In the early 20th C, Joseph Grinnell, the founding Director of the Museum of Vertebrate Zoology (MVZ) at UC Berkeley, had the foresight to establish an extensive record of the distribution of mammals and birds throughout California so that future researchers could understand how environmental change affects this rich and unique biota. Some 100 years later, teams from the MVZ have revisited the major transects across the mountains of the Sierra Nevada to do just this (Figure 1). Grinnell’s record was unusually rich, backed by not just specimens, but also photographs and field notes with locality descriptions and daily records of field effort and observations or captures. This enabled the modern MVZ team to determine with statistical confidence, how upper and lower range limits of species have changed over a century of environmental change. The goals of the Grinnell Resurvey Project (GRP: mvz.berkeley.edu/Grinnell) were to document change in elevational limits, understand why distributions are changing, and, crucially, to provide another benchmark, of early 21st C distributions, for future researchers.

**Intellectual benefits:** The GRP resurvey, analyzed using rigorous and conservative statistical methods, revealed considerable change in species limits over the past century. For small mammals, the dominant pattern is upwards shift of lower limits in the higher elevation species, in some cases leading to pronounced range contractions. This is especially notable for the alpine chipmunk (unique to the Sierra Nevada) and Belding’s ground squirrel. Genetic comparisons of historical and modern specimens of the alpine chipmunk also demonstrate increasing population fragmentation and loss of diversity. Comparisons of observed range changes with local patterns of environmental change suggest that, whereas upwards expansions of some lower elevation species is attributable to vegetation change, contractions of higher species is associated with increasing minimum temperature. Yet, species’ responses are highly variable. This heterogeneity was especially notable for birds, for which there were as many shifts down as up. For birds in particular, it appears that changing precipitation as well as temperature has affected species ranges. Of interest, there is a trend for lower elevation birds to respond to changed precipitation, whereas higher elevation species are influenced more strongly by temperature.

While the GRP has clearly demonstrated changes in species’ elevational limits over the past century, there is considerable unexplained variation in species’ responses to environmental change. A more mechanistic approach, informed by natural history, is required to predict vulnerability**.** Towards that end, ongoing studies are using the modern vs. historic small mammal specimens to detect changes in eco-morphology and diet (via stable isotopes) and, using exome-scale nextgen sequencing, to test for signatures of selection on genes.Despite all this change in species limits, also resulting in substantial change in local community structure, it is important to note that these large protected areas are doing their job – Yosemite NP, for example, has maintained species richness even as species shifted idiosyncratically across the elevation gradient.

**Broader benefits**: Perhaps the most enduring result from the GRP is the new collections and data it has generated, again backed by field notes and images and protected for the future in the MVZ. The specimen collection data (primarily small mammals) is all publically accessible via the MVZ on-line database (mvz.berkeley.edu). In associated studies, these resurvey data are being used to test the performance of species distribution models over time, and to inform the California Climate Change Adaptation strategy. The GRP has been strongly supported by regional National Parks staff and is generating valuable information for management. To that end, in addition to transect-specific resurvey reports (GRP web site), we have packaged all MVZ records and data for each of the regional national parks to improve data access. All this serves to demonstrate the enduring value of well-maintained and data-rich natural history collections.

The GRP has also inspired and trained many students, from undergraduate to postdoctoral. Drawing on the diverse student body at UC Berkeley, the project has engaged over 30 undergrads, 4 graduate students, and 5 postdocs. The results are routinely incorporated in our teaching and professional seminars, as well as in many public talks and the broader media (see GRP web site for details).