California Energy Commission
Public Interest Energy Research (PIER) Program
ENVIRONMENTAL AREA RESEARCH

Advanced Modeling of the Biological Effects of Climate Change in California

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Fact Sheet

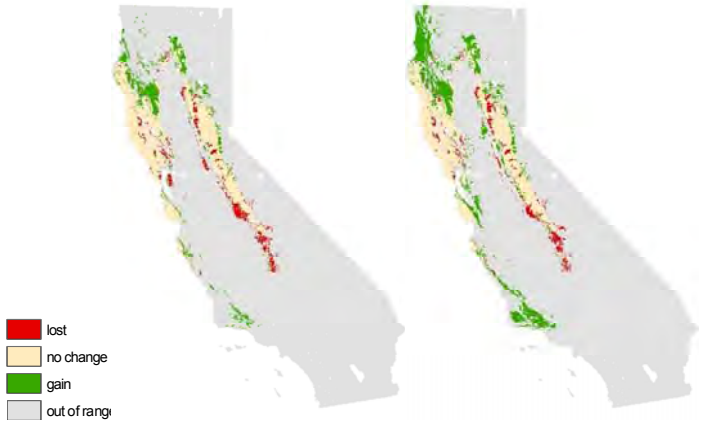
The Issue

Temporal and spatial scale are among the greatest challenges for currently modeling the biological effects of climate change. Current models of species' responses to climate change are generally at scales of 5-100 kilometers and use climate projections within a single time frame of 50-80 years, which is a very coarse resolution relative to the generation times and processes of plants and animals.

Moving down in spatial scale and decreasing the time frame will create many opportunities for research collaboration between climatologists and biologists. Refining spatial and temporal scales, however, comes with a series of challenges. Computational time increases exponentially—rather than linearly—with dimensions of scale. Random genetic, demographic, and environmental processes and events become much more important, leading to multiple outcomes as model uncertainty increases.

Project Description

BioMove is a novel, spatially explicit, and dynamic species modeling approach developed to predict future habitat ranges of a target species in response to climate change. The model combines various submodels to integrate competition, dispersal, and disturbance. This project applies the BioMove model and other tools to climate change assessment at biologically relevant scales. The project will pioneer new methods of working at a fine scale, as well as testing the established BioMove model in these applications.



Projected change in habitat suitability from the present to year 2080 for species *Torreya californica* (California Torreya or California Nutmeg) under two climate change emissions scenarios.
Source: California Energy Commission Publication #500-04-2008

This research will identify optimal networks of sites that are important for the conservation of species through multiple time-steps as climate change progresses in California. Specifically, this project aims to:

- Improve fire modeling.
- Develop a better understanding of vegetation regeneration and fire interactions at finer spatial and temporal scales.

- Develop methods for species habitat modeling at annual temporal scales.
- Create solutions for temporal, spatial and computational problems.

PIER Program Objectives and Anticipated Benefits for California

In a previous PIER research project, the BioMove model was developed and used to demonstrate the effects of climate change through 2100 on the distributions of Ponderosa Pine, Blue Oak, and Joshua Tree in California. This project builds on this previous research by testing the capabilities of the model to project species' distributions at scales suitable for land use planning.

Projections of change in vegetation and biodiversity at biologically appropriate temporal and spatial scales are needed to interface with models of other land use changes resulting from climate change, such as urban development, and also to better understand interactions with habitat disturbances, such as fire. These results are critical to producing improved conservation strategies, land use plans, and impact assessments.

This project supports California's goal of developing data and methods for assessing the regional implications of climate change for planning activities in the state. These climate change projections are needed both to prepare for future changes in energy demand and generation and to identify the capacity of California's ecosystems to provide energy offsets in future cap and trade markets related to forestry.

Project Specifics

Contract Number: 500-08-020
Contractor: UC Santa Barbara
Amount: $300,000
Term: May 2009 to January 2013

For more information, please contact:

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