Safeguarding California In Action:

Climate Change Adaptation Examples from State Agencies

CALIFORNIA natural resources AGENCY

Summary

California is experiencing a changing climate, and impacts from climate change are only accelerating in their severity and frequency. Projections showing increased drought, wildfire, inland and coastal flooding, and extreme heat events require action to safeguard California from the harmful impacts of climate change. The Safeguarding California Plan, updated in 2018, is the State's roadmap for ongoing actions and next steps to adapt to climate impacts.

The 33 examples in this compilation provide more concrete examples of the steps outlined in the Safeguarding California Plan to make communities, infrastructure, services, and the natural environment more resilient to climate change. Each of these examples highlights unique strategies funded by the State to combat and adapt to the effects of climate change in concrete and meaningful ways.

To find more case studies across California, as well as resources for implementing climate adaptation projects and policies, please visit the Adaptation Clearinghouse coordinated by the Governor's Office of Planning and Research: opr.ca.gov/clearinghouse/adaptation/

Guide to Safeguarding California Identifiers

The 13 sector icons below help create a visual system that shows how state government agencies' adaptation actions in distinct sectors are woven together as part of a holistic roadmap for resilience to climate change. Each of the examples in this compilation are marked with one or more of these icons to indicate the focus of the programs and projects described.

- General
- Climate Justice
- Emergency Management
- Energy
- Land Use
- Public Health
- Transportation
- Agriculture
- Biodiversity and Habitat
- Forests
- Water
- Oceans
- Parks, Recreation, and California Culture

Climate Resilience Planning Among California Native Tribes

The Blue Lake Rancheria ("Tribe"), a federally-recognized tribe in rural Humboldt County, has undertaken an aggressive, integrated strategy to improve public health, lower greenhouse gas (GHG) emissions, and adapt to a changing climate. Pollution and climate hazards are amplified on these tribal lands due to geographic isolation; the region's main roads are prone to landslides and connections to outside electricity, natural gas, and communication grids are tenuous. The Tribe has identified nearby hazardous infrastructure and air and water pollution concerns, and these impacts are exacerbated by the effects of climate change.

Aligning with California, the Tribe's government, elected leaders, and staff have made significant progress toward clean energy, GHG reductions, and community resilience. The Tribe has implemented a wide range of projects to address these goals, including steps to ensure greater critical infrastructure and resource reliability during emergencies. For example, with funding from the California Public Utilities' Electric Program Investment Charge, the Tribe developed a low-carbon, community-scale microgrid with a 500-kW solar array, a 1-MWh Tesla battery storage system, and a Siemens microgrid management system. Backed by numerous partners, including the California Energy Commission, Schatz Energy Research Center, California State University at Humboldt, Pacific Gas and Electric Company, Idaho National Laboratory, Siemens, Tesla, REC Solar, McKeever Energy, Colburn Electric, Kernen Construction, and the American Red Cross, the microgrid enables the Tribe to supply its own power to a campus of critical infrastructure during emergencies, and it has resulted in energy savings of $200,000/year, a 10% increase in clean energy employment, and a reduction of at least 150 tons/year of GHG emissions. Other projects to improve the Tribe's resilience to climate change include 1) development of a smart community water system, 2) a food sovereignty initiative, 3) development of a Resilience Training and Innovation Center, 4) transition to green transportation, including development of regional Electric Vehicle (EV) infrastructure, adding EV buses within the Tribe's public transit system, and biodiesel manufacturing using the Tribe's waste cooking oil, and 5) an agreement with the American Red Cross to serve as a shelter-in-place in the event of a regional emergency. The Tribe's efforts, including significant mitigation of greenhouse gas emissions, improved energy and water efficiency, and plans to shelter and protect indigenous and other communities in the event of climate emergencies or extreme events, are critical for sustainable climate change adaptation.

Images provided by Blue Lake Rancheria

For more information about Safeguarding California and Climate Change Adaptation efforts in California, visit http://resources.ca.gov/climate/safeguarding/

Hazard Mitigation at Donner Trail Elementary School

Climate change will contribute to variable and unpredictable snowfall in California's mountainous areas. As extreme weather becomes more frequent, buildings and infrastructure must undergo renovations to withstand the impacts of these events. Donner Trail Elementary School in the Tahoe-Truckee Joint Unified School District is prone to receiving between 200-400 inches of snow in the wintertime. The school building, with a snow load rating of approximately 130 pounds per square foot in the winter (well below the Nevada County Building code's required 252 pounds per square foot) was at risk of collapse under the weight of an increased snow load. Recognizing the dangers to the building and the public health risk in the event of heavy snow accumulation, the District applied for the California Office of Emergency Services' Hazard Mitigation Grant for support in renovating the roof of the school and increasing the school's snow load capability to meet building code requirements. In January 2017 after the project was complete, the area experienced one of the worst winter storms and snowfalls on record with approximately 300 inches of snow. As a result of the facility's structural improvements, the school withstood what could have previously been a catastrophic winter event.

Image provided by the California Office of Emergency Services. Clockwise from left: Donner Trail Elementary School from the outside; the interior of the roof before it was renovated to meet local building code specifications; the interior of the roof after it was renovated to meet building code requirements.

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Big Bear Roof Replacements

The threat of climate-related wildfires called the California Office of Emergency Services to action. Partnering with the Big Bear Lake Fire Protection District, The City of Big Bear Lake, and San Bernardino County Fire Protection District, the Office of Emergency Services set out to replace hazardous wood shake shingle roofs on structures identified by the Mountain Area Safety Taskforce near the San Bernardino National Forest boundaries. These high-risk structures were enhanced by replacing the wood shake shingles with 30-year Class A composition roofing material and by retrofitting homes with non-ember intrusion vents with the goal of reducing the risk of wildfire-destroyed homes by 51%. With the advent of climate-exacerbated wildfire, these precautionary measures are critical to protecting California homes.

Image provided by the California Department of Water Resources Photoshelter Gallery (KG_oroville_8531_09_01_2017.jpg)

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Enhancing Energy Efficiency in the Santee Unified School District

Climate change is impacting energy needs in the state of California. During periods of extreme heat, for example, energy demand increases as more people rely on air conditioning to stay cool. As climate-related events become more frequent, improved energy efficiency will enhance the state's resilience to climate change. The Santee Unified School District recognized the opportunity to improve its energy efficiency by retrofitting the entire district with over 8,000 new LED lighting fixtures. In partnership with the California Conservation Corps' Vista Energy Center, California Energy Commission, and Department of Education, the District used Proposition 39 funding to implement the project between June and September of 2016. With the new lighting fixtures, the district saves a projected 720,000 Kilowatt hours per year, which translates to 171 metric tons of annual greenhouse gas emissions reduction. Not only does this project reduce the school's routine energy use and the cost of the utility, but it also prepares the district with more efficient means to maintain function during extreme climate events when energy demands fluctuate.

Image provided by the California Energy Commission

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Single-Family Affordable Solar Homes Program (SASH)

The Single-Family Affordable Solar Homes (SASH) program provides direct funding for solar installations in low-income communities in California. Administered by nonprofit GRID Alternatives, it provides up-front rebates to help low-income homeowners served by investor-owned utilities access the benefits of solar power, with integrated workforce development opportunities. The program was created by Assembly Bill 2723, which directed that a minimum of 10% of California Solar Initiative funds be set aside for programs assisting low-income households in investor-owned utility service territories. Funding for the program was extended in 2013. Over 6,800 low-income households have received solar power through the program to date.

Image provided by the California Energy Commission. *Senator Kevin De León (second from right) at a LIWP solar installation in Sacramento. He is flanked by the homeowner, left and a job trainee, right.*

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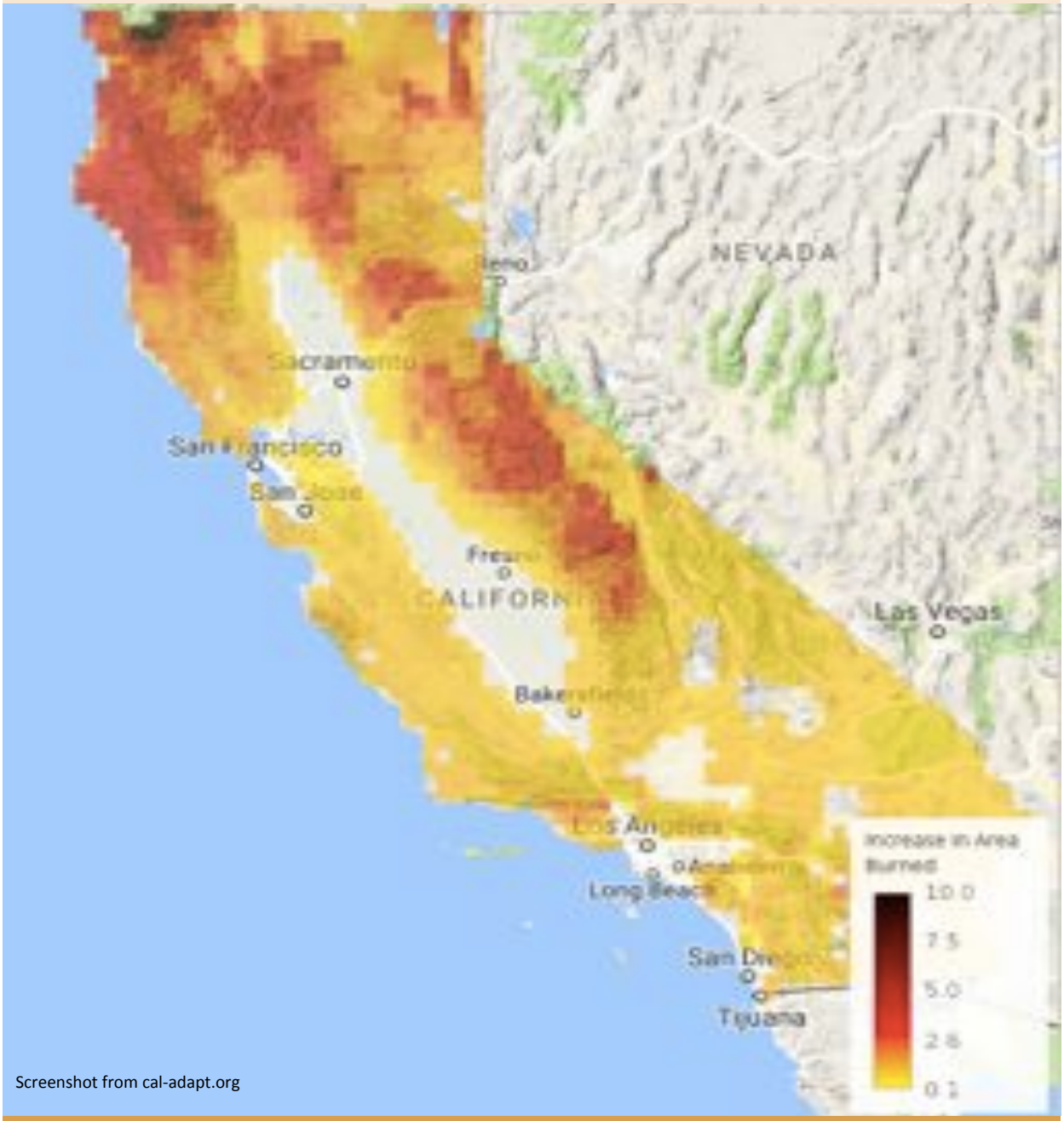
Visualizing Climate-Related Risks to the Electricity and Natural Gas Systems Using Cal-Adapt

Cal-Adapt is an online, interactive, visualization tool that enables researchers, decision makers, and the general public to explore how climate change will impact specific regions in California. A recommendation in the 2009 California Adaptation Strategy to support local decision-makers and planners in identifying, understanding, and adapting to climate risks spurred the creation of Cal-Adapt. Current research projects are launching updates to 1) climate change visualization tools and data (projected as well as historical) hosted on Cal-Adapt, 2) migrate Cal-Adapt to an open source Application Programming Interface (API) that supports third-party tool development, and 3) implement concerted outreach efforts to ensure that results reach target audiences in the electricity sector and are responsive to their needs.



Screenshot from cal-adapt.org

Los Angeles County Grid Vulnerability to Extreme Heat

Extreme heat events compound climate change effects on energy use, particularly where the grid is most vulnerable to extreme peak demand. Funded by the Electric Program Investment Charge (EPIC), the project develops an in-depth analysis of future demand, grid response, and vulnerability due to increased (and prolonged) heat events in Southern California Edison territory. Current and future climate scenarios will project and evaluate how extreme heat incidences lead to strain on stations and substations, and whether they trigger peaker plant generation. With the release of the Fourth Climate Change Assessment in August 2018, researchers will offer grid operation guidance.

Image provided by the California Department of Water Resources Photoshelter Gallery (JRC_Los_Angeles_Hollywood—3.jpg)

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Low-Income Weatherization Program (LIWP)

The Low-Income Weatherization Program's (LIWP) solar , launched in 2015, provides rebates for low-income households in economically and environmentally disadvantaged communities to receive solar power. The program, part of the California Department of Community Services and Development's broader LIWP program, is administered in conjunction with the Single-Family Affordable Solar Homes Program (SASH) by the nonprofit GRID Alternatives, with an additional pilot program in Fresno run by Fresno Economic Opportunities Commission (Fresno EOC). GRID Alternatives expects to install solar for 2,900 families through the program through mid-2018. It also integrates workforce development opportunities into its projects. Implementing clean energy and energy efficiency measures, providing workforce development and green jobs training opportunities, and creating opportunities for broad community engagement for low-income communities helps low-income households increase their climate resiliency.

Image provided by the California Department of Water Resources Photoshelter Gallery (FL_Solar-8971_12_12_2017.jpg)

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Extreme Weather-Related Vulnerability and Resilience for California's Independent Transportation Fuel Sector

Extreme weather-related events can be problematic for California's transportation fuel sector. The California Energy Commission-lead research team will identify and assess California's joint energy and transportation vulnerabilities to extreme weather-related events. The team is poised to identify options to improve the sector's resilience to climate change, with particular consideration of wildfire and flooding. Engagement with petroleum sector stakeholders and the public through workshops informs the project's priorities, methodology, and implementation. Initial vulnerability assessments using existing available data will be a first step in identifying risks and avenues for improved resilience. Further refinement will leverage the team's sophisticated hydrodynamic modeling capabilities, the scenarios available through California's Fourth Climate Change Assessment, and extensive stakeholder engagement to increase resilience.

Image provided by the California Department of Water Resources Photoshelter Gallery (FL_Solar_Panels-3983.jpg**)**

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San Diego Natural Gas Vulnerability and Resilience

In collaboration with San Diego Gas & Electric, the California Energy Commission is conducting a multi-hazard analysis of climate change impacts on San Diego's natural gas system. Through research involving mapping applications to overlay complex modeling results, workshops, and interviews, the analysis illuminates the direct and indirect impacts of sea level rise, coastal storms and flooding, and inland hazards and exposure. Based on this analysis, adaptation measures and potential implementation protocols will be identified, evaluated, and assessed as a means of improving San Diego's preparedness for climate change.

Image provided by the California Department of Water Resources Photoshelter Gallery (San Diego Coronado Bridge)

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Imperial Valley Urban Forest Expansion

The California Department of Forestry and Fire Protection, in partnership with the City of Brawley, Brawley High School District, the City of Imperial, the City of Calexico, and the City of Holtville, organized the planting of 1,400 trees in predominantly disadvantaged communities in the Imperial Valley. Funded by the United States Forest Service's Urban and Community Forestry Program and California Climate Investments from the Greenhouse Gas Reduction Fund, the project offers job training, community involvement, and young tree care as a means of expanding the urban canopy, particularly in disadvantaged communities. Improving the urban forest inventory is an effective low-cost means of adapting to the changing climate. The increased urban shade will help to save energy by reducing the urban heat island effect and offer protection to the public during extreme heat events. The expanded canopy will benefit public health as it filters polluted air and stormwater in the Imperial Valley. During this 40-year project, not only will an estimated 5,622 tons of greenhouse gases be reduced, but the expanded urban forest will help the area develop a stronger resiliency to the impacts of climate change.

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Upgrading Streets, Sidewalks, and Alleys for a Healthy and Resilient California

California State Water Resources Control Board provided multiple grants from the Proposition 84's Storm Water Grant Program to the City of Santa Barbara to implement Low Impact Development (LID) designs within parking lots, alleys, and streets. The City replaced more than 230,000 square feet of asphalt and concrete with permeable interlocking concrete pavers to treat stormwater, allow runoff to infiltrate into the soil, and provide groundwater recharge and flood protection. The projects capture and infiltrate approximately 8 acre-feet of rainfall in Santa Barbara per year. The elimination of runoff mitigates public health risks associated with pooling, flooding, and polluted runoff resulting from recurring flash storms, and it also reduces the risk of flash floods and prevents habitat damage downstream. The infiltrated water increases the amount of groundwater which is pumped, treated, and distributed to residents for municipal water. Increased infiltration and higher groundwater levels contribute to higher base flows in the creeks, thereby enhancing the stream habitat benefits for aquatic organisms. The city's century-old Italian pine trees displayed some of the most surprising results; the trees, which had previously displaced cemented sidewalks with their water-deprived roots, began to grow deeper to reach the newly-replenished water source far below ground and showed visible signs of improved health soon after the projects were implemented. The trees will further help to filter pollutants from water, improve air quality, and reduce urban heat island effect in the city. The light color of pavers also helps reduce the urban heat island effect. The environmental and public health benefits are especially important with the threat of storms becoming more frequent and extreme, and the number of extreme heat days increasing with climate change. Recognizing multiple benefits, ease of maintenance, reusability, and durability of permeable pavers, city staff are now favoring LID practices over traditional methods for managing stormwater and dry weather flows.

Image provided by the State Water Resources Control Board

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Assessing Drought Impacts in Tulare County

The drought in California which began in 2012 was the most severe in the State's recorded history. In addition to the far-reaching impacts that drought has on the environment and the economy of affected communities, it may also have significant effects on public health. Particularly as climate change exacerbates the occurrence of drought, understanding the impact of these events on California residents is a critical part of establishing resilience in the state. In 2015, the California Department of Public Health (CDPH) partnered with Mariposa County Health Department and Tulare County Health and Human Services Agency to quantify the public health impacts of drought. Tulare County reported the greatest number of dry private wells in the state, and Mariposa County experienced unparalleled tree mortality. Using Community Assessments for Public Health Emergency Response (CASPER), a rapid community needs assessment method developed by the Centers for Disease Control and Prevention, CDPH evaluated household water use as well as drought-associated exacerbations of chronic diseases and behavioral health issues, acute stressors, and financial impacts.

These assessments produced the first estimates of drought impacts on household health, peace of mind, acute stress, worsening of chronic disease, finances, and property, demonstrating that households might perceive physical and mental health effects and financial and property impacts due to drought. The findings were used to augment ongoing drought response operations in Tulare and Mariposa Counties, including targeted outreach to residents for water assistance, expanding behavioral health services, identifying populations with special needs, and the development of drought adaptation plans through a cooperative agreement with the Center for Disease Control (CDC). These findings were published in the Community Assessment Report for Tulare County, Community Assessment Report for Mariposa County and in the American Journal of Public Health's article, Physical, Mental, and Financial Impacts from Drought in Two California Counties, 2015.

Image provided by the State Water Resources Control Board

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Climate Change and Health Profile Reports

The Climate Change and Health Profile Reports, developed by the California Department of Public Health – Office of Health Equity's California Building Resilience Against Climate Effects program (CalBRACE), assist counties in California to prepare for the health impacts related to climate change through adaptation planning. The reports present an overview of climate science and link current and projected climate change risks to health outcomes. Both the reports and indicators provide unique data at the smallest geographic level available to inform public health practitioners and their partners about climate change risks to health. Indicators in the reports include heat-related emergency department visits, adults living with multiple chronic conditions, population in high wildfire areas, population living in poverty, race/ethnicity, outdoor workers, air conditioning ownership, tree canopy, and public transit access.

Image provided by the California Department of Water Resources Photoshelter Gallery (KG_oroville_pm_3701_07_17_2017.JPG)

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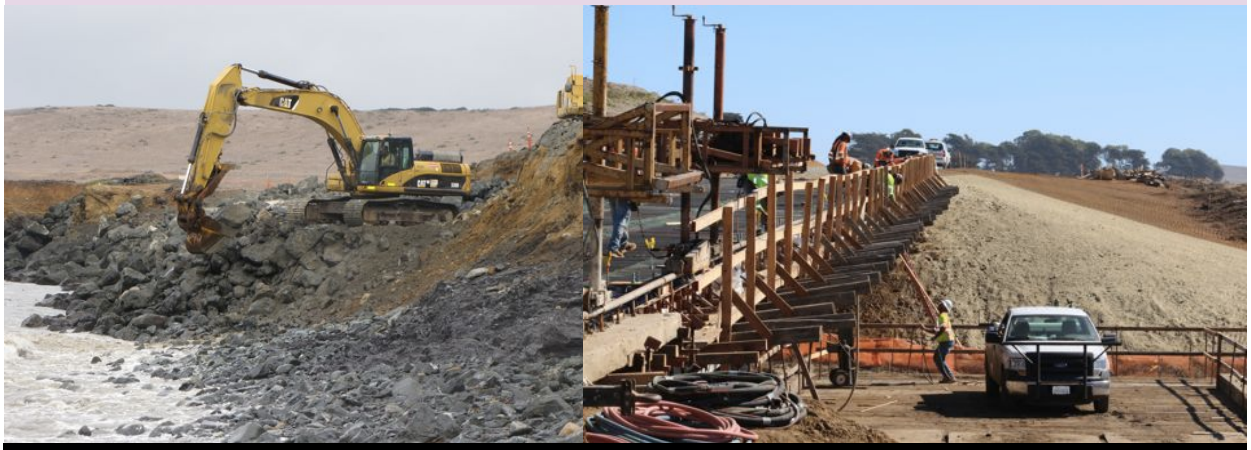
Highway 1 Piedras Blancas Realignment

The California Department of Transportation (Caltrans) has realigned 2.8 miles of Highway 1 in northern San Luis Obispo County up to 475 feet inland of the original alignment to protect the route from severe coastal erosion exacerbated by the effects of climate change. The project will protect the highway for the next 100 years and provide access for vehicles, bicycles and pedestrians. Completed in 2017, the realignment of the highway at Piedras Blancas will not only restore the natural functions of nearby creeks by replacing three significant crossings with bridges but the removal of artificial revetments will enable bluff and intertidal zones to reestablish equilibrium. Furthermore, the permeable roadway materials used during construction will maintain the hydrologic connectivity of adjacent wetlands. As climate-related extremes such as sea-level rise, drought and flooding impact the integrity of California's coastal areas, the realignment of this iconic highway is one adaptive measure that will uphold the built and natural environment for years to come.



Images provided by the California Department of Transportation

For more information about Safeguarding California and Climate Change Adaptation efforts in California, visit http://resources.ca.gov/climate/safeguarding/

Transportation Vulnerability Assessments

The California Department of Transportation's (Caltrans) Climate Change Vulnerability Assessments identify vulnerabilities and assess the possible impacts of climate change on the State Highway System across the state. The assessments will indicate locations where infrastructure may be at risk and help Caltrans recognize processes that may need to change to be resilient to future climate conditions. In the next phase of the assessment, Caltrans will study vulnerable assets to develop strategies and adaptive management plans to address and reduce the potential costs of climate impacts. By October 2019, assessment reports will be released for each of Caltrans' twelve districts.

Partnering organizations include the Coastal Commission; Department of Forestry and Fire Protection; Department of Water Resources; Energy Commission; California Geological Survey; Climate Central; Federal Emergency Management Agency; Federal Highway Administration; Metropolitan Transportation Commission; National Oceanic and Atmospheric Administration; Pacific Gas and Electric Company; Point Blue; San Francisco Bay Conservation and Development Commission; United States Geological Survey; University of California, Berkeley; University of California, Davis; Scripps Institution of Oceanography at University of California, San Diego; and United States Army Corps of Engineers.

Image provided by the California Department of Transportation

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Advancing Water Management in Merced County

Changes to the climate are impacting the already brief precipitation season in California, necessitating supplemental irrigation to support agricultural production in the state. Seth and Michelle Rossow utilized funds from the California Department of Food and Agriculture's State Water Efficiency and Enhancement Program (SWEEP) to purchase and install an improved irrigation system on their farm in Merced County. Seth and Michelle Rossow Farms now automate irrigation of tomato and bell pepper crops on their 175 acres of land. The automation mechanism on their existing sub-surface drip irrigation system utilizes newly installed soil moisture probes to alert workers when the crops need water. The new system thus conserves water by utilizing smaller quantities more frequently and directly to the crop root zones. By replacing an above-ground diesel-fueled sprinkler system, this automated irrigation technology is not only saving water, but reducing diesel emissions, conserving electricity, and saving money. Efforts to adapt to climate change by enhancing the water and energy efficiency of existing agricultural systems in this way are imperative components of a resilient future.

Image provided by the California Department of Food and Agriculture. Clockwise from top right: Drip system installed in a stone fruit orchard, drip system installed in a vineyard, microsprinkler system installed in a walnut orchard.

For more information about Safeguarding California and Climate Change Adaptation efforts in California, visit http://resources.ca.gov/climate/safeguarding/

Technical Assistance for State Water Efficiency and Enhancement Program Applicants

Since 2014, the California Department of Food and Agriculture (CDFA) has provided grants to the agricultural community through the State Water Efficiency and Enhancement Program (SWEEP). The purpose of SWEEP is to provide financial assistance to farms to implement irrigation systems that conserve water and reduce greenhouse gas emissions. SWEEP projects help farms adapt to climate change impacts by achieving improved water and energy efficiency, thereby maintaining productive farms with less resource inputs.

In 2016, in an effort to increase access to SWEEP funds to farms of all resource and economic levels, CDFA received funding from the United States Department of Agriculture's Natural Resources Conservation Service (USDA NRCS) to support technical assistance workshops for SWEEP applicants throughout California. Through this strategy, CDFA was able to maintain the competitive nature of the SWEEP program and also enhance opportunities for farmers to receive application assistance. As a result, for the 2016 SWEEP solicitation, 23 application assistance workshops were held, reaching over 200 workshop attendees in four languages (English, Spanish, Hmong, and Punjabi). This technical assistance strategy has now become an integral part of the SWEEP program. Funding from both USDA NRCS and from the Strategic Growth Council allowed CDFA to provide funding to technical assistance providers during the 2017 SWEEP solicitation. Eleven technical assistance providers held 24 workshops throughout California, reaching 270 people with application assistance. CDFA aims to implement similar technical assistance programs for its other climate smart agriculture incentive programs such as the Healthy Soils Incentive Program. Regional technical assistance professionals are vital to future climate change adaptation because they help to bring conservation technologies and practices to farms.

Image provided by the California Department of food and Agriculture.

For more information about Safeguarding California and Climate Change Adaptation efforts in California, visit http://resources.ca.gov/climate/safeguarding/

South Bay Salt Pond Restoration

Tidal marshes are vegetated coastal wetlands that provide critical habitat for numerous species, including young salmon, steelhead trout, shorebirds, waterfowl, harbor seals, and endangered birds and mammals like the California clapper rail and salt marsh harvest mouse. As climate change challenges the integrity of these habitats, restoration efforts are critical to maintaining a resilient coast. The South Bay Salt Pond Restoration Project is the largest tidal wetland restoration project on the West Coast. When complete, the restoration will convert 15,000 acres of former salt evaporation ponds at the south end of San Francisco Bay to a mix of tidal marsh, mudflat, and other wetland habitats. In addition to restoring and enhancing wetland habitat, the project also aims to provide wildlife-oriented public access and recreation as well as flood management in the South Bay that will increase resilience to sea level rise. The project is a partnership between the United States Fish and Wildlife Service, California Department of Fish and Wildlife, Santa Clara Valley Water District, and State Coastal Conservancy. The first phase of projects, which restored or enhanced 3,750 acres, was completed in May 2016. The second phase of projects (3,335 acres) will break ground in 2018.

Images provided by Chris Benton

For more information about Safeguarding California and Climate Change Adaptation efforts in California, visit http://resources.ca.gov/climate/safeguarding/

King Fire Watershed Rehabilitation and Reforestation

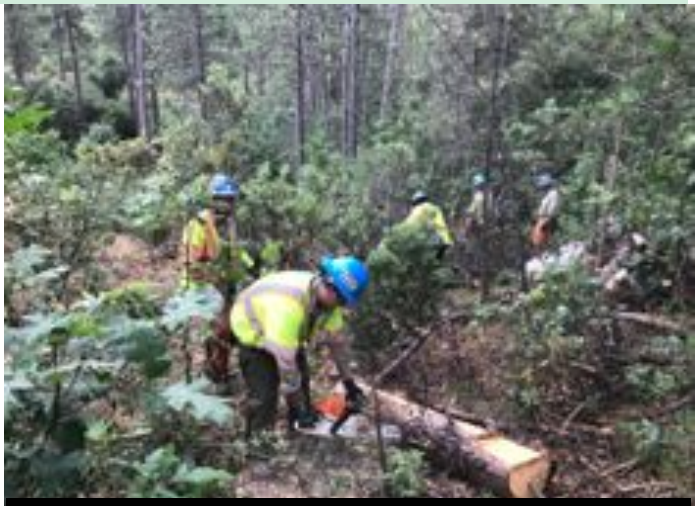
The King Fire Watershed Rehabilitation and Reforestation project will begin the process of reversing the ecological, economic, environmental, aesthetic and social impacts of 1,300 acres burned in the King Fire in the Fall of 2014. The California Department of Forestry and Fire Protection partnered with the United States Forest Service, Georgetown Divide Resource Conservation District and University of California Cooperative Extension to plant approximately 390,000 trees, sequestering over 169,671 tons of greenhouse gases over the next 60 years. With funding from the Forest Health Program and California Climate Investments, the project aims to rally landowners within the King Fire perimeter to the cause of reforestation through educational and financial support to foster healthier forests. The improved health and re-established cover of forested lands will increase potential carbon sequestration and reduce the greenhouse gas emissions on the burned areas, benefitting not only local habitat, but protecting watershed values and water quality in areas that are important sources of domestic water supply. Removing accumulated debris and dead trees from the affected lands not only improves the growth potential of future vegetation, but also reduces the risk of wildfire and makes the forests more resilient to drought.

Images provided Images provided by the Georgetown Divide Resource Conservation District.

For more information about Safeguarding California and Climate Change Adaptation efforts in California, visit http://resources.ca.gov/climate/safeguarding/

Combatting Tree Mortality

The risk of wildfire is by increasing tree mortality in California forests. In an effort to address these risks, the California Conservation Corps (CCC) collaborated with California Volunteers to treat 500 acres of tree mortality-stricken land from throughout 2017 by felling, bucking, and limbing dead and dying trees. Through the first six months of the project, CCC Tree Mortality crews treated 120 acres in the six highly-impacted counties in the Southern Sierra Nevada Range to improve forest health and remove hazards for public safety. This initiative promotes resiliency to climate change by improving the health of forested watersheds in the Sierra Nevada mountains and proactively responding the increasing threat of wildfires.



Images provided by the California Department of Forestry and Fire Protection

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Fuel Reduction at Lake Theodore

Lake Theodore in Placer County was identified by the California Department of Forestry and Fire Protection (CAL FIRE) as a high priority fire prevention location based on its proximity to Interstate 80, the Union Pacific railroad, power infrastructure, residential structures, and outdoor recreation at Lake Theodore. In response, California Conservation Corps crews, in partnership with CAL FIRE and the Placer County Water Agency, completed approximately 23 acres of fuel load reduction at the lake. With funding from the State Board of Forestry and Fire Prevention, crews set to work to remove ladder fuels, clear brush, and prune trees as a means of reducing the risk of wildfire in the area. Though the project was completed in June 2017, the improvements to forest health have made the area more resilient to wildfire and other impacts of climate change for years to come.

Images provided by the California Department of Forestry and Fire Protection

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Replanting Trees in Modesto

The California Department of Forestry and Fire Protection (CAL FIRE) partnered with Our City Forest, San Jose State University, Master Gardeners of Santa Clara County, the Audubon Society, and California Fish and Wildlife Service to complete an urban tree inventory and create a long-term urban forest management plan for the City of Modesto. These efforts, along with a review of city ordinances and policies, will significantly improve management of local resources. The 200 trees planted in disadvantaged communities in Modesto will reduce greenhouse gas emissions by 582.3 tons and also help the community develop a stronger resilience to extreme weather events. Increased urban shade helps safeguard against climate extremes by reducing energy costs and reducing the urban heat island effect during extreme heat events. The additional vegetation will also help to reduce stormwater runoff in the streets and sidewalks and improve air quality within the city. As weather extremes challenge natural systems and public health, urban forest expansion will help the City of Modesto and other communities throughout California become more resilient to climate change.

Images provided by the California Department of Forestry and Fire Protection

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Sacramento Tree Foundation Urban Wood Rescue

The California Department of Forestry and Fire Protection (CAL FIRE) partnered with the Urban and Community Forestry Program and California Climate Investments in 2014 to remove and reuse logs from trees in Sacramento's urban areas that would otherwise be considered waste and sent to landfills. Sacramento Tree Foundation uses these salvaged materials to create usable products, including post and beam timber, fence pickets, elegant banquet tables, chairs, and boutique wooden bowls. Over the three-year grant period, the project is expected to mill 1,820 logs from urban tree removals. This salvaged usable wood coupled with the milling of waste wood and bark that will be used in future tree planting projects will sequester an estimated 2870.14 tons of greenhouse gases in this three-year timeframe. The project aims to engage residents in understanding the lifecycle of the urban forests and the benefits of reclaiming urban wood. As milling operations reach their full potential, the project aims to create job opportunities for local residents in this disadvantaged community. Active maintenance of the urban forests in Sacramento is not only reducing waste, but it is also creating a healthier environment for the urban vegetation that will contribute to California's resilience to climate change impacts.

Image provided by the California Department of Forestry and Fire Protection

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City of San Jose Community Forest Management Plan

The California Department of Forestry and Fire Protection (CAL FIRE) partnered with Our City Forest, San Jose State University, Master Gardeners of Santa Clara County, Audubon Society, and California Fish and Wildlife Service in 2016 to complete an urban tree inventory and create a long-term urban forest management plan for the city of San Jose. Funded by the Urban and Community Forestry Program and California Climate Investments, the 200 trees that will be planted and established in disadvantaged communities will not only help reduce greenhouse gas emissions, but make the communities more resilient to climate change impacts. The canopy will reduce the urban heat island effect and the associated energy costs. Additional vegetation will improve air and water quality by filtering pollutants from air and stormwater. As climate change exacerbates the effects of extreme heat days, efforts to expand urban vegetation will only enhance California's public health and resiliency of the natural environment.

Image provided by the California Department of Water Resources Photoshelter Gallery (KG_plant_closeups_46538.jpg)

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San Pedro Urban Forest Restoration

The California Department of Forestry and Fire Protection partnered with the Los Angeles Conservation Corps, City of Los Angeles Recreation & Parks Department, Port of Los Angeles, and the City of Los Angeles Council District 15 to recruit, hire, and train youth and young adults from local disadvantaged communities to restore the urban forestry in San Pedro. Efforts included planting 3,000 drought tolerant trees, creating 3,600 linear feet of landscaped stormwater capture, installing 25 street-side landscaped rain gardens, and converting 25 front yards (37,500 square feet) to drought tolerant landscaping. The project is simultaneously achieving greenhouse gas reductions of 10,335 tons during the 40-year project life with numerous co-benefits to the public and natural environment. The urban vegetation enhances the quality and supply of water, helps filter pollutants from the air, and maintains natural systems to enhance the community's resiliency to extreme climate change events.

Image provided by the California Department of Water Resources Photoshelter Gallery (FL_Griffith_Park-2582.jpg)

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Stormwater Capture at Katella High School

Katella High School Stormwater Capture Project received a Drought Response Outreach Program for Schools (DROPS) grant from the State Water Resources Control Board to implement the use of Low Impact Development Best Management Practices strategies for storm water capture and groundwater recharge at the high school. Katella High School in Anaheim, California qualifies as a Disadvantaged School, with 84% of students eligible for Free and Reduced Price Lunch. The project, designed to capture and infiltrate approximately 6 acre-feet per year of storm water and dry weather flows, replaced existing impervious surfaces with permeable pavers, vegetated bioswales, rain gardens, and native, water-wise gardens. In addition to capturing storm water, the project contributes to the high school's resiliency to impacts of climate change through urban greening and reduced urban heat island effect. The added vegetation helps reduce the risk of flooding while also conserving water. Stormwater infiltration is improved and both augments the local water supply and enhances the stream habitat. Now that construction is complete, the high school continues to raise awareness about water sustainability through school and community education and outreach.

Image provided by the Anaheim Unified School District

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Institutional Turf Replacement Program

The California Conservation Corps (CCC) established the Institutional Turf Replacement Program in July 2016 in partnership with Department of Water Resources (DWR) to utilize Proposition 1 funds for water efficient landscaping and irrigation projects at local government facilities and non-profit institutions within the San Joaquin Valley. Priority is given to projects within a designated Disadvantaged Community or Economically Distressed Area. Projects include removing turf and other high water use landscapes, installing or modifying irrigation systems with high water efficiency components, planting drought resistant and/or California native plants, and installing other water-efficient landscape materials (organic material, rock, decomposed granite) as needed. Over 20 projects are either complete or currently under way. While data collection and water savings calculations for this program have not yet been fully calculated, CCC and DWR are pleased with the outcomes so far and look forward to Year 2 of the program.

Image provided by the California Department of Water Resources Photoshelter Gallery (JRC_cash_for_grass_11-9953.jpg)

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Drought Resilience in Tulare County

California's five-year drought left Tulare County particularly vulnerable. The unincorporated community of East Porterville, in the heart of Tulare County, is considered "ground zero" of the drought. Hundreds of households lost access to clean, running water as a result of dry wells, or faced deteriorating water quality from increasing nitrate contamination. Residents were relying on deliveries of bottled drinking water and non-potable water before the unprecedented joint collaboration of the three state agencies – State Water Resources Control Board, Department of Water Resources, and the California Office of Emergency Services, and the governments of Tulare County and the City of Porterville – provided a more permanent, safe, and reliable solution. Together, through Proposition 1 grants and loan forgiveness, the state agencies fully funded a connection to a public water system. The project connects approximately 1,100 properties to clean and reliable source of drinking water. Already, the project is enabling Tulare County residents to be prepared for the worsening effects and frequency of drought. As climate change intensifies drought conditions, these collaborative efforts to safeguard communities against the effects of drought and other extreme events are critical to maintaining a resilient future.

Image provided by the California Department of Water Resources Photoshelter Gallery (FL_Porterville-6912.jpg)

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Madera Irrigation Water Efficiency

On January 11, 2017, the California Conservation Corps (CCC) Fresno crew, in partnership with the Department of Water Resources and Madera Irrigation District, completed a project to improve water efficiency in the County of Madera. The project team distributed bark mulch and decomposed granite, removed turf, replaced sprinklers, installed water efficient irrigation components, and planted hundreds of drought resistant plants and trees. Using the Model Water Efficient Landscape Ordinance's (MWELO) methodology for water savings calculations, the CCC estimates this project will save the district 790,000 gallons of water per year. The project will maximize the conservation of landscape irrigation water at the District Office and demonstrate the long-term water savings to all of the district's more than 500 growers, helping build resiliency to climate change by responding to drought and water scarcity through water conservation and public education.

Image provided by the California Department of Water Resources Photoshelter Gallery (KMG-capitol_mulch-05796.jpg)

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Adapting to Rising Tides (ART) Program

In 2010, the San Francisco Bay Conservation and Development Commission and the National Oceanic and Atmospheric Administration's Office for Coastal Management brought together local, regional, state and federal agencies and organizations, as well as non-profit and private associations for a collaborative sea level rise adaptation planning project along the Alameda County shoreline to identify how current and future flooding will affect communities, infrastructure, ecosystems and economy. The Adapting to Rising Tides (ART) Program was born from this effort.

Since then, the ART Program has continued to both lead and support multi-sector, cross-jurisdictional projects that build local and regional capacity in the San Francisco Bay Area to plan for and implement adaptation responses to address current and future flooding. These efforts have enabled the ART Program to test and refine adaptation planning methods to integrate sustainability and transparent decision-making from start to finish, and foster robust collaborations that lead to action on adaptation.

Screenshot from http://www.adaptingtorisingtides.org/project/art-subregional-project/

Examples of completed and ongoing projects and services of the ART Program include, but:

- ART Help Desk – An on-call service to connect local governments and others with knowledgeable ART Program staff who can assist with understanding and using ART tools and data, and connect them with other relevant information and expertise.
- Bay Area Sea Level Rise Mapping and Analysis – A project to develop integrated regional shoreline mapping and analysis products needed to support consistent sea level rise assessment and adaptation.
- Stronger Housing Safer Communities – A project to develop strategies for building community resilience to seismic and flooding risks
- ART Alameda County Project – A collaborative adaptation planning project to address sea level rise and storm event impacts along the Alameda County shoreline.
- Corte Madera Baylands – A pioneering effort in San Francisco Bay to demonstrate the importance of baylands as the first line of defense against coastal flooding.
- Eastern Contra Costa County – A collaborative adaptation planning project that will assess climate change vulnerabilities in Eastern Contra Costa County to improve individual and shared actions towards resilience to rising sea levels.

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Cardiff Beach Living Shoreline

Development has had a heavy impact on the welfare of coastal dunes. In an effort to restore habitat and provide nature-based sea-level rise adaptation along the Cardiff Beach, the State Coastal Conservancy, in partnership with California State Parks, Ocean Protection Council, California Coastal Commission, City of Encinitas, San Elijo Lagoon Conservancy, and the University of California, Los Angeles, is implementing a dune restoration project. This nature-based sea-level rise adaptation strategy will reconfigure bottom layers of cobble and stone beneath a top layer of imported sand and introduce native seeds collected from nearby lagoons to protect the 2,900 feet of vulnerable Pacific Coast Highway along the beach. This living shoreline approach will produce four acres of native dune habitat and enhance the public's access to the coast. Physical and biological monitoring will be conducted before and after the project construction to provide information on how and why dune topography changes over time and which native plants and planting methods are best suited for dune restoration in the region. The planning and design processes have recently been completed, and current implementation and monitoring efforts will help ensure that the shoreline will maintain viable habitat and natural barriers against the impacts of sea-level rise in the near future.

Images provided by the State Coastal Conservancy

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Marin Bay Waterfront Adaptation Vulnerability Evaluation (BayWAVE)

The State Coastal Conservancy provided funding and technical assistance to Marin County to develop a bayshore sea-level rise vulnerability assessment. Marin County ranks second of the nine Bay Area Counties for projected risk of impacts from sea level rise flooding and storms, with potential losses of $8.5 billion worth of buildings and contents on the bay shoreline. The project inventoried all assets along the county's bayshore vulnerable to six different sea level rise scenarios (up to 60 inches plus a 100-year storm surge), evaluated the vulnerability of impacted assets, created profiles for each city within Marin County, as well as each asset type (e.g. Recreation), and developed adaptation fact sheets and a memorandum on the outcomes of the county's sea level rise adaptation demonstration projects. The final Marin BayWAVE vulnerability assessment draft was accepted by the Marin County Board of Supervisors in June of 2017. The county also has community engagement and outreach programs working in conjunction with the vulnerability assessment, including the Here-Us-Now "OWL" Virtual Reality Project, "Game of Floods" public education activity on sea level rise adaptation, and the Youth Exploring Sea Level Rise Science (YESS) program. Marin County is also coordinating with San Mateo County, which is also completing a sea-level rise vulnerability assessment funded by the Conservancy.

Image provided by the California Department of Water Resources Photoshelter Gallery (cc_king_tides_27.jpg)

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