Safeguarding California

The Safeguarding California Plan provides policy guidance for state decision makers, and is part of continuing efforts to reduce impacts and prepare for climate risks. This plan, which updates the 2009 California Climate Adaptation Strategy, highlights climate risks in ***nine sectors*** in California, discusses progress to date, and makes realistic sector-specific recommendations.

AGRICULTURE
Ensuring the sustainability of food production in the face of climate risks will require a concerted collaborative effort by farmers and ranchers, government agencies, agricultural service organizations, and other partners.

BIODIVERSITY AND HABITAT
Supporting ecosystem resilience to climate change will require increased linkages between habitats, innovative management strategies, and the reduction of non-climate stressors. Monitoring will be essential to ensure that these strategies are effective.

EMERGENCY MANAGEMENT
Working together, we can promote and implement risk reduction activities and increase our awareness and resilience to threats, hazards, and vulnerabilities, and coordinate the development of strategies, actions, and plans to manage risk and create long-term sustainability.

ENERGY
While the energy sector is a primary contributor to climate change, its supply and demand infrastructure is also vulnerable to climate change impacts such as those associated with extreme events, sea level rise, and heat waves.

FORESTRY
Forests can help absorb carbon dioxide and counteract the emissions that cause climate change, but, California forests are also in need of protective actions to prepare them to withstand mounting climate threats such as increasing temperatures, drought, increasing risk of pest infestations, and increasing risk of severe wildfires.

OCEAN AND COASTAL ECOSYSTEMS AND RESOURCES
Climate change presents new threats to ocean and coastal ecosystems and resources including sea-level rise, extreme events, and ocean acidification, and continued investments are needed in climate-smart ocean and coastal management.

PUBLIC HEALTH
Climate change poses direct risk to public health. and impacts the natural systems-air, water, food– and built environments that sustain our health. Climate adaptation planning strengthens ongoing health protection, while promoting healthy and resilient communities.

TRANSPORTATION
Impending climate impacts not only have implications for decisions regarding the siting of new transportation infrastructure, but also climate maintenance and operation plans, planning and design features of transportation systems, including system design for emergency planning and extreme weather events.

WATER
The major impacts of climate change on California's water sector may be changes in the timing, form, and amount of precipitation, changed runoff patterns, increases in the frequency and severity of extreme precipitation events (floods and droughts), and sea level rise, affecting both water supplies and water quality.

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Strategies to Safeguard California:

1. **All core functions of government must make the risks Californians face from a changing climate an integral part of their activities.**

2. **Provide risk reduction measures for California's most vulnerable populations.**

3. **Identify significant and sustainable funding sources for investments that reduce climate risks, human loss, and disaster spending.**

4. **Support continued climate research and data tools to inform policy and risk reduction activities.**

5. **Maximize returns on investments by prioritizing projects that produce multiple benefits and promote sustainable stewardship of California's resources.**

6. **Prioritize climate risk communication, education, and outreach efforts to build understanding among all Californians.**

7. **Promote collaborative and iterative processes for crafting and refining climate risk management strategies.**

Safeguarding our Everyday Lives from Climate Change

A Changing Water Future: Develop an urban water use plan that reduces reliance on distant, unpredictable sources.

Keeping the Lights On: Promote development of smart grids that are connected, but localized.

Cooling California: Promote strategies to keep Californians cool and guard against longer, more frequent heat weaves, which are already responsible for a growing number of hospitalizations and deaths.

Do Better Today, Live Better Tomorrow: By reducing our carbon output today, we can lessen the extent of impacts in the future.

Safeguarding our Natural World

Nature Moves with the Climate: As climate patterns shift, so will nature. Providing habitat connectivity and chances for adaptation will help allow species and habitats to survive.

Help Nature Protect Herself: Improve forest and other habitat resilience.

Safeguarding California – What Science and Lawmakers Can Do

Knowing the Real Impacts: Sound science will highlight risks, and help provide a path to solutions.

Help is on the Way: Assess adequacy of emergency responders.

Better Together: Collaborate with federal and local government.

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Strategies to Safeguard Agriculture

Improving understanding of climate impacts on agriculture. Specifically, with research, modeling, and monitoring, as well as visualization tools like Cal-Adapt.

Developing and promoting adoption of management strategies that reduce climate risks to agriculture. This includes soil conservation practices, supporting pollinator health, drought resiliency, farmland conservation, and improving new technologies.

Understanding and responding to evolving trends that relate to agriculture. Related actions involve changing climate risks and emergency management, new revenue streams for agriculture that support positive climate action, and cross-sectoral climate impacts.

Support risk sharing mechanisms that protect food security and California's agricultural sector. These mechanisms would provide crop insurance and disaster assistance safety net programs to all commodities, and ensure that California farmers and ranchers have access.

Outreach and Education
It will be important to disseminate information regarding climate risks to agriculture, the development of best management practices, and any expanded business, funding, or risk sharing opportunities that can enhance resilience. This information must be shared with farmers and ranchers, decision makers, and other partners in a format that is easily accessible and readily usable

Climate Risks

Changing Precipitation

- Changing water availability from loss of snowpack and natural water storage, sea level rise and saltwater intrusion, flood events and drought
- Altered precipitation patterns and increased soil erosion

Invasive Plant Species, Insect Pests, and Pathogens

- Changing pressures from weeds, diseases and insect pests
- Changes in timing and coincidence of pollinator lifecycles

Increasing Temperatures

- More extreme weather events: severe drought, more intense storms, floods, etc.
- Changing air temperatures including loss of chill hours

Additional Climate Risks

- Changing ground level ozone and cloud cover
- Heat impacts on agricultural workers
- Damage or disruption to energy and transportation infrastructure supporting agricultural production
- Increases in prices of agricultural inputs
- Changes to quality of agricultural inputs
- Loss of forage due to increased wildland fires

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Strategies to Safeguard Biodiversity and Habitat

Improve understanding of climate risks to biodiversity and habitats. Completing habitat and vegetation mapping, refining regional connectivity analyses, doing climate vulnerability analyses, understanding extreme events and disturbance regimes, and identifying opportunities to address the emissions that contribute to climate change.

Develop management practices to help safeguard species and ecosystems from climate risks. This includes improving habitat connectivity, reducing existing stressors, and protecting climate refugia to name a few.

Enhance biodiversity monitoring in California to detect climate impacts and inform responses. Identify and develop baseline ecological information that can detect changes in terrestrial and aquatic species and habitat patterns on the landscape as well as implementing adaptive management to refine approaches for conserving biodiversity.

Support environmental stewardship across sectors. This can be done by promoting nature-based solutions for adapting to climate risks and maintaining and supporting tools that help resource managers determine when and where to focus conservation activities.

Information Sharing and Education
It will be important to create and maintain partnerships that support biodiversity, promote public education and outreach, and provide support for the continuation of the CDFW Climate College and broader state climate literacy programs.

Climate Risks

Sea Level Rise & Storm Surge

- Salt water intrusion into freshwater wetlands
- Direct impacts to sensitive species
- Erosion or degradation of coastal habitat

Additional Climate Risks

- Extinction risks
- Food web disruptions
- Changes in the timing of seasonal life-cycle events
- Change in species range and abundance
- Altered migration patterns
- Loss/alteration of habitat due to increased or severe wildfire

Invasive Pests, Parasites, and Disease

- Climate change could enhance the survival and spread of invasive pests and pathogens that that pose additional threats and stress to native species, human communities, and the economy

Changes in Temperature & Precipitation

- Patterns of snow accumulation and timing of melt
- Changes in habitat, vegetation structure and plant and animal communities

Ocean Acidification and Low Oxygen ("Hypoxic") Waters

- Profound effects on marine ecosystems leading to large-scale die-offs, local damage to fisheries, and long-term loss of biodiversity, and economic impacts

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Strategies to Safeguard Emergency Management

Better understanding of climate impacts on all phases of emergency management. This includes assessing the adequacy of surge and response capability in light of more frequent and severe weather and climate-related disasters and emergencies. Research and monitoring to expand and refine information about the climate vulnerabilities of California's populations, infrastructure, property, food and agriculture, and biodiversity.

Improve integration of climate impacts and projections into all phases of emergency management. Promote the implementation of the Climate Adaptation Planning Guide (APG) and inclusion of climate risk reduction in hazard planning efforts. Continue to support the integration of climate risks in state and local government emergency planning efforts and enhance capability to respond and recover from disasters and climate-related risks.

Support risk sharing mechanisms. Efforts taken to reduce climate risks through hazard mitigation activities, will be important to managing risks and supporting sustainable insurance and disaster programs.

Climate Risk Communication and Education. Continue to update and maintain the MyHazards and MyPlan mapping tools and integrate where practical climate projections; increase outreach efforts to prepare for extreme events; and provide training for first responders and other emergency managers on climate risks.

Climate Risks

Sea Level Rise & Storm Surge

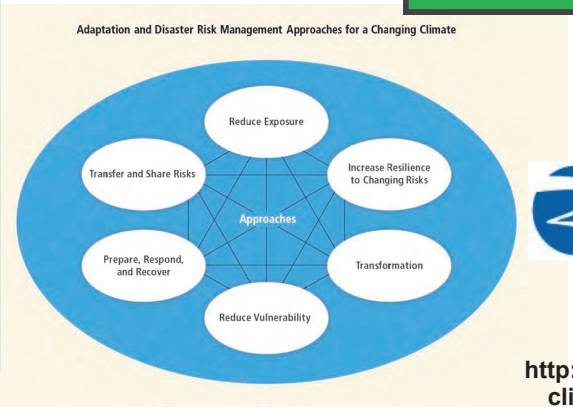
- Severe storms, flooding, landslides
- Coastal inundation
- Sacramento-San Joaquin Delta levee impacts
- Increased tsunami risk
- Infrastructure failures
- Toxic releases

Changes in Temperature & Precipitation

- Prolonged heat/drought
- Severe storms, flooding, landslides
- Increased heat emergencies
- Drying of regions
- More frequent and intense wildfires
- Lowered water supply
- More extreme weather
- Avalanche risk
- Infectious disease outbreaks

Extreme Weather Events

- Public safety
- Displacement and devastation
- Property damage
- Emergency response costs to government and taxpayers



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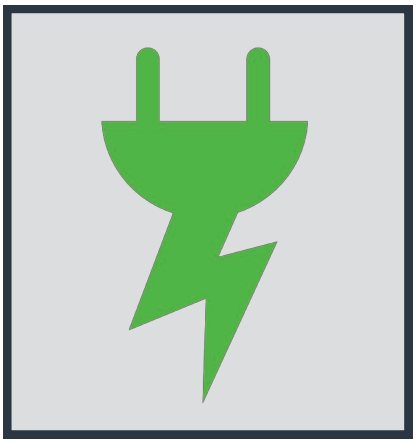
Strategies to Safeguard Energy

Protect existing energy facilities and consumers from impacts of climate change. Specifically, conduct vulnerability and adaptation studies for the energy sector, and support clean energy technology deployment.

Diversify energy supply to reduce vulnerability to extreme weather-related events and climate change. This includes diversifying the energy supply portfolio, and understanding how climate change impacts energy demand and supply.

Promote energy demand side measures that facilitate climate adaptation. Investigate measures that allow high quality energy services at the lowest possible cost, support the use of smart energy meter data, broaden the use of automated demand response, support retrofitting existing buildings, and adopt aggressive efficiency standards.

Enhance energy-related climate change research. Help coordinate climate change research among all the state agencies, support energy-related climate research in California, and support efforts to develop and maintain the California Climate Research Plan.



Climate Risks

Changing Precipitation

- Reduced snowpack
- Potential negative impacts to hydropower generation
- Potential hydro capacity reduction during hot summer months

Increasing Temperatures

- Reduced outputs from thermal power plants, transformers, and other parts of the electric system
- Increased overall electricity demand and peak demand during hot days

Sea Level Rise

- Potential impacts to power plants and substations
- Potential increased flooding impacts to storage, terminals and refineries
- May affect natural gas supply and the electricity system

Extreme Events

- Wildfire-potential disruptions to electricity reliability due to impacts to transmission lines
- Heat waves could tax the electricity system increasing the risk of outages

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Strategies to Safeguard Forestry

Improve understanding of forest climate impacts to support improved forest management responses. This includes improved monitoring to support tool development, analysis, and evaluation of management options; better modeling of vulnerabilities and climate impact trends in California's forests; and identification of priority landscapes for protection.

Improve forest management practices and the capacity of the forest sector to withstand impacts. Includes coordinated efforts to reduce wildfire risks and promote fire safe communities, funding for seed banks and seedling production, assess and implement cost-effective forest watershed protection and restoration, and improved understanding of trade-offs between different management responses to climate impacts and forest health.

Statewide assessment of potential cost savings from urban forestry Investments. Research has quantified the potential benefits at the residential and city level, but there is still a need to assess statewide costs and urban forestry investments opportunities to achieve significant energy and cost savings and other urban forestry benefits.

Information Sharing and Education. Information sharing and coordination with partners and stakeholders will continue to be important in order to monitor and protect forest resources in the face of growing climate risks. In order to assist incorporation of expected climate impacts into forest management decisions, education must be made available to forest land managers.

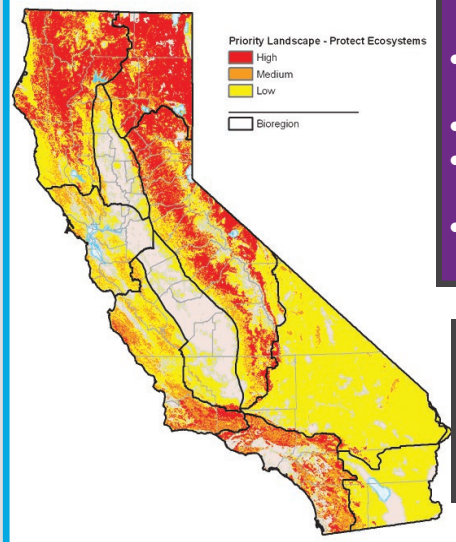
Climate Risks

Pest infestations

- Forest loss
- Tree mortality
- Changes in the extent and frequency of disturbances

Changing Temperature and Precipitation

- Decreased forest growth causes geographic shifts in tree distribution and forest types
- Forest loss and tree mortality
- Changes in hydrologic processes
- Earlier spring runoff
- Lower summer base flows
- Decreased snow pack



Priority Landscapes for preventing wildfire threats to maintain ecosystem health. CA Dept. Forestry and Fire Protection 2010

Wildfires

- Changes in the extent and frequency of disturbances from wildfires
- Economic impacts from increased fire damage and fire suppression costs

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Strategies to Safeguard Ocean & Coastal Ecosystems & Resources

Better understanding of climate impacts on ocean and coastal ecosystems and resources. Further vulnerability assessments and cost analyses and continued support and investment in monitoring efforts.

Improve management practices for coastal and ocean ecosystems and resources and increase capacity to withstand and recover from climate impacts. Includes hazard avoidance for new development, innovative design of new structures/infrastructure in vulnerable areas, integration of climate risk considerations into emergency management activities.

Coordinated action informed by science needs assessment. Support pilot projects for innovative shoreline management techniques and cost-effective green infrastructure

Addressing climate impacts in local coastal programs and general plan guidelines.

Integrated ecosystem approach to management of ocean resources.

Continued development of state sediment master plan and sediment management activities.

Water management responsive to saltwater intrusion issues.

Information Sharing and Education
Invest in risk communication efforts, improve maps and tools, provide training to incorporate best-available science into planning, operation and management decisions.

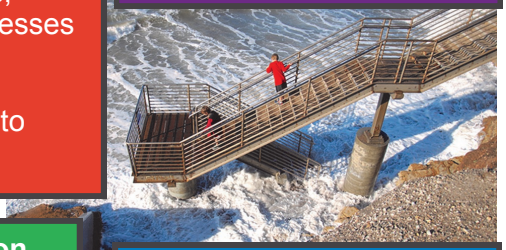
Climate Risks

Sea Level Rise & Storm Surge

- Intensify flooding and erosion
- Infrastructure & property damage
- Permanent submersion of coastal lands
- Toxic releases
- Salt water intrusion risks to water supply
- Threat to ports and low lying airports, roads and highways, transit systems, energy & fueling infrastructure
- Hospitals, schools, homes, and businesses at risk
- Cultural sites
- Negative impacts to coastal tourism

Changing Precipitation & Extreme Events

- Increase in pollution runoff & ocean water contamination
- Increase releases of raw sewage into marine environments
- Infrastructure and property damage including wastewater treatment and storm water management facilities, hospitals, schools, homes and businesses



Ocean Acidification

- Impacts various economic sectors (e.g. fisheries, aquaculture, tourism) and coastal communities in California
- Indirect effects on food security & biodiversity
- Calcifying organisms have difficulty forming and maintaining their shells and skeletons
- Impact wild fisheries that are of great economic importance to California

Expansion of Areas of Low Oxygen ("Hypoxic") Waters

- Profound effects on marine ecosystems leading to large-scale die-offs, local damage to fisheries, and long-term loss of biodiversity

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Strategies to Safeguard Public Health

Better understanding of climate impacts on public health. Further development and support of local vulnerability assessments; increase capacity to prevent climate-related deaths & illnesses; and improve the accuracy of warnings for extreme weather.

Improve capacity of communities to prepare, respond and recover from climate-related health risks. Support the development and implementation of planning tools such as 2013 Preparing California for Extreme Heat: Guidance and Recommendations. Incorporate climate change adaptation into ongoing public health and health care sector planning and ensure that the needs of vulnerable populations and health equity are addressed in state plans.

Monitor and evaluate the evolving trends that impact public health. Develop and maintain more complete monitoring systems for health impacts such as heat illness, respiratory conditions like asthma and allergies, occupational health hazards and community risks for extreme weather events.

Information Sharing and Education for Action. Increase capacity to build awareness and foster action to address climate risks to public health by supporting local health departments and health organizations through training, education, data-sharing and capacity building. Develop strategies to inform the public and promote community involvement in actions to reduce climate change risks, using linguistically and culturally appropriate approaches that are effective for diverse populations.

Climate Risks

Extreme Weather, Storms and Flooding, Sea Level Rise, Warmer Water, Drought

- Injury, death, mental health impacts
- Displacement, loss of jobs, economic damage
- Creation of hazards (mold, toxins, water quality)
- Damage to health care facilities, service disruption
- Salt water incursion and decreased water quality
- Damaged infrastructure (sewage, water treatment, others)

Increasing Temperatures

- Heat illness and death
- Making other health problems worse
- Air pollution
- At high risk: elderly, isolated, very young, outdoor workers, those without access to cooling

Wildfires

- Injuries and death
- Displacement and loss of homes and jobs
- Air pollution (local and transported)
- Creates flooding and water quality problems

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Strategies to Safeguard Transportation

Better understanding of expected climate impacts to inform transportation planning. Specifically, regional climate model downscaling and specific vulnerabilities of transportation, energy, and fueling infrastructure.

Better understanding of evolving trends that may impact transportation systems. Better understand impact and opportunities with vehicle electrification and other advanced clean cars on timing and demand for energy supplies along with better understanding of likelihood of land subsidence events that may compromise transportation systems.

Improve the reliability of California's transportation system in the face of expected climate impacts. Translate the findings of vulnerability studies into actions that improve the reliability of California's transportation by integrating climate considerations into planning, design, programming, construction, operations and maintenance.

Further enable incorporation of anticipated climate impacts into transportation plans. Enable incorporation of climate impacts into sustainable community strategies and/or regional transportation plans.

Information Sharing and Education. Convene an interagency task force on reducing risks to California transportation to assist in the development of training tools and guidance for transportation professionals regarding incorporating climate impacts and considerations into planning.

Climate Risks

Sea Level Rise, Storm Surge & Extreme Storms

- Disruption of transit, route closure and travel delays
- Damage to ports, low lying airports, coastal roads and highways, bridge supports, energy and fueling infrastructure
- Impaired goods movement,
- Increased need for emergency response
- Impacts evacuation routes

Changing Precipitation

- Flooding of roads and railways result in washouts, closures, and delays
- Landslides
- Emergency response
- Flooding can compromise underground storage tanks causing fuel delivery interruption, pipe ruptures, and toxic releases

Increasing Temperatures & Extreme Heat

- Asphalt rutting & buckling
- Concrete deterioration
- Route closures
- Travel delays
- Limits on periods of construction activity
- Rail buckling, breakage, and derailment.
- Thermal expansion of bridges
- Increase in wildfires and mudslides that impact transportation

Wildfires

- Damage to roadways and infrastructure
- Disruption and delays

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Strategies to Safeguard Water

Better understand climate risks to California water and develop tools to support efforts to prepare for climate risks.

Vigorously prepare California for flooding.

Support regional groundwater management for drought resiliency.

Diversify local supplies and increase water use efficiency.

Reduce Sacramento-San Joaquin Delta climate change vulnerability.

Prepare California for hotter and dryer conditions and improve water storage capacity.

Address water-related impacts of climate change on vulnerable and disadvantaged populations and cultural resources.

Continue to mainstream climate considerations into water management.

Utilize low impact development and other methods in State and regional stormwater permits to restore the natural hydrograph.

Require closer collaboration and coordination of land use and water planning activities to ensure that each reinforces sustainable development that is resilient to climate changes.

Protect and restore water resources for important ecosystems.

Climate Risks

Sea Level Rise & Storm Surge

- Salinity intrusion with impacts to water supplies exported from the Delta
- Coastal groundwater aquifiers vulnerable to salinization
- Wastewater treatment systems vulnerable to sea level rise

Changing Precipitation and Runoff

- Changing water demand
- Subsidence and reduced flows from intensified groundwater use
- More precipitation falling as rain instead of snow

Hydrologic Variability & Extreme Events—Flooding and Drought

- Public health impacts
- Changes to water quality
- Safety concerns
- Property damage
- Displacement of people
- Post disaster mental health issues
- Impacts on groundwater use
- Economic effects and disruptions
- Impacts to agriculture

Increasing Temperatures

- Earlier melting of snowpack impacts water supply; ecosystems; and winter recreation
- Impacts to hydropower, energy generation, agriculture, and recreation
- Thermal changes affecting aquatic habitats for species and associated industry & recreation

Wildfire

- Burned watersheds prone to flooding and erosion
- Impaired water supply
- Impacts to water quality
- Increased water treatment costs

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