public is keenly aware of the growing threat of wildfires, there seems to be a lack of public knowledge about how wildfires can impact water supply quantity and quality throughout the entire state. Fewer than half of Californians know where their water comes from, lower than any other Western state (Water Foundation, 2017). Now, while there is heightened attention on the wildfire threat throughout

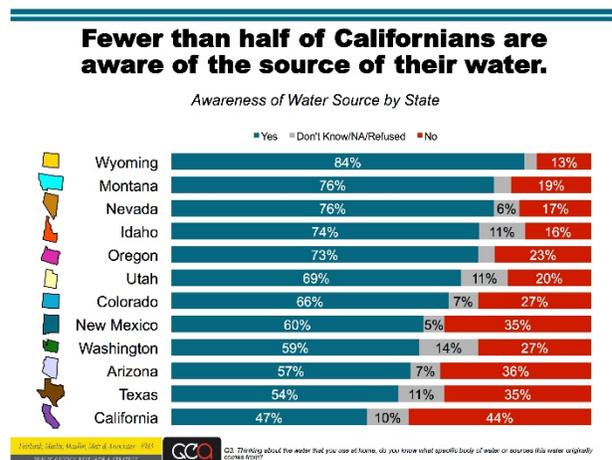


Figure 6-1: Water Awareness Poll

A Fall 2017 poll run by the Water Foundation found that Californians have the lowest awareness of their water sources of any Western state (Water Foundation 2017).

the state, a public outreach campaign is needed to focus on how wildfire and watersheds are connected by linking water supply reliability to watershed management. People who live in urban areas need to understand where their water comes from and the risk to all of California's water supply if our forests are not managed back to a healthy state. Additionally, the public has been taught for decades to believe that we need to do everything possible to prevent forest wildfires, and that forests should be allowed to grow naturally. However, while current science has changed that thinking, public service campaigns have not. Current outreach and educational messaging fail to communicate to the general public what healthy watershed and forest management looks like. For example, the Smokey Bear Wildfire Prevention campaign that was created in 1944, which is administered by the U.S. Forest Service, the National Association of State Foresters and the Ad Council, still emphasizes human prevention of wildfires. Wildfire prevention messages center around Smokey's Five Rules of Wildfire Prevention such as, "never play with matches or lighters" and "make sure your campfire is completely out before leaving it." These are good tips for people to know, but do not adequately communicate the importance of healthy, resilient forests and watersheds, or the fact that fire is a natural process in many California forests. There is no current campaign to share the fact that wildfire suppression efforts of the past several decades have created overgrown forests, flush with ladder fuels, primed for a megafire. While the Smokey Bear Wildfire Prevention campaign is still important, the public also needs to hear critical messaging about where their water comes from, the connection between wildfire and water and how wildfires affect their municipal water supplies.

6.2 Statewide Healthy Watersheds Outreach and Education Campaign

6.2.1 Messaging of a Successful Public Education Campaign

This paper does not propose a specific campaign, messaging or tactics, as the expectation would be for professional communicators to develop those strategies and tactics. However, the themes that are

Recommendation I: Develop a public outreach campaign focused on healthy watershed management and the connection between wildfires and water supply.

worthy of further consideration for statewide campaigns can be divided into two categories: Connecting people with their water source and understanding what makes a healthy forest.

Potential messages for statewide campaigns:

Connecting People with their Water Source:

- Ecological, economic, and health impacts. Wildfire destroys and degrades forests, contaminates water supplies, releases climate-warming greenhouse gases, puts lives and property at risk and negatively impacts local forest products and tourism economies.
- Benefits of forests. Healthy forests maintain air and water quality, control flooding, provide opportunities for recreation, and support biodiversity and rural economies.
- Wildfire affects everyone. The megafires of recent years are contaminating water sources with toxic chemicals, reducing water supply by crowding reservoirs with sediment and debris, and costing water providers millions of dollars in cleanup, which must be passed on to customers via higher water bills.

Understanding What Makes a Healthy Forest:

- Past efforts, while well-intentioned, were actually harmful. We have literally loved our forests to death. Although well-intentioned, the “hands-off” approach to forest management of the past several decades has proven catastrophic, and now our communities, infrastructure and water supply are at significant risk.

- Current condition of our forests. Many forests in California are now critically unhealthy. Forests, once characterized by large, widely spaced trees and beneficial low-to-moderate severity wildfires, are now overrun with vegetation that is not wildfire-resilient, including dense thickets of small trees and brush that act as ladder fuels in overstocked forests.
- The risk is higher than ever. California is now at great risk of high-severity wildfires due to wildfire suppression and historic timber harvesting practices, exacerbated by climate change.
- A healthy forest requires active management. Projects to restore resilience to the watersheds of California could include clearing underbrush, thinning smaller trees, controlled burning, reforestation and meadow restoration, among other efforts.

6.2.2 Campaign Goals

The goal of a robust educational campaign is to increase public understanding that while wildfires may be miles away, the devastating effects that they have on watersheds such as flooding and erosion can have both short-term and long-term impacts on local water supplies up and down the state. Some of these impacts include increased water treatment costs, the need for alternative water supplies and diminished capacity in reservoirs (Smith et al., 2011). A successful campaign would garner public awareness and support for funding to preserve and protect the state's watersheds before and after a wildfire.

Elected officials and key decision-makers need to be better equipped to help a diverse group of stakeholders, including water agencies and members of the public, stay informed and agree on approaches for community development, wildfire and watershed management as well as education. A statewide educational campaign would increase public understanding about where water comes from and how wildfire affects that supply. As a result, the campaign would build political will among elected officials and their constituency to support funding initiatives that promote healthy watersheds and forests.

6.2.3 Structure of a Successful Public Education Campaign

A successful public education campaign will require a strong agency structure and avenues for two-way collaboration from the state to local level. Raising public awareness of the importance of healthy watersheds and forests for the stability of all Californians' water resources will need to cover issues from forestry to infrastructure to endangered species and beyond. The California Natural Resource Agency (CNRA) would be an effective home for the campaign, as it is the parent agency to many of the departments that cover these issues, and that would be consistent with recommendation A.2, expanding CNRA's leadership role in forest health responsibility. CNRA, through its departments, boards, conservancies, councils and commissions, has existing relationships with local agencies, public utilities, academic institutions and community-based organizations. It should use these networks to establish processes for input from the local level and dissemination to the local level.

There are many successful examples for building a compelling and far-reaching public education campaign from the water conservation space. Core to all of them is a powerful, emotional message to capture public attention. The Save Our Water Campaign (SOW) (Association of California Water Agencies, n.d.), created in 2009 by the Association of California Water Agencies and the California Department of Water Resources, provides a useful model for the structure and outreach methods that could be used by a campaign to raise public awareness around the wildfire/water nexus. SOW provides customizable educational materials on water conservation and partners with local agencies and community-based organizations to reach constituents.



Figure 6-2: Sample Save Our Water Campaign Ad

(Association of California Water Agencies, n.d.)

SOW and other public education campaigns leverage diverse media, such as video, photos, TV and radio spots, newspaper ads, billboards, fact sheets, social media, infographics, websites and owned and earned media to reach constituent audiences. CNRA can further partner with existing public-facing organizations and avenues for delivering campaign messages, including public school curricula, Boy and Girl Scouts of America, 4-H, community events, service organizations and community-based organizations.

Another recommendation for outreach is for an educational organization, such as Water Education Foundation's Project WET (Water Education for Teachers) or the University of California Cooperative Extension to develop curriculum specifically about the water-fire nexus. Such programming could be designed to meet the Next Generation Science Standards for California public schools and/or shared through educational programs such as 4-H.

6.3 Campaign Strategies

6.3.1 Funding

The state should pursue diversified funding sources to support the campaign, both to provide sustainable funding and to create broad buy-in. State agencies, public utilities, private insurance

companies, water utilities and developers all stand to benefit from greater public understanding of the connection between responsible forest management and healthy watersheds. This broad benefit can be leveraged to secure a permanent funding source. The state should explore a continual appropriation of general funds and reallocation of resources within the National Resource and Environmental Protection (NREP) budget to provide a consistent funding stream for an effective outreach campaign. Increasing the amount allocated to the Forest Health and Fire Prevention Program under the Cap and Trade Discretionary Spending or to the Drinking Water Program under the Drought Response and Drinking Water Funding would allow an administering agency (i.e., the Department of Forestry and Fire Protection or the State Water Resources Control Board) to plan, on an annual basis, an effective outreach strategy. Allocating funding within the NREP budget would align with similar outreach efforts such as SOW, which has been successful in educating the public regarding the multiple benefits of water conservation and use efficiency.

6.3.2 Strategies for Reaching Diverse Communities

All parties involved in the campaign must work to ensure that all California water users are reached effectively. This will require dedicated outreach to and collaboration with diverse communities. All materials should be provided in a variety of languages relevant to community demographics. Campaign organizers should make use of demographic information to assess what language needs exist in different communities and ensure that materials are provided in all languages used in that community.

The campaign should also work with community organizations and local agencies to understand what communication tools will be most appropriate for a given community. For example, areas with poor internet access may require a greater focus of mail-based or door-to-door education resources. Measures can also be taken to make educational materials financially accessible to local entities at any resource level. As was done for SOW, the state can provide “print-ready” and “distribution-ready” materials that local entities can use at minimal cost. These resources can provide tailored information at the regional level, for example, by specifying the water sources, wildfire risks, rebate programs, etc. for communities in a region.

6.3.3 Strategies for incorporating best available science and information

The public education campaign should be grounded in the best available data, science and information. Core to this will be: 1) processes for scientific and expert engagement and oversight; 2) robust systems for assessing public education needs; and 3) a commitment to transparency and access to data and information.

First, expert engagement and oversight can be achieved by establishing an external review board to vet all educational materials and partnering with existing cooperative extension programs to develop and update the educational materials. Secondly, CNRA will need to establish a regionally resolved understanding of the general public's level of knowledge on where their water comes from, what a healthy watershed looks like and how wildfire impacts their water. For example, the Texas Water Development Board, prior to its statewide Water IQ public awareness program, produced a report including a quantitative survey, focus groups and in-depth interviews to assess public awareness of water issues (Texas Water Development Board, 2016). CNRA should also work with community-based organizations to understand the demographics and needs of constituent communities and optimize strategies for reaching them. Lastly, an important component of the public education campaign should be making data and science on wildfire and water issues more publicly accessible. This will enable citizen science initiatives, which have been identified as a strong strategy for building public awareness (Bonney et al., 2009) and increasing public trust in campaign content, to be part of the campaign. Creating processes for soliciting stakeholder feedback throughout the campaign and providing transparent, accessible tracking of source information for all public engagement materials will also increase public trust and buy-in.

7 Conclusion

Based on the analysis conducted in this report, several points emerge as opportunities for action to improve the state's resilience against wildfires and their impacts to our forests and watersheds.

- Increased cooperation between and among state, regional and federal agencies is imperative.
 - Regional water boards, as well as the State Water Resources Control Board, ought to participate in the Department of Forestry and Fire Protection (CAL FIRE) wildfire incident command as well as post-fire response activities by the California Office of Emergency Services (Cal OES) to monitor water quality issues that might arise.
 - CAL FIRE should collaborate with federal wildland fire agencies to coordinate prioritization, funding and implementation of post-wildfire actions.
 - The California Natural Resources Agency (CNRA) should replace CAL FIRE as the primary agency in overseeing forest health grants, the Forest Management Task Force, and the development of a regional consortium to serve as a proactive initiative that funds and bolsters forest and watershed health projects.
- Incorporation of a water and wildfire plan standard in Integrated Regional Water Management Plans, including Timber Harvest Plans (THPs) and Community Wildfire Protection Plans, with forest management activities included for regional scale projects and future funding.
- Long-term monitoring, planning and funding is essential to deal with chronic threats to forest and watershed health, as well as post-wildfire complications.
 - The state should delegate the CNRA to create a toolbox of proven forest management projects, which will allow local agencies the flexibility to determine the best strategies to combat the fire risks and improve the health of watersheds.
 - CAL FIRE and Cal OES should be tasked and funded to play a leading role in post-wildfire response activities for up to three years post-wildfire, in coordination with regional water boards.
 - Legislature should develop a legislative strike force to develop policies related to the potential funding sources and mechanisms for on-going forest management restoration.
- Processes for forest health project applications should be streamlined and regulations should be eased when and if needed for immediate implementation.

- Revising air quality standards for water agencies is needed, particularly during a state of emergency.
- The THP process should be streamlined and exemptions granted to align with wildland management goals and needs.
- State agencies should offer support tailored to the needs of water agencies in times of emergencies and for emergency preparations, such as facilitation, stipend, technical assistance and trainings.
- Policymakers and stakeholders should rethink messaging around wildfires and water.
 - Connecting people with their water sources is one component of this new communication strategy. Harmful effects of wildfires on water sources and livelihoods, such as contamination, flash flooding and mudslides, should be combined with the message that healthy forests can prevent these incidents.
 - Importance of forest health should be further emphasized through biodiversity, rural economy and recreation-oriented messaging to keep the issue relevant to the layperson. The financial costs of wildfires in terms of damage to water systems, increased rates and cleanup costs, should also be communicated in connection with forest health.
 - Forest management practices that have often met opposition from the public, such as prescribed burning and thinning, should be explained more clearly. The public should be made aware of the trade-offs of not managing forests, combined with the negative impacts of climate change on forest health.

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