

RESEARCH SUMMARY

Understanding and Predicting Climatic Envelopes in the California Flora

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As global warming reshapes the biosphere, mountains may be the most threatened habitats in the world. At lower altitudes, species may be able to move north or south to follow the temperature ranges they live in. Mountaintops, however, are like islands, in that the nearest comparable habitat may be far away on a distant peak – with many miles of inhospitable temperatures in between. Some species can move up the slope to find cooler areas, but once they reach the top of the mountain, there is often nowhere else to go... except extinct.

Plants are in particularly close contact with their environments because once a seed takes root in a certain place, it is stuck with the conditions it finds there. Because of this, plants offer an ideal opportunity to study the stresses caused by changes in climate. Plants also make a good starting point for studying how different communities respond to climate change because animals depend on them for food, habitat structure, and other resources.

My project focuses on understanding how plants respond to the environmental conditions around them. Because plants can not move, they must respond directly to climate, surviving or dying as conditions grow warmer and more variable. My research looks at the effects of stress on plants, including how freezing damage takes place, how sensitive they are to drought, and how well they produce fruit and seeds. I also study the plants' structure to find good predictors of stress responses. For instance, narrow vessels are a very good predictor of how well a woody plant, such as an oak tree or manzanita shrub, can survive freezing.

In California, the Sierra Nevada represents a transition from mild or Mediterranean conditions in the foothills to cold to alpine conditions at the summit. My study focuses on plant genera that are able to grow across the entire slope—from the foothills to the top of the mountain, but also have members that are important parts of major California biomes. These include oak, manzanita, willow, spruce and pine. By studying each group of close relatives, I hope to unravel why it is that some plants are able to expand their ranges to endure different climatic conditions, and others plants cannot.

Because the plants that I have chosen to work on represent major elements of the California flora, they have been present in California throughout Recent (10,000 years ago to present) and Quaternary (1.8 million years ago to 10,000 years ago) time. Many of the species in my field study left excellent fossil records, particularly riparian genera such as willow and wind-pollinated genera such as oak, spruce and pine. To support my work on range limits, I will be tracking distribution of these plant groups through the past 21,000 years of time.

The combination of field work to study why plants can survive in certain places and not in others, and fossil documentation of past ranges will help us form a complete picture of where California's climate has been and where its most important plants are going. I am excited to contribute to this work and believe knowledge can help us protect California's diverse biomes.