

The Costs of Wildfire in California

An Independent Review of Scientific and Technical Information



EXECUTIVE SUMMARY

A Commissioned Report prepared by the
California Council on Science and Technology



CCST
CALIFORNIA COUNCIL ON
SCIENCE & TECHNOLOGY

A nonpartisan, nonprofit organization established via the California State Legislature
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Executive Summary

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Executive Summary

California's 2020 fire season, still underway in late October as we go to press, has been a clarion call for the State. Although wildfires are a natural and integral part of California's landscape, the record-breaking losses of the past several years have illustrated the increasing destruction and complexity of fire disasters, and have highlighted tensions between short-term responses focused on firefighting and longer-term strategies required to strengthen mitigation and resilience. Absent a reorientation of California's approach to wildfire, these alarming trends are likely to worsen. However, there are important steps California can take as a state to minimize the destructiveness of wildfires and their attendant costs.

This report, undertaken by the California Council on Science and Technology (CCST) and funded by the Gordon and Betty Moore Foundation, challenges the assumptions underlying current fire management policies and proposes a novel framework for understanding the total cost of wildfire in California. The results of this study suggest opportunities for policy makers to improve the effectiveness of wildfire management in California by enabling regional approaches, increasing investments in mitigation and resilience strategies, and accounting for the cumulative public health impacts of exposure to multiple fire events.

This report summarizes the state of knowledge regarding wildfire losses and their associated costs across key sectors. It highlights both known costs of wildfire and where research suggests the State should be concerned, but data are inadequate to fully estimate the costs of societal losses. Accurately quantifying societal losses will require substantial additional data collection and research in a number of disciplines. The costs of wildfires may be cumulative (e.g., accruing over time and multiple fire events), indirect (e.g., via impacts of smoke exposure on health or post-fire water quality), and difficult to quantify.

A key finding from this study is that a comprehensive statewide calculation of wildfire costs is not possible with currently available data. Moreover, the costs associated with unquantified categories of loss (e.g., health impacts, loss of ecosystem services) may likely exceed the reported costs. For example, federal and State firefighting expenditures exceed \$3 billion per year; utility wildfire prevention and mitigation costs are approximately \$5 billion per year; whereas the insured property losses in three out of the past four years have exceeded \$10 billion per year. Evidence suggests health impacts due to wildfire smoke represent a substantial portion of the total costs to the State, and that there are impacts from the interaction of wildfire smoke and COVID-19. Yet these additional billions of dollars in costs due to wildfire smoke impacts are not consistently tracked or factored into policy planning.

New standardized methodologies are needed to assess wildfire costs as accurately as possible. Given the magnitude of wildfire losses and of spending to prevent and suppress wildfires, more systematic assessment of these costs is urgently warranted. We acknowledge

that this additional proposed research will take time to complete, and that the State of California is likely to take policy actions in the interim. Where possible, we have articulated recommendations that can be acted upon immediately.

Overview

Conclusion ES.1. *Wildfire in California presents a complex management challenge, as natural fire regimes—long-term spatial and temporal characteristics of wildfires—are increasingly altered by population growth and the growth of the developed footprint.*

Wildfire in California can be both beneficial and damaging. It results from a complex mixture of environmental and biological variability, forest and land management, land use development policy, building codes, electric utility policy, and fire suppression. Climate change is an increasingly important factor that amplifies and intensifies wildfire impacts. California is home to a rich diversity of ecosystems, each with their own distinct fire regime. Increased fire frequency in chaparral ecosystems in Southern California is leading to conversion from evergreen woody shrublands to highly flammable grasslands, whereas fire suppression in California's forested ecosystems is leading to a greater risk of high-severity fires. These changes create the potential for catastrophic events that extend beyond the wildland urban interface and into suburban communities. Greater human activity in wildland regions and in the wildland urban interface has also increased wildfire risk. The overall growth and expanded spatial footprint of California's population has increased fire frequency while also increasing the economic value at risk, thus raising the total losses from wildfire. The history of fire management in the U.S. teaches that we will be more successful as a state if we address wildfire policy with this ecological and regional context in mind rather than a one-size-fits-all, state-wide approach.

Recommendation ES.1. *To design contextually appropriate wildfire policy, policymakers must remain attuned to how climate change, land use change, and other human impacts may impact wildfire differently across the diverse regions of the State.*

Conclusion ES.2. *While wildfire suppression, utility investments, and structure losses are well quantified, understanding the scale of other losses and the cost—and cost effectiveness—of other mitigation and prevention activities will require the measurement of impacts that may range well beyond the geographic boundaries of fire events.*

Two relatively well-understood costs of wildfire in California are the cost of fire suppression by firefighting agencies and of ignition prevention by electric utilities. We find costs for fire suppression and most utility investments in ignition prevention are well quantified and increasing over time. Structure losses due to wildfire are well quantified and increasing through time. Losses to infrastructure and clean up costs are also substantial, but are less systematically quantified.

Evidence suggests that home hardening and creation of defensible space around structures are effective wildfire mitigation measures. Public safety power shutoffs also appear to be an effective prevention measure but impose unmeasured and potentially large economic costs on the State. Actions intended to reduce human exposure to wildfire via land use planning and urban development have high potential for cost-effectiveness but cannot be calculated because they have yet to be implemented. In general, the scale, cost, and cost-effectiveness of wildfire mitigation measures such as home hardening, defensible space, public safety power shutoffs and community- and landscape-scale vegetation management are not systematically tracked. There is no comprehensive accounting for the total costs of these programs, nor of how much these programs might reduce suppression costs. What is clear is that utility, CAL FIRE, and USFS expenditures on wildfire suppression appear to be substantially larger in scale than these mitigation activities.

Recommendation ES.2. *The State should create a comprehensive public accounting of relevant programs in order to better understand the costs of wildfire mitigation activities.*

Recommendation ES.3. *The State should consider supporting necessary research to fully assess the cost-effectiveness of prevention and mitigation activities. The research will provide an opportunity to compare these investments to costs of suppression and the losses incurred as a result of wildfire. This accounting should explicitly consider ecosystem and natural resource values as well as structure values.*

Conclusion ES.3. *The location and pattern of housing development is one of the most important factors explaining structure loss in wildfires.*

Recommendation ES.4. *The State should evaluate land use planning and urban development as an alternative strategy for preventing structure loss and increased ignitions in wildland areas.*

Conclusion ES.4. *Public health impacts from wildfire are substantial and likely to be significantly underestimated. Aside from injuries or deaths due to heat exposure from fires, these impacts are not systematically tracked in the State. Available evidence suggests that pulmonary and cardiovascular outcomes from wildfire smoke are the most significant cause of morbidity and mortality and may have both acute and long-term consequences.*

When wildfires occur, they cause widespread public health impacts. We find that the most significant, although perhaps least well-appreciated health-related impact is due to exposure to wildfire smoke. Numerous case studies document a variety of severe health impacts due to smoke, but there is no statewide tracking of smoke exposure and related health impacts, or costs. Nevertheless, case studies and knowledge regarding health impacts of PM_{2.5} lead us to conclude that smoke impacts are likely the largest public health concern from wildfire—larger than the burn injuries and deaths due to direct heat exposure to wildfires. Smoke impacts are significant both for first responders and for distant population centers. They are

particularly impactful for vulnerable populations. In addition, the number of deaths from direct heat exposure to wildfires is increasing. Other public health impacts due to post-fire landslides and water contamination may also be significant in certain contexts.

Recommendation ES.5. *In order to understand the full costs of wildfire and the potential public health benefits of mitigation activities, as well as the tradeoffs associated with prescribed fire, the State should create a program to systematically track public health impacts from wildfire smoke, especially for vulnerable populations.*

Wildfire is a challenge that is not going away for California. Indeed, absent change in policy, climate change is likely to worsen the problem. California policymakers should be considering the balance of investment in prevention and suppression that makes the most sense for the people of California, its environment, and its economy. Today, policymakers attempt to strike that balance without complete information about the overall costs to society or of how alterations to California's fire management approach might impact total societal costs. It is in the State's and federal government's interest to conduct the necessary data collection and research to understand these costs if we are to move toward sound fire management policy.

Recommendation ES.6. *California should create and manage a systematic, comprehensive data clearinghouse for wildfire events including wildfire smoke, prevention and mitigation, losses including health, societal and ecological impacts, and associated costs. Models exist for this type of clearinghouse in the CalEnviroScreen and the California Open and Transparent Water Data Platform. Such a clearinghouse could be established via an extension and expansion of the recently established Wildfire Forecast and Threat Integration Center.*

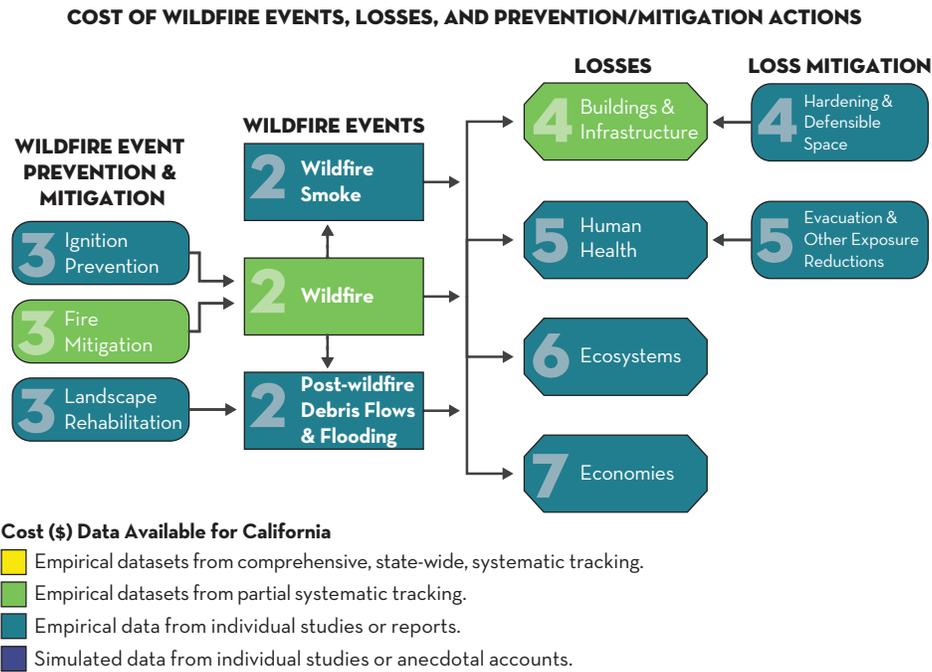


Figure ES-1. Overview of Costs Information. Each color identifies the types of databases and studies available to assess the cost (dollar value) estimates of topics addressed in this report. Lines indicate the interactions across multiple topics, illustrating the complexity of interrelated wildfire-relevant issues. Large font numbers within each shape indicate the chapter in which each item is discussed. Note that no shapes are colored yellow, indicating very few or no topics are tracked in a comprehensive, systematic way for the State as a whole. .

This executive summary rests upon a number of findings, conclusions, and recommendations presented and discussed in greater detail in the report.

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Study Process

CCST organized and directed the study leading to this report. Members of the CCST Steering Committee were appointed based on technical expertise and a balance of

viewpoints. Appendix A in the full report provides information about CCST's Steering Committee membership. All experts who contributed to the study were evaluated for potential conflicts of interest. Under the guidance of the Steering Committee, a team of experts (authors) assembled by CCST developed the findings based on original technical data analyses and a review of the relevant literature. Appendix B in the full report provides information about the authors. The Steering Committee met regularly to interact with the lead authors as the authors studied each of the issues identified in the scope of work. With regular interaction, the authors and the Steering Committee were able to collaborate to develop a series of findings, conclusions, and recommendations defined as follows:

Finding. *Fact(s) the study team finds that can be documented or referenced and that have importance to the study.*

Conclusion. *A reasoned statement the study team makes based on findings.*

Recommendation. *A statement that suggests an action or consideration as a result of the report findings and conclusions.*

The committee process ensures conclusions are based on findings (facts), and recommendations are based on findings and conclusions. Both the authors and the Steering Committee members proposed draft conclusions and recommendations. These were modified based on peer review and discussion within the Steering Committee, along with continued consultation with the authors. Final responsibility for the conclusions and recommendations in this Executive Summary lies with the Steering Committee. All Steering Committee members have agreed with these conclusions and recommendations. The conclusions and recommendations expressed in this publication are those of the Steering Committee and authors, and do not necessarily reflect the views of the organizations or agencies that provided support for this project.

The full report has undergone extensive peer review; peer reviewers are listed in Appendix D of the report, "Expert Oversight and Review." Nine reviewers were chosen for their relevant technical expertise. More than 700 anonymous review comments were provided to the author team and Steering Committee (study team). The study team revised the report in response to peer review comments. A report monitor appointed by CCST then reviewed the response to the review comments and when satisfied, approved the report.



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