

Research Summary:

Using the fossil record to reveal how California mammals may respond to climatic change

Jessica L. Blois, Department of Biological Sciences, Stanford University

Understanding how organisms will respond to global climate change is one of the main problems facing biologists today. The complete biological response to ongoing environmental change will occur over evolutionary time scales, much longer than the time scale over which policy decisions are made; thus, a long-term perspective is required to fully understand how today's species and communities will respond to current and future climatic change. The fossil record provides such a long-term perspective: we can determine how species have dealt with climatic change of the past and thus can better predict how they will deal with climate change today and in the future.

My dissertation research explores the recent paleontological record and evolutionary history of modern species to discover how these species deal with environmental change. Specifically, I am investigating how mammalian species and communities in northern California have responded to significant biotic and climatic change from 20,000 years ago to the present. This period begins during a full glacial, transitions through the Late Pleistocene extinction event, and then spans the Holocene, which encompasses the warming and cooling events of the last 10,000 years. Thus, this time period is perhaps the most analogous period in Earth's history to the current extinction and climatic change crisis. Significantly, the survivors of this warming event and extinction crisis (our modern fauna) are the same species affected by current and future climatic change.

I will use a comparative approach by sampling the small mammal community before and through this warming event into the present to determine how communities and species were affected by climate change. Several fossil localities from the Lake Shasta region in northern California will be used to reconstruct a temporal sequence spanning the last 20,000 years by re-examining previously excavated fossil deposits from ~20,000 years ago, and excavating a new locality in one of the same fossil sites: Samwel Cave. **The primary goal of my research is to integrate multiple types of population and community dynamics over the past 20,000 years to determine genetic, morphologic, and abundance change in small mammals in response to climatic change.**

The importance of the fossil record and the use of a comparative approach across major transitions were highlighted by a recent National Academy of Science report, which states that use of the fossil record is of paramount importance for revealing actual biotic responses to climatic events. Additionally, my project will extend our knowledge of the recent faunal history of mammals in order to better inform policy decisions related to land use and conservation of the extensive biological resources of northern California, a relatively understudied but important region of North America. The in-depth, multilevel assessment of species-level response is a powerful approach that will provide the initial data to create a predictive model for how species will respond to future environmental and climatic change. Consequently, results from this study will inform intelligent conservation strategies that consider the effects of current global climatic change and species extinction on the survivors of ecosystem change.