Executive Summary

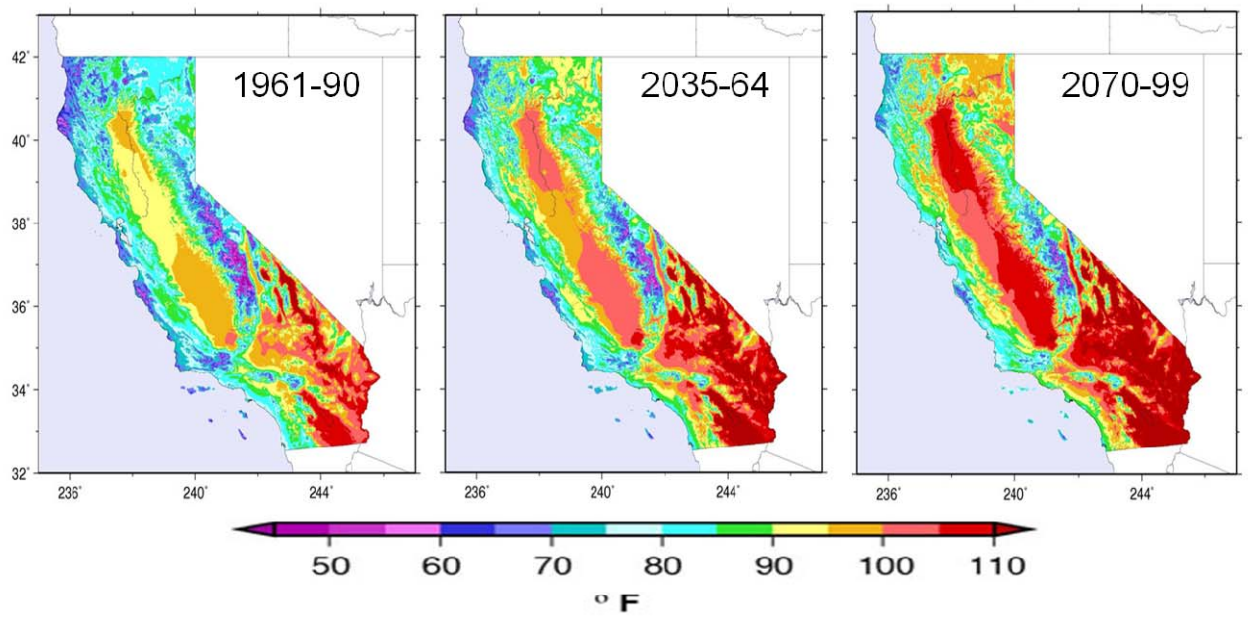
2009 California Climate Adaptation Strategy

A Report to the Governor of the State of California in Response to Executive Order S-13-2008




California natural resources Agency

Figure 1. California Historical & Projected July Temperature Increase 1961-2099



SOURCE: Dan Cayan et al. 2009.

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

EXECUTIVE SUMMARY

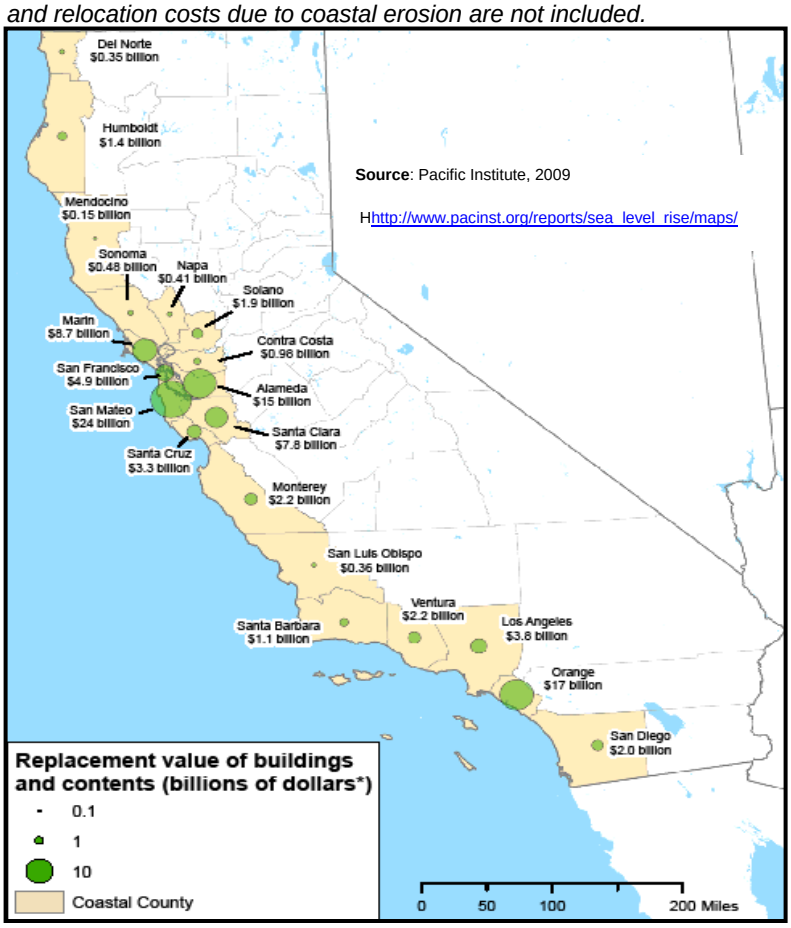
The Golden State at Risk

Climate change is already affecting California. Sea levels have risen by as much as seven inches along the California coast over the last century, increasing erosion and pressure on the state's infrastructure, water supplies, and natural resources. The state has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and both snowmelt and rainwater running off sooner in the year.

These climate driven changes affect resources critical to the health and prosperity of California. For example, forest wildland fires are becoming more frequent and intense due to dry seasons that start earlier and end later. The state's water supply, already stressed under current demands and expected population growth, will shrink under even the most conservative climate change scenario. Almost half a million Californians, many without the means to adjust to expected impacts, will be at risk from sea level rise along bay and coastal areas. California's infrastructure is already stressed and will face additional burdens from climate risks. And as the Central Valley becomes more urbanized, more people will be at risk from intense heat waves.

If the state were to take no action to reduce or minimize expected impacts from future climate change, the costs could be severe. A 2008 report by the University of California, Berkeley and the non-profit organization Next 10 estimates that if no such action is taken in California, damages across sectors would result in "tens of billions of dollars per year in direct costs" and "expose ***trillions*** of dollars of assets to collateral risk." More specifically, the report suggests that of the state's $4 trillion in real estate assets "$2.5 trillion is at risk from extreme weather events, sea level rise, and wildfires" with a projected annual price tag of up to $3.9 billion over this century depending on climate scenarios (www.next10.org/research/research_ccrr.html). The figure at right, from a study by the Pacific Institute, shows coastal property at risk from projected sea level rise by county with replacement values as high as $24 billion in San Mateo County.

Figure 2: *Replacement value of buildings and contents vulnerable to a 100 year coastal flood with 1.4 meters of sea level rise. Land values and relocation costs due to coastal erosion are not included.*



Source: Heberger et al. 2009.

California understands the importance of addressing climate impacts today. The state strengthened its commitment to managing the impacts from sea level rise, increased temperatures, shifting precipitation and extreme weather events when Governor Arnold Schwarzenegger signed Executive Order (EO) S-13-08 on November 14, 2008. The order called on state agencies to develop California's first strategy to identify and prepare for these expected climate impacts.

The *2009 California Climate Adaptation Strategy (CAS)* report summarizes the best known science on climate change impacts in the state to assess vulnerability and outlines possible solutions that can be implemented within and across state agencies to promote resiliency. This is the first step in an ongoing, evolving process to reduce California's vulnerability to climate impacts.

The California Natural Resources Agency (CNRA) has taken the lead in developing this adaptation strategy, working through the Climate Action Team (CAT). Seven sector-specific working groups led by 12 state agencies, boards and commissions, and numerous stakeholders were convened for this effort. The strategy proposes a comprehensive set of recommendations designed to inform and guide California decision makers as they begin to develop policies that will protect the state, its residents and its resources from a range of climate change impacts. Following a 45-day public comment period since its release as a Discussion Draft in August 2009, the CNRA and sector working groups have revised the strategy incorporating public stakeholder input. All public comments can be seen on the adaptation Web site at www.climatechange.ca.gov. Not all material has been incorporated at this time, but will potentially be added later to accommodate additional information and expand upon as strategies are implemented and more organizations and processes become involved. This document will be updated approximately every two years to incorporate progress in strategies and changing climate science.

California's Climate Adaptation Strategy

As the climate changes, so must California. To effectively address the challenges that a changing climate will bring, climate adaptation and mitigation (i.e., reducing state greenhouse gas (GHG) emissions) policies must complement each other, and efforts within and across sectors must be coordinated. For years, the two approaches have been viewed as alternatives, rather than as complementary and equally necessary approaches.

Adaptation is a relatively new concept in California policy. The term generally refers to efforts that respond to the *impacts* of climate change – adjustments in natural or human systems to actual or expected climate changes to minimize harm or take advantage of beneficial opportunities.

California's ability to manage its climate risks through adaptation depends on a number of critical factors including its baseline and projected economic resources, technologies, infrastructure, institutional support and effective governance, public awareness, access to the best available scientific information, sustainably-managed natural resources, and equity in access to these resources.

As the *2009 California Climate Adaptation Strategy* illustrates, the state has the ability to strengthen its capacity in all of these areas. In December 2008, the California Air Resources Board released the state's *Climate Change Scoping Plan*, which outlines a range of strategies necessary for the state to reduce its GHG emissions to 1990 levels by 2020. Many climate mitigation strategies, like promoting water and energy efficiency, are also climate adaptation strategies. By building an adaptation strategy on existing climate science and frameworks like the Scoping Plan, California has begun to effectively anticipate future challenges and change actions that will ultimately reduce the vulnerability of residents, resources and industries to the consequences of a variable and changing climate. Now that the state has produced plans for climate mitigation and adaptation, closer coordination is needed to implement both approaches. The strategies included in this report were approved by the CAT Team, which represents all of state government. Now, the CAT will lead in the coordination of measures and push to develop the necessary tools to effect adaptation protocols. California's mitigation (CAT) and adaptation (CAS) processes will be further integrated through extensive information exchange and consolidation of working groups from both efforts.

To ensure a coordinated effort in adapting to the unavoidable impacts of climate change, the *2009 California Climate Adaptation Strategy* was developed using a set of guiding principles:

- Use the best available science in identifying climate change risks and adaptation strategies.
- Understand that data continues to be collected and that knowledge about climate change is still evolving. As such, an effective adaptation strategy is "living" and will itself be adapted to account for new science.
- Involve all relevant stakeholders in identifying, reviewing, and refining the state's adaptation strategy.
- Establish and retain strong partnerships with federal, state, and local governments, tribes, private business and landowners, and non-governmental organizations to develop and implement adaptation strategy recommendations over time.
- Give priority to adaptation strategies that initiate, foster, and enhance existing efforts that improve economic and social well-being, public safety and security, public health, environmental justice, species and habitat protection, and ecological function.
- When possible, give priority to adaptation strategies that modify and enhance existing policies rather than solutions that require new funding and new staffing.
- Understand the need for adaptation policies that are effective and flexible enough for circumstances that may not yet be fully predictable.
- Ensure that climate change adaptation strategies are coordinated with the California Air Resources Board's AB 32 Scoping Plan process when appropriate, as well as with other local, state, national and international efforts to reduce GHG emissions.

The *2009 California Climate Adaptation Strategy* takes into account the long-term, complex, and uncertain nature of climate change and establishes a proactive foundation for an ongoing adaptation process. Rather than address the detailed impacts, vulnerabilities, and adaptation needs of every sector, those determined to be at greatest risk are prioritized.

The development of the adaptation strategies presented within this report was spearheaded by the state's resource management agencies. CNRA staff worked with seven sector-based Climate Adaptation Working Groups (CAWGs) focused on the following areas: public health; ocean and coastal resources; water supply and flood protection; agriculture; forestry; biodiversity and habitat; and transportation and energy infrastructure.

Working group experts have an intimate knowledge of California's resources, environments, and communities, and also of the state's existing policy framework and management capabilities. This understanding informs the adaptation strategy and ensures a realistic assessment of adaptive capacities, current limitations, and future needs.

A Collaborative Approach

This adaptation strategy could not have been developed without the involvement of numerous stakeholders. Converging missions, common interests, inherent needs for cooperation, and the fact that climate change impacts cut across jurisdictional boundaries will require governments, businesses, non-governmental organizations, and individuals to minimize risks and take advantage of potential planning opportunities.

Throughout the development of this report, it became increasingly clear that overlapping missions and goals will require agencies and organizations at all levels to work together to develop close partnerships with regard to climate adaptation. This is the only means by which the far reaching effects of climate impacts can be addressed efficiently and effectively while avoiding potential conflicts. The Comprehensive State Adaptation Strategies chapter underscores the need for collaboration and identifies where cross-sector relationships are necessary.

To further enhance stakeholder participation the CAWGs initiated a process that allowed for consultation with stakeholders through public workshops and review opportunities. This input has considerably shaped the content and refinement of this report. However, future updates of the adaptation strategy will require ongoing input through active stakeholder engagement and an even closer integration of state agency efforts.

In order to best analyze climate change risks, the *2009 California Climate Adaptation Strategy* draws on years of state-specific science and impacts research, largely funded through the California Energy Commission's Public Interest Energy Research (PIER) Program and an engaged research community. The research provides for an understanding of the climate-related risks California will face and has significantly contributed to greater public awareness of climate change. As data continues to be developed and collected, the state's adaptation strategy will be updated to reflect current findings.

All participating agencies prepared this report with existing resources amidst a serious state financial crisis. It is clear that more funding will be needed to address all aspects of climate adaptation and that potential sources will need to be sought from agencies and organizations at all levels to address the full scope of the problem. At this time CNRA is currently seeking additional funding for climate adaptation work.

Preliminary Recommendations

The preliminary recommendations outlined in the adaptation strategy were developed by CNRA staff, CAWGs, the CAT, and from public comments. Public comments were sought beginning August 3, 2009 when the CAS was released as a discussion draft. During the ensuing 45-day public comment period 83 comments were received, totaling over 400 pages of suggested revisions to the strategy. These comments provided substantive feedback, drawing on the expertise of many organizations and countless individuals offering different perspectives on effective approaches to climate adaptation. Stakeholder comments covered many topics, with the most common being the need for more coordination and guidance, funding, and outreach. Many comments offered excellent ideas supported by the working groups and were incorporated into this report where possible; Others will be better addressed once additional information comes in through the implementation of key strategies outlined in the report or when supporting information, resources and funding issues change. All comments will be kept on record as consideration for future updates of this strategy, complemented by additional opportunities for public input. All public input on the *CAS Discussion Draft* can be viewed on the web at: www.climatechange.ca.gov/adaptation/.

It is recognized that implementation of the following strategies will require significant collaboration among multiple stakeholders to ensure they are carried out in a rational, yet progressive manner over the long term. These strategies distinguish between near-term actions that will be completed by the end of 2010 and long-term actions to be developed over time, and are covered in more detail in the sector chapters in Part II of this report as well as in initial efforts.[1]

Key recommendations include:

1. A Climate Adaptation Advisory Panel (CAAP) will be appointed to assess the greatest risks to California from climate change and recommend strategies to reduce those risks building on California's Climate Adaptation Strategy. This panel will be convened by the California Natural Resources Agency, in coordination with the Governor's Climate Action Team, to complete a report by December 2010. The state will partner with the Pacific Council on International Policy to assemble this panel. A list of panel members can be found on the California adaptation Web site. (CS-1).

2. California must change its water management and uses because climate change will likely create greater competition for limited water supplies needed by the environment, agriculture, and cities. As directed by the recently signed water legislation (Senate Bill X71), state agencies must implement strategies to achieve a statewide 20 percent reduction in per capita water use by 2020, expand surface and groundwater storage, implement efforts to fix Delta water supply, quality, and ecosystem conditions, support agricultural water use efficiency,

[1] Each of the twelve Executive Summary strategies is drawn from multiple strategies within the subsequent sector specific and cross-sector adaptation strategy chapters. The recommendations here may not reflect exact wording of individual sector recommendations but relate to their core message. Each Executive Summary recommendation here lists the sector and recommendation number using the following acronyms to identify the sector: Public Health (PH), Biodiversity and Habitat (BH), Ocean and Coastal Resources (OCR), Water Management (W), Agriculture (A), Forestry (F), Transportation and Energy Infrastructure (TEI), and Cross-Sector (CS).

improve state-wide water quality, and improve Delta ecosystem conditions and stabilize water supplies as developed in the Bay Delta Conservation Plan. (BH-2, W-3, 6, and 7; A-1; TEI-3).

3. Consider project alternatives that avoid significant new development in areas that cannot be adequately protected (planning, permitting, development, and building) from flooding, wildfire and erosion due to climate change. The most risk-averse approach for minimizing the adverse effects of sea level rise and storm activities is to carefully consider new development within areas vulnerable to inundation and erosion. State agencies should generally not plan, develop, or build any new significant structure in a place where that structure will require significant protection from sea level rise, storm surges, or coastal erosion during the expected life of the structure. However, vulnerable shoreline areas containing existing development that have regionally significant economic, cultural, or social value may have to be protected, and in-fill development in these areas may be accommodated. State agencies should incorporate this policy into their decisions and other levels of government are also encouraged to do so. (CS-2; OCR-1 and 2; W-4 and 9; TEI -2 and 7).

4. All state agencies responsible for the management and regulation of public health, infrastructure or habitat subject to significant climate change should prepare as appropriate agency-specific adaptation plans, guidance, or criteria by September 2010. (PH-3 and 5; BH-1, 2, and 6; OCR-3; F-1 and 2; TEI-2 and 5).

5. To the extent required by CEQA Guidelines Section 15126.2, all significant state projects, including infrastructure projects, must consider the potential impacts of locating such projects in areas susceptible to hazards resulting from climate change. Section 15126.2 is currently being proposed for revision by CNRA to direct lead agencies to evaluate the impacts of locating development in areas susceptible to hazardous conditions, including hazards potentially exacerbated by climate change. Locating state projects in such areas may require additional guidance that in part depends on planning tools that the CAS recommendations call for (see key recommendations 3, 6, 8, 9, and 10; BH-3; OCR-1; TEI-2).

6. The California Emergency Management Agency (Cal EMA) will collaborate with CNRA, the CAT, the Energy Commission, and the CAAP to assess California's vulnerability to climate change, identify impacts to state assets, and promote climate adaptation/mitigation awareness through the Hazard Mitigation Web Portal and My Hazards Website as well as other appropriate sites. The transportation sector CAWG, led by Caltrans, will specifically assess how transportation nodes are vulnerable and the type of information that will be necessary to assist response to district emergencies. Special attention will be paid to the most vulnerable communities impacted by climate change in all studies. (CS-3 and 4; PH-4 and 5; OCR-5; W-4; F-2 and 3; TEI-2, 5, 6 and 8).

7. Using existing research the state should identify key California land and aquatic habitats that could change significantly during this century due to climate change. Based on this identification, the state should develop a plan for expanding existing protected areas or altering land and water management practices to minimize adverse effects from climate change induced phenomena. (BH-1; W-5; F-5).

8. The best long-term strategy to avoid increased health impacts associated with climate change is to ensure communities are healthy to build resilience to increased spread of disease and temperature increases. The California Department of Public Health will develop guidance by September 2010 for use by local health departments and other agencies to assess mitigation and adaptation strategies, which include impacts on vulnerable populations and communities and assessment of cumulative health impacts. This includes assessments of land use, housing and transportation proposals that could impact health, GHG emissions, and community resilience for climate change, such as in the 2008 Senate Bill 375 regarding Sustainable Communities. (PH-3).

9. The most effective adaptation strategies relate to short and long-term decisions. Most of these decisions are the responsibility of local community planning entities. As a result, communities with General Plans and Local Coastal Plans should begin, when possible, to amend their plans to assess climate change impacts, identify areas most vulnerable to these impacts, and develop reasonable and rational risk reduction strategies using the CAS as guidance. Every effort will be made to provide tools, such as interactive climate impact maps, to assist in these efforts. (BH-1; OCR– 2 and 4; CS-2).

10. State fire fighting agencies should begin immediately to include climate change impact information into fire program planning to inform future planning efforts. Enhanced wildfire risk from climate change will likely increase public health and safety risks, property damage, fire suppression and emergency response costs to government, watershed and water quality impacts, and vegetation conversions and habitat fragmentation. (PH-4 and 5; F-1; TEI-2).

11. State agencies should meet projected population growth and increased energy demand with greater energy conservation and an increased use of renewable energy. Renewable energy supplies should be enhanced through the Desert Renewable Energy Conservation Plan that will protect sensitive habitat that will while helping to reach the state goal of having 33 percent of California's energy supply from renewable sources by 2020. (TEI-2).

12. Existing and planned climate change research can and should be used for state planning and public outreach purposes; new climate change impact research should be broadened and funded. By September 2010, the California Energy Commission will develop the CalAdapt Web site that will synthesize existing California climate change scenarios and climate impact research and to encourage its use in a way that is beneficial for local decision-makers. Every effort will be made to increase funding for climate change research, focusing on three areas: linkages with federal funding resources, developing Energy Commission -led vulnerability studies, and synthesizing the latest climate information into useable information for local needs through the CalAdapt tool. (CS-4; PH-7; BH-4; OCR-6; W-8, 9, and 10; A – 8; F-4 and 5; TEI-3 and 9).