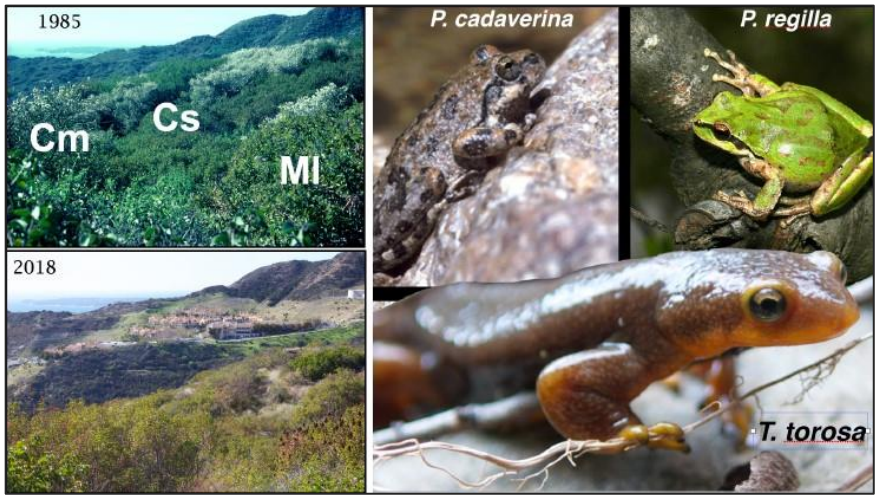
Looking Back to See Ahead: Using long-term monitoring data to predict species persistence across the North Santa Monica Bay Watershed



Amphibian and plant communities serve vital roles in freshwater and chaparral habitats. Unfortunately, these interdependent communities have experienced an alarming decline in the Santa Monica Bay watersheds that needs to be investigated.

In freshwater communities, amphibian populations have declined due to habitat destruction, spread of invasive species such as crayfish, and a yet-to-be identified disease. Plants in chaparral communities are under stress and declining from drought, shifting wildfire patterns, as well as pathogens. Understanding the effects of these stressors on freshwater and chaparral communities is crucial to pinpoint the long-term consequences of climate change across the region.

A team of researchers at Pepperdine University hypothesize that the factors threatening amphibian and plant species in the Santa Monica Mountains can be attributed to rapid climate change. With funding from the Santa Monica Bay Restoration Commission's Proposition 50 grant program to, a team of researchers led by Pepperdine University will quantify the impacts of climate change and predict how plant and amphibian communities will respond into the future.

The two goals for the project are to:

1. Determine how the physical traits of amphibian and plant species have changed over time in response to stressors like invasive species, novel disease outbreaks, wildfires, severe drought, and record-setting warmer temperatures.
2. Test how strongly climate change and other disturbances have influenced the physical traits in each species. Then, use this information to predict species persistence under future climate and environmental conditions.

Over three years, the Pepperdine team will visit streams and chaparral areas throughout the Santa Monica Mountains to understand climate resiliency of amphibian and plant species. The project will survey California newts, Pacific tree frogs, and California tree frogs and collect data on abundance, reproductive output, and presence of fungal pathogens among other variables. Researchers will also survey big pod Ceanothus *(Ceanothus megacarpus),* green bark Ceanothus

(Ceanothus spinosus), and laurel sumac (*Malosma laurina*) in surrounding chaparral communities to understand soil condition, plant health, and pathogen presence.

The results of this project will fill data gaps and guide regional land managers' actions to reduce further decline and enhance this important habitat. The findings of this study will be published in the next State of the Bay Report for the Santa Monica Bay National Estuary Program.

Meet the Team

Gary Bucciarelli – Pepperdine University

Bucciarelli serves as the project director for this project including overall project management, developing deliverables, and organizing and coordinating with the project team.

Bucciarelli's recent work evaluates long-term amphibian population dynamics across California and population responses to changing conditions. He also leads projects focused on benthic macroinvertebrate community responses to invasive species and amphibian population genomics in the Santa Monica Mountains region.

Courtney Davis – Pepperdine University

Davis assists with development of statistical and mathematical models and guiding model parameterization, data integration, and interpret results.

Davis also works with local biologists to predict how to preserve biodiversity when ecosystems become strained by invasive species. Her work has provided novel insights into how best to manage invaded freshwater ecosystems to prevent local population extinctions of amphibians and endangered fish species.

Stephen Davis – Pepperdine University

Davis co-leads all plant-related fieldwork, conducts fieldwork and data collection, and assists with data interpretation.

Davis has studied plant water relations in California chaparral since 1985. His research evaluates mechanical properties of chaparral in relation to cavitation resistance and hydraulic properties, pathophysiology of fungal disease and emergent dynamics, plant physiological ecology including plant adaptations to wildfire and drought, and native vegetation responses to climate change and extreme climatic events.

Helen Holmlund – Pepperdine University

Holmlund co-leads all plant-related fieldwork, conducts fieldwork and data collection, assists with data interpretation, oversees data entry, and assists with data analyses, interpretation of results, and development of project deliverables.

Holmlund's work includes studying plant response to drought, salinity, disease, and frequent fire, with an emphasis on ferns and shrubs in the chaparral ecosystem of Southern California. Her current research examines the regeneration niche of chaparral species and the effect of frequent fire on chaparral vegetation type conversion.

Lee Kats – Pepperdine University

Kats leads all aquatic-related fieldwork, conducts fieldwork and data collection, and assists with data interpretation.

Kats has studied amphibian and stream ecology in California since 1995. His work evaluates persistence of amphibian populations, by studying amphibian population responses to fire, flooding, drought, and invasive species; amphibian population declines resulting from climate change and urbanization; and amphibian conservation biology.