

PREPARING FOR THE
EFFECTS OF CLIMATE CHANGE –
A STRATEGY FOR CALIFORNIA



*A Report by the California Adaptation Advisory Panel
to the State of California*

EXECUTIVE SUMMARY



SPECIAL THANKS

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The Pacific Council on International Policy is a non-partisan organization headquartered in Los Angeles with members and activities throughout the West Coast of the United States and internationally. Founded in 1995, the Pacific Council is a 501c(3) not-profit organization whose work is made possible by financial contributions and in-kind support from individuals, corporations, foundations and other organizations.

The Pacific Council is responsible for convening the task force and the preparation of this executive summary and the full report detailing the work of the task force. The report represents the view and opinions of the task force members who participated in their individual, not institutional capacities. The Pacific Council takes no institutional position on policy issues. All statements of fact and expressions of opinion contained in its publications are the sole responsibility of the task force.

The full report can be downloaded at www.pacificcouncil.org. For further information about the Pacific Council or this Task Force Report, please write to the Pacific Council on International Policy, 801 S. Figueroa Street, Suite 1130, Los Angeles, CA 90017 or contact the Project Director, at 213-221-2010

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GUIDING PRINCIPLES

During Task Force deliberations, a set of principles emerged as the foundation for climate adaptation decisions in California. These principles recognize the potential challenges presented by climate change and the need to address the issue with the best science available, in a comprehensive manner, and inclusive of the full range of stakeholders.

Guiding principles for all climate adaptation decisions

Science-based policy. Adaptation policies must be grounded on the best available scientific information on the effects of climate change and the risks they pose. The practice of assuming a static climate as the basis for decision making is no longer tenable. Because the science of climate change is evolving, as is the climate, policies will have to be revisited as more is learned.

Cost-effective actions. No regrets: Adaptation policies should encourage cost-effective actions that make sense in their own right and seek to minimize long-term costs and provide long-term benefits.

Aligned incentives. In recognition of the likely costs of adaptation to individuals, businesses both large and small, and communities, adaptation strategies should encourage timely actions and choices that foster resiliency and help overcome hurdles presented by financing, organizational, and other barriers.

Public engagement. Meaningful public engagement is needed at all levels – State, regional and local – and across all economic sectors. Engagement should be informed by climate science and embody cultural sensitivity in reaching out to communities most vulnerable to the effects of climate change. Especially important is the direct and sustained involvement of those who will have to bear the cost of adaptation measures – businesses of all sizes, property owners, and State taxpayers.

Coordination of planning and public decision making. Lead agencies are needed at every level of government to reconcile competing interests, forge compromises, expedite decisions on adaptation, and overcome barriers to action.

PREPARING FOR THE EFFECTS OF CLIMATE CHANGE – A STRATEGY FOR CALIFORNIA

The Task Force on Adaptation to Climate Change was created in the spring of 2009 by the Pacific Council on International Policy (Pacific Council) to address the long-term challenge that climate change brings to the people of California. The goal of this effort has been to develop a path forward in light of the growing base of knowledge about climate science¹ and the discussions beginning among officials and planners in State agencies². The purpose has not been to recommend specific actions, for instance, protecting a particular coastal resource from sea-level rise by building a sea wall or relocating the structure. Rather this effort aims to encourage that all major planning and development decisions throughout the State be made within a coherent, comprehensive framework to guide adaptation. The focus of the Task Force is a strategic one: to ensure a science and analyses-based, collaboratively planned, and financially viable long-term approach to adaptation at all levels of decision-making.

Adaptation to climate change has emerged the world over as a growing concern. Even with aggressive mitigation, California is unlikely to escape serious impacts from the continuing emission of greenhouse gases into the atmosphere. Scientists already are reporting effects. Average global temperatures are rising, bringing with them the potential for hurricanes, floods, and wildfires both more frequent and more severe. Over this century, scientists expect these trends to continue and intensify, threatening the State's valuable land, water, and other natural resources. Shorter, warmer winters, for example, are likely to decrease the Sierra snowpack, a major source of annual water supply on which many Californian's depend for drinking water and other purposes. Longer, hotter summers in the semi-arid southern part of the State could upend agricultural production and create ideal conditions for wildfires.

¹ Intergovernmental Panel on Climate Change, "Fourth Assessment Report: Climate Change 2007 (AR4), at: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.htm#1

"Global Climate Change Impacts in the United States," A State of Knowledge Report from the U.S. Global Change Research Program, Thomas R. Karl et al, Cambridge University Press, 2009, at: <http://www.global-change.gov/publications/reports/scientific-assessments/us-impacts>

Climate Action Team 2009. "Biannual Report to the Governor and State Legislature" (Draft, March 2009), and underlying research funded by the California Energy Commission's PIER Program, at: <http://www.climatechange.ca.gov/publications/cat/index.html>

"Indicators of Climate Change in California" compiled and edited by Linda Mazur and Carmen Milanes, California Protection Agency, Office of Environmental Health Hazard Assessment, April 2009, at: <http://www.oehha.org/multimedia/epic/pdf/ClimateChangeIndicatorsApril2009.pdf>

² California Natural Resources Agency, "2009 California Climate Adaptation Strategy," A Report to the Governor of the State of California in Response to Executive Order S-13-2008, at: <http://www.climatechange.ca.gov/adaptation/index.html>

Institute for Local Government, "California Climate Action Network: Best Practices Framework"; http://www.ca-ilg.org/sites/ilgbackup.org/files/BestPracticesFramework_v5.0.pdf American Planning Association, "Policy Guide on Planning and Climate Change," adopted April 27, 2008, at: <http://www.planning.org/policy/guides/pdf/climatechange.pdf>



Among the impacts associated with climate change that California is likely to experience is the rising level of the Pacific Ocean. Although significant uncertainty remains, recent projections suggest as much as 55 inches – nearly 5 feet – of possible sea level rise by 2100. Should this occur, it would dramatically alter coastal landscapes, shoreline habitat, and wetlands. Flooding of low-lying homes and commercial and industrial development – not just along the 1,100 mile open ocean coastline, but along extensively built-up shorelines and floodplains across the State – could cause financial hardships. From the waterways of San Francisco Bay to the floodplains in the Central Valley to the southernmost port in San Diego, all could be affected.

Failure to anticipate and plan for climate variability and the prospect of extreme weather and related events in land development patterns and in natural resource management could have serious impacts far beyond what has already been experienced.

Failure to anticipate and plan for climate variability and the prospect of extreme weather and related events in land development patterns and in natural resource management could have serious impacts far beyond what has already been experienced. The increasing intensity and frequency of climate events in the future will cause communities across the state to exist in emergency management response mode more frequently. In addition to the economic human and environmental impacts, operating in a state of emergency will result in hasty decisions with unintended negative consequences, greater costs, and poorer outcomes

However, this need not and should not be our future. We can start now to change our planning management practices to significantly increase our ability to anticipate and better gauge the likelihood and extent of climate change effects. Until now we have relied on the assumption of a fairly static environment in which weather patterns and climate events are projected to happen with similar frequency and intensity as they have in the past. By recognizing the increasing variability in weather patterns, we can better protect ourselves from the risks posed by climate change today and in the future. This new approach represents a paradigm shift in resource management, planning, and development that must be integrated into decisions made throughout the state. It will require major changes in the way decisions are made today and a far greater appreciation and understanding of the risks the

climate poses to our natural and built environments and the way we live. Starting today and continuing in the years and decades to come, we can adapt to these risks through hundreds, if not thousands, of resilient resource and land-use choices. In so doing, California will find itself far better equipped and more resilient to the inevitable adverse effects of a changing climate.



Figure 1: Coastal cliff erosion threatens this apartment building along Pacific’s open ocean coast. Source: Michael Macor, San Francisco Chronicle (Picture ID: ba-pacifica18_25_0500970893)

Our Approach

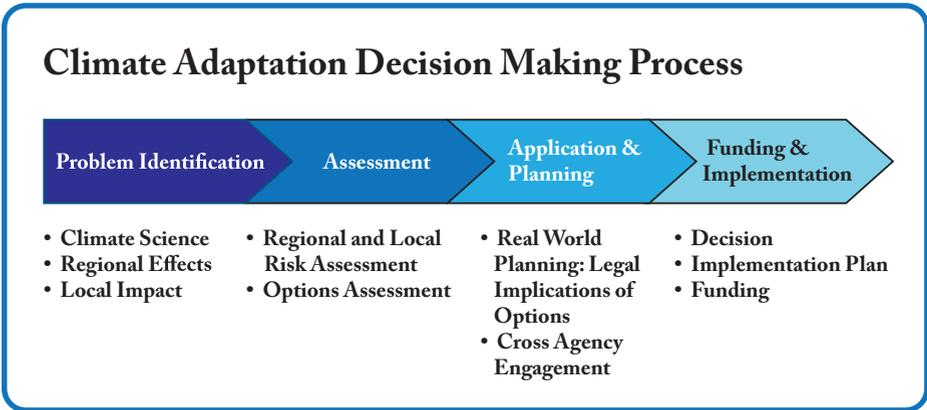
The Task Force sought to answer three critical questions: What are the key challenges triggered by accelerated climate change? What are the options for dealing with them? What are the gaps in planning and policy at the local, regional and state level for dealing with adaptation? To gain a perch on these questions we focused on the most recognized threats from climate change facing the state:

1. Sea-level rise
2. Water supply availability, changing patterns of rain and snowfall
3. Forest and rangeland fires

These were selected on the basis of the cumulative, multiple and tangible effects they will likely have, combined with the relative level of confidence of current climate science that they will indeed occur. By focusing on these three, we do not mean to imply that other impact areas are unimportant or unworthy of careful attention. Indeed, rising temperatures may create various other effects including extreme heat, reduced air quality, loss of marine and forest biodiversity, and others. We expect that future policy reviews will focus on the impacts we have not had the capacity to include here.

The members of the Task Force, aided by scientists and other experts, divided into teams to examine each threat. Recommendations were reached by working through illustrative case studies resembling the typical decision making process for major public planning or project approval with the threat in mind. The exercise revealed capacity gaps and needs across all four stages of decision-making.

Figure 2:



Key Recommendations

1. Increase monitoring and data gathering on the uses of, and changes to, the State’s natural resources and land-use patterns

In order to anticipate and plan for the effects of climate change on resources – both natural and human – across the state, we need to improve our understanding of the current status and the pace of change. More effective, comprehensive and long-term data gathering in many areas such as resource usage, land-use patterns, changes in natural, managed, and human systems, is required. We also need to invest in continuously monitoring the impact of the actions we take. In addition, a single entity or working group needs to be responsible for specifying the range of climate sensitive resource uses to be monitored, the kinds of data to be collected on a statewide basis, and ensuring that the information is available in planning and development decision-making at all levels of the State.³

Key Recommendations

1. Increase monitoring and data gathering on the uses of and changes to the State’s natural resources and land-use patterns in areas with a high probability of being affected by climate change

2. Establish a Climate Risk Council (CRC) for California

3. Improve communication and coordination across levels of government and economic sectors in planning

4. Align incentives for proactive adaptive management and to fund large scale community-based adaptation projects

2. Establish a Climate Risk Council (CRC) for California

Planners and developers need the support of a scientific authority to translate climate science into expected impacts for California in ways that are easily understandable. A small body appointed by the Governor and supported by a mobilized scientific community across the state should be formed for this purpose. It should be responsible for assessing what the climate science implies and translating that into risk guidance to be used in decision-making and for ensuring that this knowledge is incorporated into thinking and action at all levels. The CRC should also devise and disseminate protocols and guidelines for conducting risk assessments at regional and local levels. (See Figure 3)

3. Improve communication and coordination across levels of government and economic sectors in planning

The State should require that a multifaceted and multi-jurisdiction climate change impact assessment be required as a part of all long-term general planning and public and private sector development proposals. It is imperative that the integrated planning involves institutionalization of processes that include local, state and federal agencies in order to avoid redundancy and overcome barriers to action. The affected agencies and jurisdictions must be required to align their respective long-range plans, objectives and decision-making activities accordingly. Additionally, the State should launch an education program for planners designed to train planners to understand climate science and conduct and integrate risk assessments into planning.

³ The State Adaptation Strategy envisions this role for a sub-team of the State Climate Action Team Research Group. A report is expected this year that will identify the specific data gathering and analysis needs and recommend how to manage the process.

4. Align incentives for proactive adaptative management and build funds to support large scale community projects

The costs of appropriate long-term, cost-effective adaptation may exceed the financial capacity of individual homeowners or businesses. In order to plan and execute such projects in a timely and proactive fashion, funding mechanisms must be established early in the planning process. Possible sources range from integrating funding requirements into long-term regional and local plans, to creating special funds generated from mandatory insurance pools, fees, taxes or capital markets. The State needs to launch a feasibility study to better understand these possible mechanisms and identify those best suited for the various needs of communities exposed to differing effects at various levels.

Figure 3:

Climate Risk Council Responsibilities

- Compile, organize and assess** scientific information on the pace of climate change and its impacts at the state and regional levels
- Develop, periodically update risk-assessment protocols and guidelines:**
 - For conducting risk assessments at regional and local levels applicable in State infrastructure planning, and regional and local planning;
 - For risk characterization processes to be used by regional and local planners;
 - For evaluation of adaptation options - including cost-effectiveness - on all long-term projects.
- Conduct a public review process** under the Administrative Procedures Act in development of the protocols and guidelines
- Advise public entities** responsible for carrying out long-term projects on how to incorporate risk assessment, risk characterization, and options assessments within their planning procedures and practices:
 - Advise State Office of the Insurance Commissioner to incorporate the best available risk characterization in the State's regulations pertinent to climate-sensitive insurance products;
 - Seek out the private insurance industry, builders and developers, public permitting officers, water and fire managers, and other relevant entities to develop risk-based approaches for climate change insurance, including incentives for property owners to make risk-reducing investments.



Threat-Specific Recommendations

I. Sea-Level Rise

1. Establish a consistent, statewide coastal hazards information database

We recommend investment in establishing a current baseline, identifying the extent and nature of coastal hazards and making this information available as an easily accessible, understandable, and locally usable tool for the public and decision-makers.

2. Educate and train coastal planners, managers and decision-makers

Traditional professional training and sector divisions in governance can hinder the ability to effectively address cross-cutting issues. We recommend that coastal planners, managers and affected decision-makers at the state, regional and local levels be educated and trained to build the necessary human capital for effective adaptation planning. To widen the existing bottle neck, the state and federal governments must help build the necessary technical capacity among responsible staff at all levels of government.

3. Strengthen risk disclosure requirements to ensure early disclosure of potential risks associated with sea-level rise and other climate risks

The effectiveness of risk disclosure on discouraging development in high-risk areas strongly depends on the timing of when developers and potential property buyers are informed of those risks. If disclosure comes too late, the investments have already been made. We thus recommend that the state legislature strengthen the risk disclosure requirement so that it occurs earlier in the development and permitting processes. As sea-level rise scenarios used for planning and decision-making across

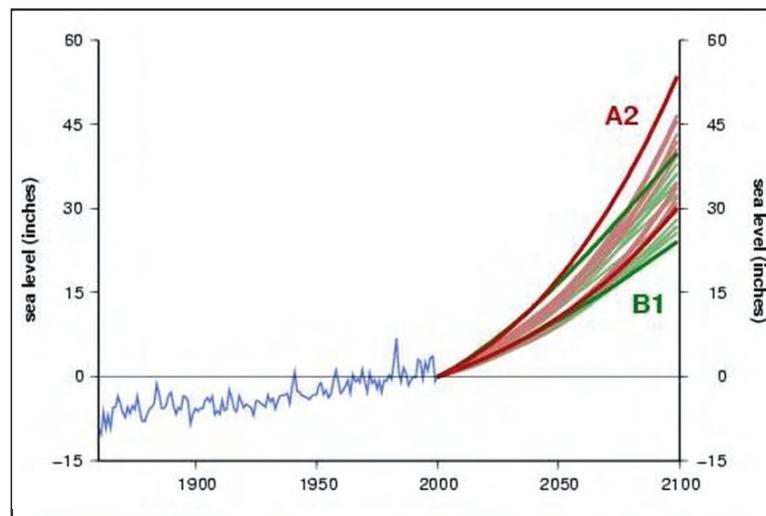


Figure 4: Historical and Projected Sea-level Rise for California. Historical sea-level rise observations (for San Francisco, shown in blue), relative to 1990, and future sea-level rise projections using a lower (green, “B1”) and higher (red, “A2”) emissions scenario. The State recently adopted a 55-inch sea-level rise planning figure proposed for use in decision making for new and upgraded existing critical infrastructure. Source: D. Cayan, Scripps Institution of Oceanography

the state are affirmed,⁴ flood risks should be assessed and disclosed for current and adjacent future floodplains. The necessary risk information should be developed through the periodic coastal vulnerability assessments and related research, and/or certified by the risk assessments conducted for the state through the proposed Climate Risk Council.

II. Water Supply

1. Protect critical fresh water resources

California's fresh water resources are threatened by inundation from flooding as a result of sea-level rise, extreme weather events and more rapid runoff. Contamination from a variety of sources including poor disposal of chemicals, leaking underground chemical or waste containment systems or pipelines, over use of pesticides or herbicides, and urban runoff is also a threat. These effects could threaten our already sparse fresh water resources. As we invest in the development of more water resources for California, we should also protect the resources we have. Therefore, we recommend significant investments and near-term action to protect our limited fresh water resources. Flood management infrastructure should be updated and reengineered to respond more effectively to the changes in timing and intensity of run-off. Aging levees in and around the Sacramento-San Joaquin Delta should be strengthened and rebuilt. Land use on flood plains needs to be re-assessed and carefully managed to enable use of flood plains for flood water management. Investment in protection and expansion of tidal wetlands at the mouth of the Delta. In addition, stricter regulation and more rigorous enforcement of current pollution laws is required to protect our ground water resources.

2. Increase conservation and efficiency in all areas of the economy and of the state

California must implement water conservation programs to reduce reliance on imports from outside the state and from the beleaguered Sacramento-San Joaquin Delta, and in so doing reduce vulnerability to decreased water supply due to drought, inundation, and/or contamination.

The Department of Water Resources will oversee the successful implementation of Senate Bill 7x7, providing economic incentives to speed adoption of water efficient technologies and practices. In addition, incentives should be provided to encourage communities to push beyond 20X2020, such as achieving the goal before the target date and achieving greater than 20% reduction beyond 2020. Increasing efficiency standards for appliances, revising building codes to enable low impact development, and providing further incentives to encourage xeriscaping, should also be considered.

3. Develop contingency plans for significant supply gap scenarios beyond 2020

While 20% per capita reduction of use in urban areas is a laudible goal, significantly more efficiency is needed in all sectors and regions if we are to accommodate the

⁴ Pursuant to Governor A. Schwarzenegger's Executive Order S-13-2008, the state has requested an assessment of defensible sea level rise projections for the West Coast from the National Research Council. This study is underway at the time of this writing.



population expansion and absorb potential shocks to supply in the coming decades. Robust scenario analysis should be conducted at both state and local levels to better understand potential impacts and possible measures to be implemented to deal with them.

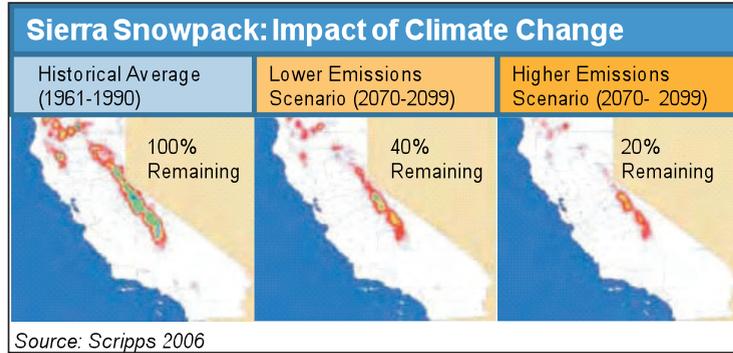


Figure 5: The Scripps Institute at the UCSD projects that, by the end of the century, the California snowpack will have diminished by 60% to 80% depending on various scenarios for the level of green house emissions over the course of the century. The snowpack in the High Sierras represents a third of all of the surface water storage capacity in the state. Therefore, the loss of as much as 70% constitutes roughly a quarter of all stored water supplies in the state.

4. Expanding water sources and storage capacity

Even under the most optimistic efficiency scenarios, investment in developing new sources and expanding storage capacity will be necessary. Ground water recharge and storage programs should be expanded and investment in conveyance combined with efforts to reduce barriers to transfer need to be implemented. In addition, surface storage capacity will need to be expanded in targeted areas. New sources of water need to be harvested such as storm and waste water capture and recycling. Finally, we should invest in development of less capital and energy intensive desalination technology.



Figure 6: Wetland restoration near the former Hamilton Air Force Base in Novato, California. Long-term monitoring is required to track and assess the success of restoration efforts and change adaptation measures as required. Source: US Army Corps of Engineers

III. Forest and Rangeland Fires

1. Make resilience the cornerstone of wildfire management

California needs to shift its basic approach to forest fire management from fire suppression to threat reduction through developing zoning, building codes, and forest management practices that make the state more resilient in the face of a changing climate. This resilience-based approach will require:

1. More widely and effectively employing vegetation and ecosystem management to reduce fuels and fire severity;
2. Adopting building codes that reduce the risk of loss to property exposed to fire threats; and
3. Adopting zoning ordinances that result in communities being less exposed to wildfire risks.

In combination, these actions reduce the complexity and scale of the fire management challenge.

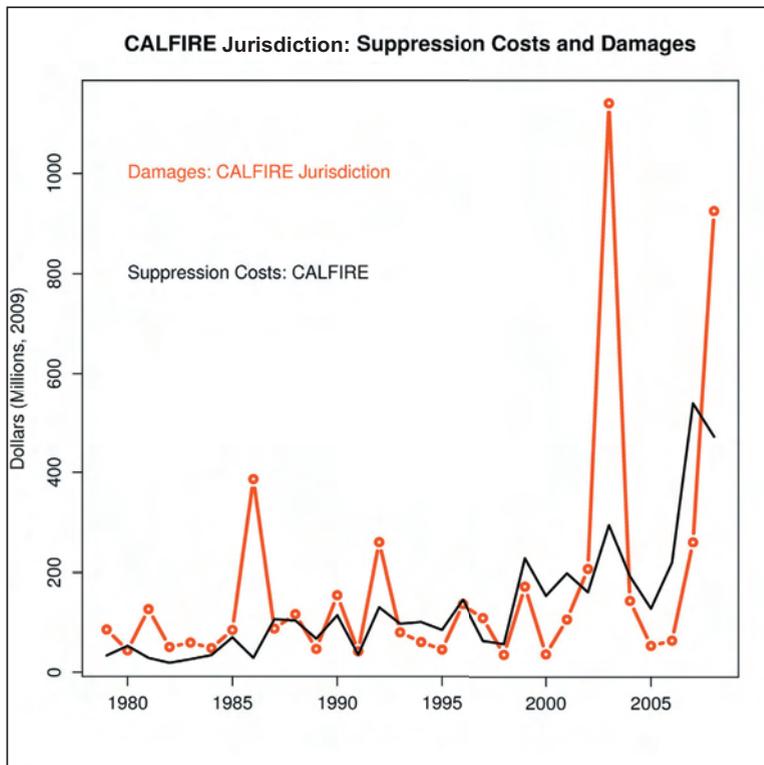


Figure 7: Suppression costs and damages due to wildfires within CALFIRE jurisdiction only, since 1979. Annual totals by fiscal year, adjusted for inflation (2009 dollars). Federal costs for fire suppression in California show a similar increase in recent decades.



2. Integrate fire and fuels management plans with land use, air pollution, and ecosystem management planning

Our recommended approach to forest and rangeland fires and vegetation management strategies complements other public policy goals such as reducing exposure to air pollution, health and sustainability. However, this requires far more coordination with land use designations and building standards and comprehensive forest and rangeland regional-based planning across federal, state, and local jurisdictions. Planning should have the scope and capacity to evaluate multiple competing objectives and methodologies and the result should be an integrated strategy that both employs adaptive management practices for the forests and rangelands and garners public understanding and support.

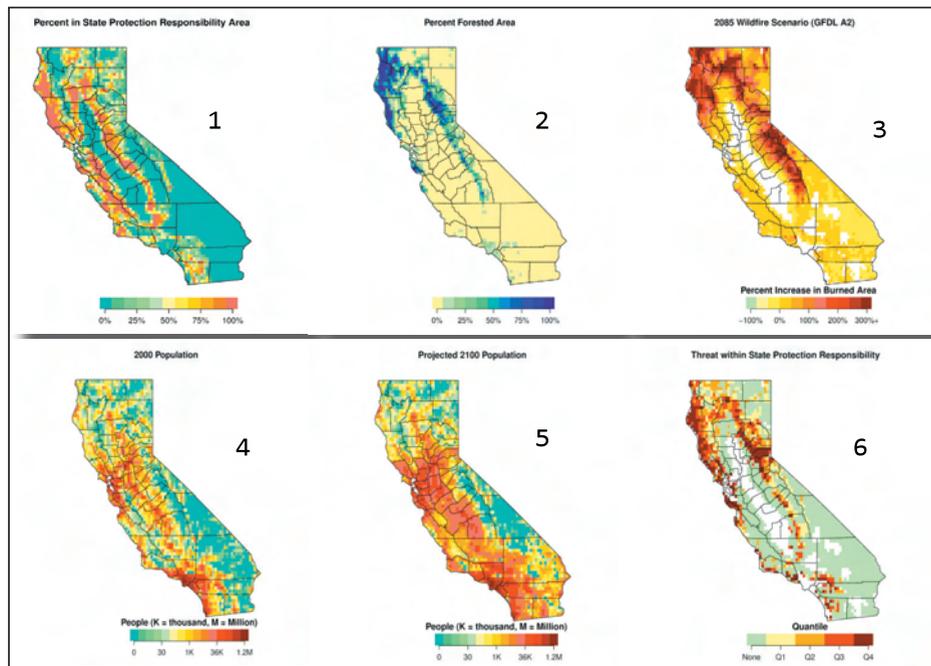


Figure 8: A graphical example of the potential threat from future increases in wildfire and development, using the intersection between the State protection responsibility area (i.e., CALFIRE jurisdiction (panel 1)), the currently forested areas of California (panel 2), a scenario for future wildfire (average increase in burned area for 2070-2099 compared to 1961-1990 for a high emissions pathway using the GFDL climate model, and assuming forest ecosystems remain in their current extent (panel 3)), and scenarios for current (year 2000) and future population (the U.S. Environmental Protection Agencies mid, or base case, growth and sprawl projection for California in 2100 (panels 4 and 5)). The intersection of these factors is shown in panel 6 as quantiles of a threat index. The darker red areas show the locations with the greatest combination of population, forest and increased fire risks within the state protection responsibility area.

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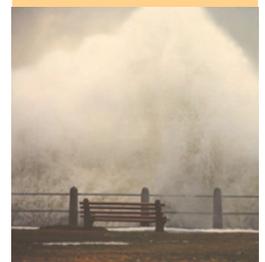
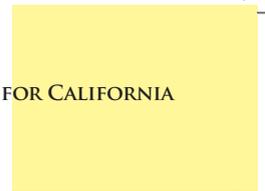
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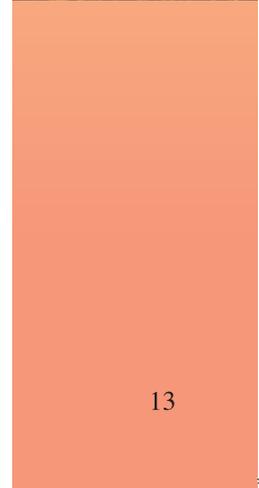
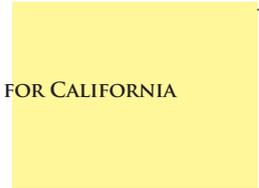
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