Research Statement: David A. Beamer

Research summary: As an evolutionary ecologist, I am interested in the patterns and processes that generate and maintain biodiversity. My research program investigates ecological and evolutionary processes on several scales ranging from testing hypotheses regarding competitive interactions among species to testing land use history effects on population connectivity to the reconstruction of family-level phylogenies. I have used population modeling techniques (occupancy and N-mixture modeling) to estimate population parameters, kernel density estimates of home range size and population genetics techniques to address landscape effects on geneflow. I also have collected DNA sequence data (both single gene Sanger sequences and next-gen genomic data) and integrate morphological and ecological data through the use of a variety of phylogenetic comparative methods. Some of the types of questions I have used these methods to address include: examining the historical role of ecoregions and watersheds in the diversification of lineages, examining the role of head shape in allowing access to novel environments and evaluating hypotheses of isolation by distance and competitive exclusion.

Over the course of my career I have amassed a large voucher and tissue collection representing co-distributed organisms of the forest floor and riparian corridors distributed across the Eastern Temperate Forest. These samples were collected with the intention of addressing the biogeographic history of this region in a comparative phylogenetic context. Since the exact biogeographic aspects that have influenced the history of the study system is unknown I sampled across a wide variety of geological and ecological features that I hypothesized to play a role in shaping biodiversity. Specifically, I have sampled each level iv ecoregion in each independent river drainage across the southeastern United States (>**800** individual sites). In total, I have >**25,000** tissue samples representing salamanders, land snails, millipedes and trapdoor spiders. This collection is unsurpassed in it's scale and comprehensiveness and provides an almost unlimited number of opportunities to design and carry out research projects. Each specimen is accompanied by georeferenced collection locality data (which often includes video and/or photographic documentation of the site) and most salamanders are also represented by dorsal and ventral photographs with a scale bar made immediately after euthanization.

Research Program at Deep Springs College: I have <u>many</u> research projects that are in various stages of completion that I could bring to Deep Springs College. Many of these projects could serve as modules in curricula. These include very large morphological datasets, DNA sequence datasets and population datasets. Scientific research can be risky and sometimes projects need to be scrapped after considerable effort has been expended. So having these types of datasets in my back pocket is a great asset for learning opportunities and they could be used to "save the day" if other research efforts go amiss. However, the unique desert environment of Deep Springs provides some fantastic opportunities to collect and analyze data sets from the ground up.

Most of my organismal expertise is with amphibians and reptiles and there are some very interesting endemic species in the immediate vicinity of the campus. Some of these species have state and/or federal protection (black toad, panamint alligator lizard, Inyo Mountain slender salamander) and would require several levels of permitting to be obtained before they are carried out. As a result the following projects must be considered tentative opportunities that are uniquely feasible due to the location of Deep Springs College but that have other hurdles that would need to be addressed.

Global Climate Change Response Capabilities In Desert Amphibians and Reptiles

Temperature regulates a myriad of ecological and evolutionary processes, and given the pace of global change, understanding how temperature has shaped--and continues to shape--the diversity of life on earth is of utmost importance. However, while straightforward rules regarding the relationships between body size, morphology and other highly visible traits are sometimes apparent in some clades--the relationship between temperature and the underlying physiological ecology, life history and growth of an organism can result in complex responses to thermal conditions. Here, I propose that this "hidden" axis of variation connecting temperature effects on metabolism and foraging to individual growth (and maximum size), maturation timing, and demography may be driving diversification in endemic desert amphibians and reptiles. The effect of temperature on easily measured traits such as body size has mixed support from previous observational studies. I hypothesize that the confounding and labile life history traits of desert amphibians and reptiles have obscured the effects of temperature and hampered our understanding of the adaptive diversification of this clade. We will integrate experimental, comparative, and modeling methods to develop a framework predicting how life history, thermal conditions, and resources determine population demography and relative fitness of desert amphibians and reptiles.

This project would address how adaptation to thermal conditions interact with early development to shape population ecology – age and size structure, as well as biomass – and fitness, which we hypothesize explains the macroevolutionary patterns of diversification in body size across the radiation. By integrating lab and field experiments, comparative studies of museum specimens, macroevolutionary tests and ecological models of our hypotheses, we will be able to predict variation in phenotypes on ecological time scales, gaining novel insights into the historic role of temperature and life history in the evolution of body size in this radiation. The members of this clade have very similar diet and behavior, providing the opportunity to study how thermal conditions affects physiology and growth when diet is less variable. This proposed research will provide a unique perspective on the way growth and development generate relationships between body size and temperature across ectotherms more broadly.

Population demographics of desert amphibians and reptiles

This line of research would use modeling techniques like occupancy modeling, N-mixture modeling and kernel densities to estimate several important population parameters including occupancy, detection, population size, home range size and movement. All of these parameters are likely to play important roles in the genetic structure of these organisms and have important implications ranging from investigating patterns of isolation by distance to forming the basis of conservation management efforts.