

State-sponsored climate change research in California

Baseline, Classification, Quantification, and Measurement For Carbon Market Opportunities in California

The California Energy Commission report *Inventory of California Greenhouse Gas Emissions and Sinks: 1990–1999* (P600-02-001F) estimated the emissions and removals of greenhouse gases (GHGs) from all economic sectors of the state for the period 1990–1999. However, the report's sections on the forest, range lands and agriculture sectors were incomplete because of a lack of data. This project, conducted by Winrock International, focused on quantifying the baseline of changes in carbon stocks on California's forest, range, and agricultural lands throughout that decade. It focused primarily on carbon, but first approximation estimates were also derived for non-CO₂ greenhouse gases where appropriate. Baselines provide an estimate of the emissions and removals of GHGs due to changes in the use and management of land, and are useful for identifying major opportunities for enhancing carbon stocks and/or reducing carbon sources in California to mitigate GHG emissions. The baseline information gained through this project provides a baseline of GHG emissions and sinks for these sectors, which will help enable researchers and decision-makers to determine future GHG gains and losses in these areas and establish policy.

Global Climate Change and California: Potential Implications for Ecosystems, Health, and the Economy Project

The world's climate is changing as a result of increased atmospheric concentrations of greenhouse gases, and this could significantly affect California's infrastructure, natural resources, economy, and health. California not only produces more than one-eighth of total U.S. economic output, it also contains the greatest diversity of species of any state. This project was the most integrated and detailed quantitative assessment of the potential impacts of climate change on California ever conducted. The Electric Power Research Institute (EPRI) co-funded the project and helped to manage research management. The project was designed to help California natural resource managers and other policy makers better understand the potential effects of climate change on the state, to develop the most economical and effective adaptive policies. Although it should be noted that many potential impacts or interrelationships were not examined, and simplifying assumptions were made about baseline conditions and relationships between sectors and climate, this study helped provide a broad foundation from which future PIER climate change efforts can examine the multifaceted impacts of climate change.

Climate Monitoring and Modeling

Many decisions about future demand for electricity in California and the state's ability to satisfy that demand are based on assumptions about its climate. Documented increases in temperature, earlier stream flow from spring snowmelt, and decreases in overall mountain runoff in the spring in California have raised concerns that the state's changing climate may affect the state's electricity demand and its ability to

meet that demand. This project, centered at the Scripps Institute of Oceanography through the California Climate Change Center, is performing climate monitoring, analyses, and modeling for California, encompassing six areas. These are: a climate data archive; climate monitoring; regional monitoring; analyses of climate variability and change; water and energy resources; and a climate change detection and attribution study for California. Researchers, power plant operators, and policy makers will be able to use the monitoring, data, analyses, modeling, and studies to better understand the impacts of climate change on California. They will also learn how to mitigate, eliminate, or adapt to those impacts both those affecting electricity supply and demand and those affecting other natural and socio-economic systems in California.

Development of New Ecological Models for California (with Conservation International)

California's highly diverse landscape hosts more plant and animal species than any other state. Across the state, these species reside in approximately 300 natural plant and animal communities, 178 major habitat types, 10 broad biological categories or "bioregions" based on distinct and consistent climate zones, and 10 floristic provinces that are further divided into 24 sub-provinces. This abundance of flora and fauna is already threatened by land-use changes, invasive species, and air and water quality degradation, and climate change impacts. The threat largely a result of unabated greenhouse gas (GHG) emissions—will intensify through increases in temperature, changes in precipitation levels, potential increases in extreme rainfall events, runoff, and evaporation; as well as from changing ecosystems, changes in snowpack levels and soil moisture, and sea level rise. This project seeks to develop a dynamic model that will more accurately estimate how changing climate will affect natural ecosystems in California. The project is also meant to overcome the key limitations of existing dynamic models by considering additional ecological variables (e.g., land use characteristics, age and spatial structure of vegetation, dispersal rates and modes of different species, and invasive species. Lastly, the research will consider the interaction of plant and animal species and the influences of the abiotic environment when modeling climate change impacts. Funded by PIER's Global Climate Change Grant Program, this project will contribute to the success of state conservation efforts by modeling the impacts climate change on California's ecology much more comprehensively; thereby helping decision makers determine where to focus limited conservation efforts and funds for the greatest benefit.

Development of New Model of the California Economy

Climate change has the potential to affect California's natural and socioeconomic systems substantially over the coming decades. At the same time, policies directed toward large-scale GHG mitigation, originating at the state or national levels, are likely to be introduced and have potentially significant effects on California's economy and energy system. Theoretical and empirical economic research is the primary source of tools and methods for estimating the costs of climate change impacts on California, the costs and benefits of measures to mitigate or adapt to them, and the costs and

benefits of measures to mitigate GHG emissions, and for integrating such analysis into policy studies and ultimately into policy-making. However, existing economic methods applied to climate change impacts and GHG mitigation require further development, and there is moreover a paucity of climate change-related economic research applied to California specifically. This project, conducted by the University of California at Berkeley (UCB), will develop an economic model (known as a *computable general equilibrium* model) for California. The model will be used to evaluate the overall economic impacts that result from climate changes in individual sectors. It will also evaluate the costs and benefits of alternative policies designed to reduce greenhouse gas emissions from within the region, and to mitigate the adverse impacts of climate change on the region. An integral part of this work is the correct representation of energy flows in California, using new data developed for PIER by Lawrence Berkeley National Laboratory. The model will be used to perform multi-year dynamic simulations of economic, climate change impact, and GHG mitigation scenarios. It is hoped that the model would greatly improve the ability of researchers and decision makers to estimate the costs of climate change impacts on California, the costs and benefits of measures to mitigate or adapt to them, and the costs and benefits of measures to mitigate GHG emissions.