

California Legislature
Senate Committee on
Environmental Quality

BOB WIECKOWSKI
CHAIR



INFORMATIONAL HEARING OF THE
SENATE ENVIRONMENTAL QUALITY COMMITTEE
BOB WIECKOWSKI, CHAIR

Tuesday, September 22, 2015
11:00 a.m.

CALIFORNIA ROOM, VISITOR'S CENTER
UNIVERSITY OF CALIFORNIA, MERCED
5200 N. LAKE ROAD
MERCED, CA 95343

**Central Valley Regional Adaptation Efforts to Climate Change
Impacts**

BACKGROUND INFORMATION

Climate Change Impacts and the Central Valley

Currently, climate change is impacting infrastructure, public health, and economies across the world. According to modeling from the Scripps Institution for the California Energy Commission's Public Interest Energy Research (PIER) Program, temperatures in the Central Valley are likely to be 2.3°F-3.6°F hotter in 2050, regardless of greenhouse gas (GHG) mitigation efforts. According to the 5th assessment report from the Intergovernmental Panel on Climate Change (IPCC), worldwide average surface temperatures have already risen approximately 1.4°F since pre-industrial times, and current research notes that an average increase of 2°F above present temperatures poses severe risks to natural systems and human health and well-being.

For every 2°F increase in global average temperature, the U.S. Environmental Protection Agency predicts 5-15% reductions in crop yields, 3-10% increases in rainfall during heavy precipitation events, and 200-400% increases in areas burned by wildfires in the western U.S.

In the Central Valley, which is already one of the most heavily pollution-burdened areas of the U.S., the expected increases in heat waves, wildfires, extreme rainfall events, and droughts will have severe consequences for public health and environmental quality, especially for the state's most vulnerable populations.

The California Communities Environmental Health Screening Tool (CalEnviroScreen) was developed by the Office of Environmental Health Hazard Assessment (OEHHA) to determine a list of disadvantaged communities in California that are the most vulnerable and pollution-burdened. Indicators in the tool include those for exposures, such as ozone concentrations, particulate matter [PM] 2.5 concentrations, drinking water contaminants, and toxic releases from facilities; environmental effects, such as groundwater threats, hazardous waste, and impaired water bodies; sensitive populations; and socioeconomic factors.

According to statewide results from CalEnviroScreen 2.0 last year, the Central Valley has high pollution burdens and population sensitivities, as shown by the dark red colors in Figure 1 below.

Air Quality and Wildfires

All eight counties of the San Joaquin Valley (Fresno, Kern, Kings, Madera, Merced, Tulare, San Joaquin, and Stanislaus) are currently listed as moderate to severe nonattainment counties for multiple criteria air pollutants according to the U.S. EPA. A “nonattainment” designation means that the air pollution in these areas persistently exceeds national ambient air quality standards.

Air quality problems have a number of health impacts, particularly for sensitive populations, including the infirm, elderly, and children. Relatively low levels of ozone can cause airway irritation, leading to coughing, shortness of breath, and chest pain, as well as worsening of chronic respiratory diseases such as asthma. Urban particulate matter (PM) has been linked to increased risks of heart attacks, arrhythmias, and other health problems in people with cardiovascular disease. As well, particulate air pollution can compromise the immune system defenses in the lungs, which may increase susceptibility to bacterial or viral respiratory infections.

A number of impacts from climate change can lead to worsening air quality. Longer, hotter days during the dry seasons result in more ground-level pollutants like ozone. Additionally, dry conditions from high temperatures and worsening drought lead to longer fire seasons and increasing wildfire frequency and intensity. Previous scientific modeling has predicted a 12-53% increase in large California wildfires by 2100 (Westerling and Bryant, 2006). According to the California Department of Forestry and Fire Protection (CAL FIRE), additional impacts from climate change for forests and rangelands include declines in the health and productivity of certain tree species, ecosystem disturbances, potential increases in drought, insects, and disease, and increased spread of invasive species.

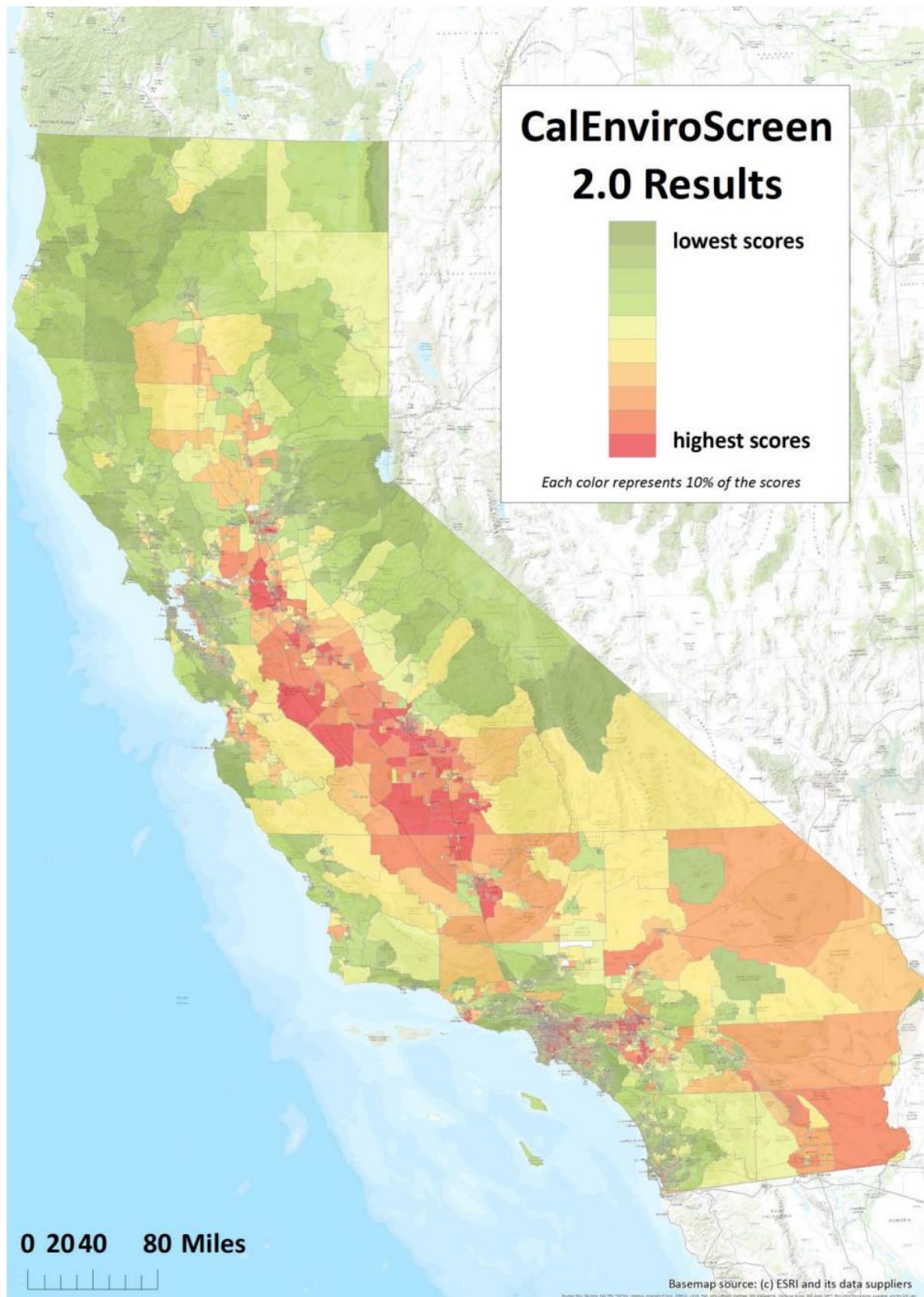


Figure 1. Source: California Communities Environmental Health Screening Tool, Version 2.0 (CalEnviroScreen 2.0), Guidance and Screening Tool, October 2014. Accessed at: <http://oehha.ca.gov/ej/pdf/CES20FinalReportUpdateOct2014.pdf>

Even in those areas not at high risk for forest wildfires in the Central Valley, air pollution is still a concern, as strong winds can spread smoke plumes over large distances, bringing smoke from mountain fires into heavily populated areas. According to the California Air Resources Board's "Wildfire Smoke Guide," the smoke can lead to minor eye and lung irritations or more serious asthma attacks, bronchitis, and premature death, especially because particles from smoke tend to be very small and, therefore, can be inhaled deeply into the lungs.

Worsening air quality as a result of climate change is especially alarming given the current rates of respiratory ailments in children. Using data from the California Environmental Health Tracking Program at the California Department of Public Health (CDPH), a recent report from Kaiser Health News noted that asthma ER visits for children ages 5-17 have been on the rise from 2005-2012, especially in many Central Valley counties. Compared to the California state average of a 17.9% increase in asthma-related ER visits over that period, the increase was 44% in Fresno County, 66.3% in Kern, 88.6% in Merced, and 108.2% in Madera.

Water Quality and Supply

According to the Sacramento and San Joaquin Basins Climate Impact Assessment by the U.S. Bureau of Land Reclamation in 2014, reductions in precipitation from 3-10% are expected in the San Joaquin and Tulare Lake basins of the Central Valley through 2100. Combined with higher temperatures, more of the precipitation will occur as rainfall, leading to increased runoff and reduced snowpack. Per the assessment, with current reservoir capacities, excess runoff would need to be released from reservoirs early for flood control, which would lead to overall reductions in the amount of stored water available for use over the dry months.

Climate change can also lead to more frequent and extreme weather. This includes heavy rainfall events, which can trigger landslides and debris flows that are especially problematic in areas where wildfires have occurred. Heavy rain events can also overwhelm sewage and water treatment facilities with negative impacts to water quality.

Additionally, drought is an important consideration for water quality. The nature of the current drought has likely been worsened due to the record temperatures across the state, which has additional implications on public health, lost jobs, and an estimated price tag of \$2.2 billion for California agriculture. Because of reduced water reserves, groundwater pumping may continue to increase, resulting in higher concentration of pollutants in drinking water.

For example, nitrate contamination of drinking water is already an acute problem in many areas in the Central Valley and may be further exacerbated by this scenario, leading to more residents who are not able to drink water safely from their tap. According to the Pacific Institute's report "The Human Costs of Nitrate-contaminated Drinking Water in the San Joaquin Valley," 75% of nitrate exceedances in the state in 2007 occurred in Valley water systems. They also note that nitrate exposure is associated with respiratory and reproductive conditions; impacts to spleen, kidney, and thyroid functions; and some forms of cancer.

Excessive groundwater pumping can also lead to increased subsidence. According to the California Department of Water Resources, some areas of the Valley are sinking nearly 2 inches

per month, which can damage infrastructure, including bridges, roads, aqueducts, and well casings. Subsidence can also increase vulnerability to flooding during extreme rain events and permanently reduce the capacity of underground aquifers to store water.

Agriculture

Per the California Department of Food and Agriculture (CDFA), California's specialty crops make up over half of the nation's fruits, nuts, and vegetables, and nearly \$7 billion of worldwide exports. A variety of climate change impacts threaten these crops, including reduced water supplies; plant heat stress from more frequent and hotter high heat days; fewer winter chill hours leading to lower yields and less bloom time for flowers, fruits and nuts; shifts in pollinator life cycles and distributions; and the spread of invasive species.

According to the California Climate Change Center's "Potential for Adaptation to Climate Change in an Agricultural Landscape in the Central Valley of California" report, the Central Valley is highly vulnerable to impacts from climate change over the next 50 years. They report that, in order to adapt to the impacts, many changes in the crop mix are needed. As well, additional research is necessary to inform farmers and other agriculture industries in the areas of irrigation methods, fertilization and tillage practices, and land management, to name a few.

In addition to plant breeding and cropping system considerations, climate change will likely lead to increasing disease and pest pressures on crops, as pathogens and parasites are able to better survive and proliferate with earlier spring arrival dates and warmer winter temperatures. Higher temperatures, increasing populations, and urbanization can contribute to uncertainty in the water supply for agricultural purposes. As well, high summer temperatures can contribute to decreased livestock production and decreased availability of irrigated crops for livestock feed.

Infectious Diseases and Health Services

Hot temperatures and drought can facilitate the spread of diseases such as Valley Fever. For the past few years, public health officials have noted that the disease is on the rise, particularly in the San Joaquin Valley region, as shown in Figure 2, where over 75% of cases occur.

The disease, also called coccidioidomycosis, is caused by a fungus that lives in the soil. During hot, dry summer seasons, both people and animals can inhale the fungus by breathing in dust, which can result in flu-like symptoms lasting up to a month or more. Rarely, this can lead to pneumonia and infection of the brain, joints, bone, skin, or other organs. However, even with respiratory illness alone, the health and economic impacts can be substantial, particularly for people who work with soil and dirt (agriculture, construction, etc.).

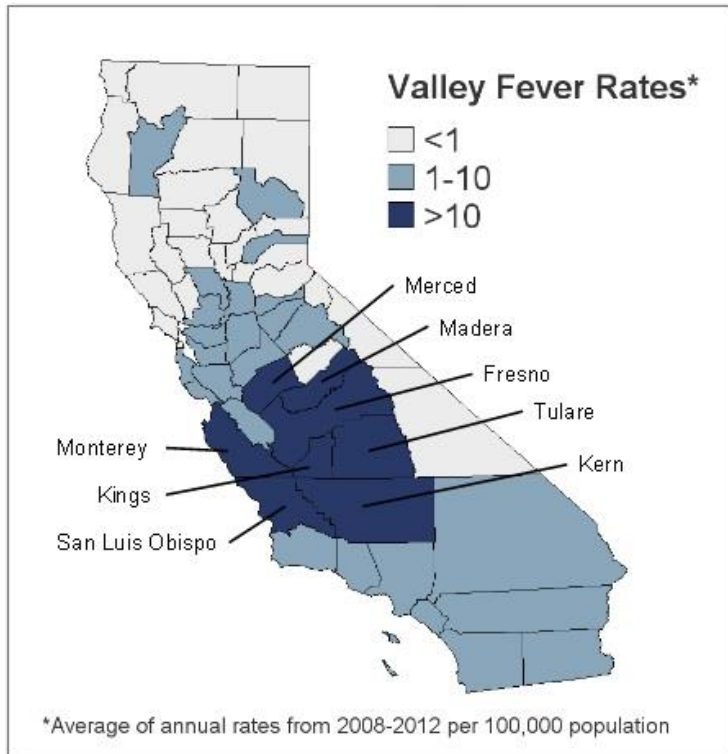


Figure 2. Rates of reported Valley Fever cases in California counties from 2008-2012. Darkest colored counties had the highest rates of disease. Source: California Department of Public Health, Valley Fever Fact Sheet, September 2013.

High heat and drought can also facilitate the spread of West Nile Virus (WNV) by aiding the development of mosquitoes, which spread the virus to people, birds, and other animals. Last year in California, the number of mosquitoes carrying WNV surged to unprecedented levels.

According to the 2014 Safeguarding California report, food-borne pathogens, such as Salmonella and Campylobacter bacteria in farm animal products also display a distinct seasonal pattern, which has been associated with climate variability, such as heat waves and flooding. As climate change will increase the frequency and intensity of these extreme events, the incidence of the diseases may also increase.

Furthermore, regular access to health services is already a challenge in certain parts of the Central Valley. Extreme events such as flooding and wildfire, could threaten infrastructure needed for access to vital services, and the influx of additional patients from heat stress, respiratory ailments, and infectious diseases, etc., could further stress the region’s health care services.

Environmental Justice Considerations

Vulnerable populations and disadvantaged communities will be harder hit by the impacts of climate change and less able to adapt to them. This “climate gap,” is of particular concern for

California which has one of the most ethnically and economically diverse populations in the U.S. (Morello-Frosch et al., 2009).

For example, according to the Pacific Institute's report, some communities in the San Joaquin Valley have already been waiting many years to have safe drinking water restored to their taps. Especially in small communities, water systems tend to have persistent nitrate violations and cannot afford to independently finance projects to reduce contaminants. Per the report, these communities also tend to be low-income with a high percentage of Latino households, in which Spanish-speakers are less likely to be aware of the contamination.

Additionally, minorities and low-income people are more likely to live close to facilities such as powerplants and refineries (Boyce and Pastor, 2013) and hazardous materials sites. These residents are regularly exposed not only to worsened air quality from high local emissions, but also to toxic chemicals during inundation from extreme events and flooding.

In the Salinas Valley, some of the state's worst air and water quality overlaps with areas of severe poverty, where per capita income is 26% lower than the state average (Fougeres, 2007). Local dust storms, field burning, farm machine use, and high numbers of shipping trucks can all contribute to high levels of local air pollutants in these severely burdened communities.

Adapting and Building Resiliency

California has implemented aggressive greenhouse gas reduction goals as part of the global effort to prevent the worst effects of climate change. However, even if all GHG emissions ceased today, many impacts of climate change would still be unavoidable because the climate system changes slowly. As we're already seeing the effects of climate change, with more impacts to come, planning and implementation of climate adaptation measures can help reduce the growing risks of impacts to public health, the environment, and economy.

State Efforts in Climate Adaptation

California has developed numerous policies focused on GHG emission reduction efforts, with a subset addressing adaptation and resiliency. Governor Brown's recent Executive Order (EO), B-30-15, focused on the state's efforts to address climate adaptation, directing the Natural Resources Agency to coordinate regular updates to California's Climate Adaptation Strategy and all state agencies to consider climate change and adaptation in their planning and investment decisions.

State Resources & Planning Documents

Many state agencies have worked together to produce multiple climate change assessments and guidance documents, as well as provide funding for affordable housing and sustainable communities. 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.

The upcoming Fourth Climate Change Assessment will provide scientific information to support adaptation decisions, implement much of the state's plan to coordinate state research on climate change, and identify additional research projects. Additionally, Cal-Adapt is a web-based climate adaptation planning tool for local planning efforts with downscaled climate change scenarios and research for regions within California.

State Strategies and Recommendations

Broadly, the Safeguarding California report listed key cross-sector strategies for adaptation, including: integrating climate change into government activities; considering vulnerable populations, significant and sustainable funding sources, and research data and tools; prioritizing projects with multiple benefits; and prioritizing communication, education, outreach, and collaborative, iterative processes. The guiding principles of the Climate Adaptation Strategy update included involving all relevant stakeholders and establishing partnerships across levels of government and between public and private sectors. This emphasis on collaboration from state agencies is further highlighted in the Adaptation Planning Guide, which states, "Climate adaptation requires a sustained iterative process meaning both local and regional staff and community members should be engaged throughout the process."

Example: Agriculture Sector

An example of this multi-stakeholder process is highlighted by CDFA's Consortium for Specialty Crops, established in 2012 to identify specific climate change adaptation strategies for growers. The Consortium discussed strategies across levels, including individual growers, local, regional, and state planning, and across multiple categories, including education and outreach, planning and research, technology and innovation. Some of the recommendations included supporting economic and environmental studies, improving technical assistance and training for growers, promoting collaborations among individual producers and regional water boards, and supporting policies to help producers adapt to climate change.

Other initiatives from CDFA can promote both mitigation and adaptation goals. For example, the Healthy Soils Initiative works to ensure that agricultural soils have adequate organic matter to sequester carbon, increase water retention, reduce erosion and dust, and improve plant health and yields.

Example: Forests and Fire Prevention Sector

CAL FIRE defines adaptation as any action adjustment to natural or human systems to minimize harm or take advantage of benefits from climate change. Fostering forest adaptation involves three main areas: forest ecosystem health and productivity, protection from wildfire, and biomass utilization for energy.

In order to address adaptation in all of these areas, CAL FIRE prioritizes monitoring forest health for pests and diseases, propagating tree species that are better adapted to climate changes, and using manual thinning, prescribed burning, and land use planning to reduce fire hazards, among

other strategies. Additionally, urban forests are important for both carbon sequestration and adaptation to reduce heat islands, absorb and filter storm runoff and flooding, and protect air quality.

Regional Efforts in Climate Adaptation

Regional agencies, including the Central Valley Regional Water Quality Control Board (Water Board) and the San Joaquin Valley Air Pollution Control District (Air District), have been working to consider the impacts of climate change in their planning and to collaborate with other levels of government and stakeholder groups.

For example, the Water Board recently held a public workshop on the effects of climate change on water quality in the Central Valley Region in March. The goals were to assess the impacts of climate change in the region, the policy responses of other government entities, and the needs and concerns of stakeholders in the Valley, in order to inform the development of a Climate Change Work Plan for the Water Board.

Additionally, the state and regional water boards have been working together in order to determine their data needs across the state and inform a coordinated work plan. The Water Board also works with local communities to assess water quality concerns.

The Air District adopted a Climate Change Action Plan in 2008. Much of the work on climate change has been focused on meeting the mitigation goals and complying with State and Federal mandates. However, the agency also recommends measures that have adaptation co-benefits by improving air quality (e.g. using methane from the dairy industry as renewable energy for low nitrogen oxides [NO_x] trucks). To protect public health while promoting forest management, the agency works with land managers to coordinate small-scale prescribed burns on days when the air quality forecast allows for it. Additionally, the agency's advisory committee for ozone includes government, industry, and environmental justice representatives.

Local Efforts on Climate Adaptation

In the Central Valley, academic institutions, counties, and cities are also engaged in climate change mitigation, adaptation, and research to varying degrees. Included here are some examples from each of these stakeholder groups.

Academic Institutions

The Institute of Climate Change, Oceans and Atmosphere (ICOA) at California State University, Fresno was created to foster interdisciplinary research and teaching in the climate change, oceanography, and atmospheric science. For ICOA's purposes, oceans are broadly interpreted to include all elements of the water cycle, including precipitation, runoff/recharge, surface water, and ground water. The areas of interest within the Institute include a broad range: soil and water, health, climate, agriculture, air quality and pollution, and environmental education. As well, in 2008 the ICOA assisted the City of Fresno in evaluating potential effects of climate change and

developing strategies to reduce the impacts and GHG emissions in the Climate Change Assessment Report for the Greater Fresno Area.

Fresno State's Office of Community and Economic Development was also selected as a regional partner in the state-run CivicSpark program. CivicSpark is Governor Brown's AmeriCorps program for building local government capacity to address climate change, administered by the Local Government Commission (LGC) in partnership with the Governor's Office of Planning and Research. In the San Joaquin Valley, there are five projects within the program, including development support for the Merced County Climate Action Plan and for urban forestry in the Valley.

The University of California, Merced (UC Merced) is engaged in climate change efforts in a variety of ways. The Sierra Nevada Research Institute (SNRI) has over 35 affiliated researchers focusing on sustainability, the ecosystem, water, drought, climate and more, using the Valley as a "living laboratory." Recently, the University hired a UC Cooperative Extension specialist, housed in the SNRI, to help farmers and ranchers adapt to the impacts of a changing climate and to collaborate with UC colleagues, state, and federal agencies in California's efforts to address climate change adaptation and mitigation. Additionally, UC Merced has its own Climate Action Plan, which includes the goals of becoming "climate neutral" by 2020 and starting a dialogue on regional solutions to global warming.

County-Level

A number of county public health departments have been working with the California Department of Public Health's (CDPH) "CalBRACE: California Building Resilience against Climate Effects" project to plan for and reduce health risks from climate change. For example, the Merced County Public Health Department received a small grant from the program to conduct a survey on climate change efforts in their county.

In 2010, stakeholders in Fresno and San Luis Obispo Counties, including elected leaders, county planners, land managers, public health officials, and citizens, with the help of the LGC, investigated regional climate change impacts and approaches to climate change, and produced the report, "Adaptation Strategies across Socioeconomic and Natural Systems in Fresno and San Luis Obispo Counties." They noted in the report that, based on climate change projections, "Adaptation is the next critical step if California cities and counties are to be prepared for the potentially devastating impacts of climate change."

Additionally, Tulare County includes a section on adaptation in the areas of water supply, agriculture and forest land, and flooding in their 2010 Climate Action Plan, and the Kern County Regional Transportation Plan touches on the topic.

City-Level

The City of Madera released a draft of their Climate Action Plan (CAP) in August. The CAP includes a section on adaptation measures which notes that adaptation planning for climate change impacts should be done across sectors and incorporated into local hazard mitigation plan

development. Furthermore, this section describes existing and/or completed efforts, general plan policies and actions, and additional implementation actions for multiple sectors, such as public health, water management, and agriculture.

In 2012, the City of Merced adopted a CAP with long-term goals through 2020. The main focus of the plan is GHG emissions reductions and sustainability. Though GHG mitigation strategies can often have adaptation co-benefits, adaptation efforts are not always called out specifically as such. Given the state's early focus on mitigation, many CAPs throughout the state follow this lead, though more are beginning to incorporate adaptation considerations and planning.

Summary

In a 2014 report, "Governing California Through Climate Change," the Little Hoover Commission noted the need for a greater emphasis on adaptation and a comprehensive administrative structure in California for creating adaptation policy. From previous hearings of this committee on climate change adaptation at the state and regional levels, the need for additional resources and tools for local governments, as well as regional coordination structures, has been a consistent theme.

These needs exist for the Central Valley as well. Because this region suffers from some of the most severe air and water quality problems in the country, and is highly dependent on water supplies to support an economy based heavily in agriculture, adaptation measures are an important part of sustaining and improving the environmental quality, public health and economic vitality of the region.

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