

California Legislature  
Senate Committee on  
Environmental Quality

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SENATE ENVIRONMENTAL QUALITY COMMITTEE  
BOB WIECKOWSKI, CHAIR

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RONALD REAGAN STATE BUILDING, AUDITORIUM  
300 S. SPRING STREET, LOS ANGELES, CA 90013

**Southern California Regional Adaptation Efforts to Climate  
Change Impacts**

**BACKGROUND INFORMATION**

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**Climate Change Impacts in Southern California**

Climate change is having global impacts that are occurring in response to greenhouse gas (GHG) emissions from human activities, as noted in the 5<sup>th</sup> assessment of the Intergovernmental Panel on Climate Change (IPCC). These global changes are manifesting in varied environmental health and infrastructure consequences for different countries, regions, and states, necessitating a change in public policy decision making in order to adapt to a new environment.

In Southern California, the University of California, Los Angeles (UCLA) has conducted the Climate Change in the Los Angeles Region project, researching climate change impacts using new techniques to downscale information and produce neighborhood level projections. Their results showed that warming will vary across the region, being more severe for inland communities as compared to coastal areas. On average, mid-century temperatures in the region will be 3°F hotter, even under mitigation scenarios in which countries come together to reduce GHG emissions.

Though a certain amount of warming is inevitable, without mitigation efforts, average regional temperature increases are projected to range from 4.3°F by mid-century to 8.2°F by the end of the century. Researchers conclude that some changes are inevitable by 2050 and must be adapted to, and through mitigation, we can prevent further changes by 2100.

In other words, as described in the “Framework for Addressing Climate Change” report by the Los Angeles County Department of Public Health (DPH), adaptation is managing the unavoidable impacts of climate change, while mitigation is avoiding the unmanageable impacts of climate change, and they are “both vital to protecting health in the long term.”

### Air Quality, Wildfires, and Extreme Heat

Increasing numbers of extreme heat days are projected in the coming decades. The “Public Health-Related Impacts of Climate Change in California” report points out that increasing high heat days from climate change have a number of impacts on communities, including direct heat-related mortalities and worsening of chronic health conditions (Drechsler et al. 2006). Southern California already experiences energy shortages, and higher demand from more frequent and intense high heat days could further impact health.

As noted by the Union of Concerned Scientists (UCS) in the 2012 report “Preparing for Climate Change Impacts in Los Angeles: Strategies and Solutions for Protecting Local Communities,” extreme heat days can lead to dehydration, heat exhaustion, and fatal heat stroke, in addition to worsening existing medical conditions, including respiratory disease, diabetes, kidney and heart disease. They report that recent research has shown that Los Angeles County has the largest number of residents in California who will be exposed to extreme heat days and at greatest risk for related health problems. Reasons for this high amount of risk include a combination of lack of air conditioning or shaded areas, outdoor work exposure to air pollutants, and preexisting health conditions.

Both wildfires and high heat contribute to reduced air quality, through the elevated levels of particulate matter and ozone pollution, with implications for public health. A 2011 report by the UCS discusses the “climate penalty on ozone,” demonstrating how increasing temperatures could increase ozone pollution. In 2020 alone, impacts from ozone formation associated with this penalty could result in nearly 443,000 additional cases of serious respiratory illness and cost over \$729 million.

In recent decades, southern California has experienced an increase in the area burned by wildfires. According to the Southern California Fires Interdisciplinary Project, the 2003 southern California fires, which were widely considered a 100-year event (Figure 1), and the 2007 fires, were responsible for billions of dollars in costs from fire fighting, property damage, environmental erosion, ecosystem services, and human health impacts. By 2050, the region’s fire season is projected to last three weeks longer with an increase of 20-30% in the annual amount of acreage burned (Yue et al. 2013). As well, many of the power transmission lines in the Los Angeles region are vulnerable to wildfire damage (UCS 2012).



Figure 1. Wildfires and smoke plumes over Southern California on October 26, 2003. Source: NASA Earth Observatory via the Moderate Resolution Imaging Spectroradiometer (MODIS) on the Terra satellite. Accessed at [http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=12373&eocn=image&eoci=related\\_image](http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=12373&eocn=image&eoci=related_image).

Wildfire smoke can result in both short-term and long-term health impacts, from minor lung and eye irritation to premature death. Research on health impacts from the 2003 Southern California wildfires showed an increase in hospital admissions for respiratory problems during the fires, including asthma attacks, acute bronchitis, and chronic obstructive pulmonary disorder (COPD), with small increases in cardiovascular admissions. The research further suggested that improved prevention measures are needed to reduce illness in vulnerable populations (Delfino et al. 2009).

### Water Quality and Supply and Sea Level Rise

As is true for the San Francisco Bay Area, sea level rise is a concern along Southern California coastlines. For the City of Los Angeles alone, there are two power plants and two wastewater treatment plants approximately 10 feet above mean sea level (Figure 2; Grifman et al. 2013).

These facilities are already vulnerable to flooding during storms and high tide events, and current projections estimate up to 2 feet of sea level rise by 2050 and up to 5.6 feet by 2100 (National Research Center (NRC) 2012). Climate researchers predict that storms will impact the coastline more powerfully in the future because sea level rise will raise wave run-up on beaches and storm surges, causing more erosion, as well as more frequent and extensive flooding and damages.



Figure 2. Image of the Hyperion Wastewater Treatment Plant and the Scattergood Generating Plant, two coastal assets in the City of Los Angeles. (Photo credit: Kenneth & Gabrielle Adelman, California Coastal Records Project, [www.Californiacoastline.org](http://www.Californiacoastline.org)). Source: Grifman et al. 2013.

According to the Los Angeles Regional Water Quality Control Board’s document, “Los Angeles Region Framework for Climate Change Adaptation and Mitigation,” from July of this year, though overall mean precipitation amounts are expected to change very little, climate change will likely impact water demand, supply, and quality of both surface and ground water.

The Los Angeles Region Framework notes that mountains around Los Angeles are expected to lose at least 31% of snowfall, which will melt faster with increasing temperatures and begin melting 16 days earlier on average. With decreased stream flows and higher temperatures, impacts could include a reduction of fish habitat, increased surface water temperatures, pollutant levels, and sedimentation, intensified algal growth, and subsequently, more harmful algal blooms.

With more extreme precipitation events, flood risks will worsen, increasing the likelihood of damaging infrastructure, increasing erosion, and overwhelming sewage treatment systems, further reducing water quality and impacting public health.

For groundwater, the potential for salt water intrusion into aquifers with sea level rise could be worsened by overpumping. The decreased water quality could further deteriorate as pollutant concentrations increase due to reduced water levels and recharge from drought and diminished snowpack.

### Public Health Impacts and Vector-Borne Diseases

In addition to the aforementioned health impacts, hot temperatures and drought conditions can contribute to the spread of diseases by aiding development and spread of the vectors that transmit them (Drechsler et al. 2006). A vector-borne disease (VBD) is one caused by a virus, bacteria, or protozoan that spends part of its life cycle in a host species (e.g. mosquitoes, ticks, fleas, rodents), which subsequently spreads the disease to other animals and people.

Regional research assessments have previously concluded that climate change and variability are highly likely to influence current VBD spread, including both short-term outbreaks and shifts in long-term disease trends. For example, as temperatures rise, mosquito reproductive cycles are shortened, allowing more breeding cycles each season, and viral transmission rates rise sharply (Githeko et al. 2000). Mosquitoes are an increasing vector of concern, particularly those species that have been introduced from other countries because changes in temperature and precipitation conditions can allow exotic species to become established in places where they could not previously survive year-round.

In Los Angeles County, there are three invasive mosquito species. One of these is the Asian tiger mosquito, which has been identified in the San Gabriel Valley. These invasive mosquitoes bite aggressively during the day and can spread a variety of disease, including chikungunya, yellow fever, and dengue, as with recent outbreaks in Florida and Texas. As noted in a recent Special Report on invasive mosquitoes in Los Angeles County by the San Gabriel Valley and Los Angeles Mosquito and Vector Control Districts, once established, the mosquitoes can reproduce in extremely small amounts of water and are very difficult to control.

The California Department of Public Health further notes three vector-borne diseases that climate change may impact in the state: hantavirus, Lyme disease, and West Nile Virus (WNV). As the ecology of vectors changes with climate, exposure to disease in people may increase significantly.

According to the Los Angeles County DPH, in 2013, WNV contributed to 9 deaths and 165 infections in the county. A previous pulmonary (lung) hantavirus epidemic in the southwest was attributed in part to rodent population growth related to climate conditions, and previous clusters of the disease have been linked spatially to areas impacted by El Nino rainfall. Furthermore, after heavy rain periods, flea-borne plague has been associated with heavy regional precipitation events. Rodents can also spread leptospirosis in their urine and harbor ticks that spread Lyme disease (Githeko et al. 2000).

### Environmental Justice Considerations

Climate change impacts affect people of color and the poor hardest, an idea previously called the “climate gap” (Morello-Frosch et al., 2009). Researchers at the University of Southern California

who have worked on this issue note that by recognizing these inequities and working to protect the most vulnerable, communities help better protect everyone.

In recent years, the City of Los Angeles produced a Sea Level Rise Vulnerability study which included a social vulnerability assessment. The assessment highlighted that, while per capita income for Los Angeles tends to be higher on the coast than inland, certain coastal communities have some of the lowest income levels in the county. For example, portions of Wilmington and San Pedro have an average income of \$13,000 per year with over 76% of the population below the federal poverty line in some census tracts. A combination of low income and high poverty correlates to high vulnerability to disasters and lower capacity for responding and adapting to climate change.

For inner city communities, people are vulnerable to urban heat island effects, in which dark materials used for roads and buildings absorb and retain heat, releasing it much more slowly than natural materials such as grass, soil, and trees. Combined with a reduced access to resources such as air conditioning or a car to move to cooling centers during extreme heat events, vulnerable populations are at an increased risk of adverse health impacts from both temperatures and air pollution on extreme heat days. Los Angeles is one of the smoggiest cities in California while also having one of the highest projections of ambient ozone increases associated with climate change and highest densities of people of color and low-income residents. These same communities are likely to lack health insurance, which can lead to even greater health impacts from air pollution and climate change (Cordova et al. 2006; Morello-Frosch et al., 2009).

Environmental justice researchers in California have looked at the relationship between disparities and exposures to a variety of health, environmental, climate and social vulnerabilities regionally. Overall, even when controlling for other possible explanatory factors, they have found consistent evidence of significant disparities in exposure by racial and socioeconomic factors (Pastor et al. 2013).

### **Adapting and Building Resiliency**

California has developed a number of GHG emission reduction efforts, and numerous state agencies have worked together to produce climate change assessments and guidance documents. Key documents that summarize climate impacts in sectors and regions and provide adaptation guidance include the 2014 Safeguarding California report, focused at the state level, and the 2012 Adaptation Planning Guide to support local governments and regional collaboratives. Additionally, Cal-Adapt was designed to be a web-based climate adaptation planning tool for local planning efforts with downscaled climate change scenarios and research for regions within California.

The guiding principles of the most recent Climate Adaptation Strategy update, Safeguarding California, included involving all relevant stakeholders and establishing partnerships across levels of government and between public and private sectors. The Adaptation Planning Guide echoes the importance of having a sustained, iterative process involving local and regional staff and community members. Additionally, the Little Hoover Commission's "Governing California Through Climate Change" report highlighted the need for more adaptation emphasis in existing programs and a more unified approach to adaptation from the state.

In Southern California, there are a number of regional collaboratives, agencies, academic institutions, counties, and cities engaged in climate change mitigation, adaptation, and research. A subset of the work from these many stakeholder groups is highlighted here.

### Regional Efforts in Climate Adaptation

The Alliance of Regional Collaboratives for Climate Adaptation (ARCCA), a network of regional collaboratives across the state, includes two in Southern California: the Los Angeles Regional Collaborative for Climate Action and Sustainability (LARC) and the San Diego Regional Climate Collaborative.

LARC, with support from the UCLA Institute of the Environment and Sustainability (IoES), fosters a network of local and regional decision-makers in the Los Angeles County region for both climate mitigation and adaptation work across sectors and locally focused research on impacts. Members include groups from academia, cities, Los Angeles County, regional agencies, nonprofits, and businesses.

Part of LARC's goals includes serving as a convening body to ensure consistency in performance, collaboration, and coordination of climate actions to maximize limited resources. They also facilitate the exchange of the latest scientific research, best practices for policy development, information systems, and education efforts. One example of this is LARC's ongoing development of the Framework, a resource to support local development of climate actions by providing regional information synthesis across sectors on vulnerabilities, adaptation strategies, and applicable federal, state, and local mandates.

The San Diego Collaborative is a network of public agencies that partners with academia, nonprofits, and businesses. The group works to aid collaboration in the region by coordinating strategies and resources, organizing workshops and training events, and facilitating networking by members of the collaborative.

Additionally, the state and regional water boards have been working to coordinate climate action planning. The Los Angeles Regional Water Quality Control Board's document, "Los Angeles Region Framework for Climate Change Adaptation and Mitigation," notes that the regional board has been engaging in a dialogue with state and federal colleagues to develop a framework for adaptation within their programs. The framework is a living document meant to be updated and expanded, in addition to serving as the first step in developing a regional climate action plan for the Board.

### Local Efforts in Climate Adaptation

The Port of San Diego's Board of Port Commissioners adopted a Climate Action Plan (CAP) in 2013 to reduce GHG emissions and prepare for the impacts of climate change. The plan addresses goals in multiple sectors, including transportation, land use, energy, water, waste reduction and recycling, and supports the Green Port Program to achieve long-term environmental, societal, and economic benefits and sustainability. As part of the GHG emissions reductions plans, within

sectors in the CAP, co-benefits are specified, including air quality, public health improvement, water quality/supply improvement, and adaptation strategy support.

The Port of Los Angeles is one of the busiest in the world, contributing over \$63 billion to the state's economy, with over 40% of all U.S. imports coming through the Ports of Los Angeles and Long Beach (Grifman et al. 2013). In 2012, the Port of Los Angeles received a Climate Leadership Award from the United States Environmental Protection Agency (U.S. EPA) for their work on climate change and cutting carbon pollution, and they have been working on a climate adaptation study as noted in their 2011 Sustainability Report.

Many nonprofits and businesses are also engaged in climate change efforts in the region. One example, Climate Resolve, is a nonprofit with a mission of helping to inspire Southern California to reduce GHG pollution and prepare for climate impacts. To do so, their website notes that they help develop communication strategies to make impacts relatable to local people, build collaboratives to implement climate initiatives, promote practical regional solutions, and share their work as a model for other cities and regions. Recently, Climate Resolve was engaged in the Cool Roofs initiative, which resulted in the Los Angeles City Council updating the municipal building code to require that all new and refurbished homes have a "cool roof," using material that naturally reflects sunlight and can result in a more than 50°F cooler surface on summer days.

### *County-Level*

The Los Angeles County Department of Public Health (DPH) has a focus on inter-departmental collaboration, which has led to the development of a "Five-Point Plan to Reduce the Health Impacts of Climate Change." The Plan includes the following goals to:

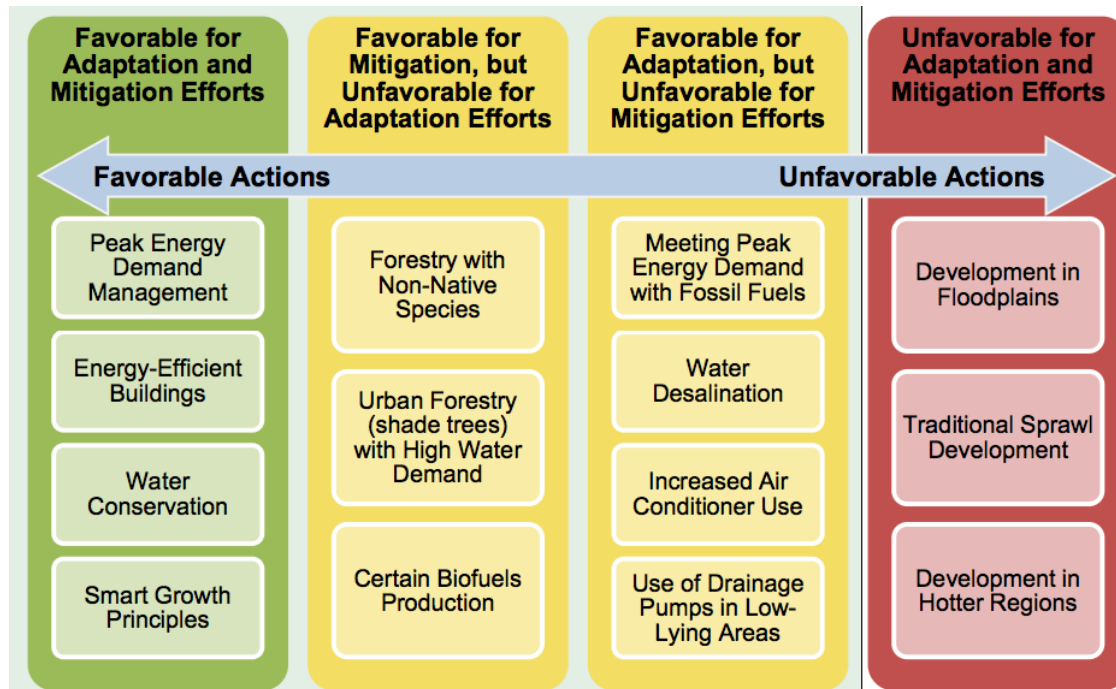
- Inform and engage the public.
- Promote local policies that support the design of healthy and sustainable communities.
- Provide guidance on local climate preparedness.
- Build the capacity of departmental staff and programs.
- Adopt best management practices within departments.

An example of the DPH's work includes their Los Angeles Climate & Health Workshop Series to build healthier and more resilient communities. This series was developed in collaboration with LARC and materials are provided as a template for other public health departments to train their staff. For the public, the DPH has developed reports to inform residents about specific, local-level health impacts of climate change and how they can reduce their contributions to climate change. As noted in these reports, addressing climate change requires "the foresight, commitment, and creativity of a host of agencies" working together.

Additionally, the Western Riverside Council of Governments (WRCOG) has developed a subregional CAP focusing on mitigation strategies. The document notes that a key next step is the evaluation and integration of climate adaptation and resiliency strategies across sectors and jurisdictions.

San Luis Obispo County adopted a CAP, named EnergyWise Plan, in 2011. In the Plan, there is a focus on adaptation, highlighting short- and long-term adaptation measures in multiple sectors and noting the importance of balancing mitigation and adaptation goals and efforts (Figure 3).





Source: Bedsworth and Hanak 2008

Figure 3. Complimentary and conflicting mitigation and adaptation actions. Source: San Luis Obispo EnergyWise Plan.

The County of Santa Barbara has a Sustainability Action Plan, and as of May 2015, an Energy and Climate Action Plan as of May 2015, which largely focuses on reductions of GHG emissions. Ventura County has a Climate Protection Plan (CPP), which includes both mitigation goals and adaptation commitments, such as creating a climate adaptation workgroup and establishing countywide education and outreach on climate change and protection.

### City-Level

LARC is currently working on a comprehensive, searchable index of climate policies and plans for Los Angeles County and its 88 municipalities.

The City of Los Angeles released its CAP, GreenLA, in 2007, focused on GHG emissions reductions, and ClimateLA is the implementation program for its detailed action items. By 2010, Los Angeles reached the goal of deriving 20% of its energy from renewable sources and reported reduced water consumption and pollution at the Port, increased energy efficiency, expanded public transportation, additional city tree canopy, and multiple green building standards.

In 2012, the City of LA's "Adapt LA Fact Sheet" reported the importance of both mitigation and adaptation efforts. In considering adaptation, the fact sheet noted the importance of standards that protect buildings from increasing temperatures, programs to plant more trees and add new parks, and the development of an adaptation strategy, focusing on:

- Evaluating impacts using sound science with the help of academic partners;
- Assessing vulnerability and risks to infrastructure and assets;
- Promoting partnerships regionally and across agencies; and
- Increasing public awareness and engagement.

The 2015 Sustainable City pLAn is a cross-sector 20-year planning document which builds on the City's previous work to address climate change impacts with a long-term goal of sustainability in 14 topic areas, including preparedness and resiliency, carbon and climate leadership, and environmental justice.

Within San Diego County, all 18 cities have performed GHG emissions inventories, and over half are working on, or have completed, CAPs. The City of San Diego's draft CAP, released last year, notes five bold strategies to address climate change, including 1) energy and water efficient buildings; 2) clean and renewable energy; 3) bicycling, walking, transit and land use; 4) zero waste; and 5) climate resiliency. Main points of focus of the CAP include social equity and job creation through climate policies, as well as current and recommended adaptation strategies for identified impacts.

## Summary

A number of cities and counties in the diverse Southern California region have begun incorporating climate change mitigation, and to a certain extent, adaptation, into their planning. The regional collaboratives have been an integral part of connecting various regional stakeholders. As with other areas of the state, many groups still stress a variety of ongoing challenges in addressing climate adaptation. Such challenges include the need for improved regional coordination, as well as scientific and planning expertise, particularly for smaller governments and those in the initial planning stages.

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