

# ***Long-term trends in Sierra Nevada avifauna: elevational shifts and species occupancy over a century of climate change***

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## **Research Summary:**

Climate change is currently perceived to be one of the greatest threats to vertebrate species throughout the world, and particularly in areas such as California. Despite the anxiety this brings, we still have relatively little knowledge as to how climate change affects species, which species are impacted most, and how sensitive different species are in their responses. My research examines these questions by looking directly at how bird species have changed their elevational ranges in the Sierra Nevada mountains over the last 100 years.

Starting a century ago, the zoologist Joseph Grinnell and his colleagues began to comprehensively survey the vertebrate life of California, recording in detail the presence of all species they found wherever they traveled. For many years, they focused their work in the Sierra Nevada mountains, leaving us with a strong historical record of what species – particularly birds – were found as you changed elevation from near sea level to over 4,000 meters. The historical bird surveys of Grinnell and his colleagues form the core foundation for my work.

My research involves revisiting the same sites and surveying birds so that site comparisons can be made between the early 20<sup>th</sup> century and today. To date, bird resurveys have been focused in two areas of the Sierra Nevada: the Yosemite region (a cross-section that goes through the national park), and the Lassen region (a 100 x 25 mile cross-section that includes all of Lassen Volcanic National Park). In combination with a future cross-section to be done in the southern Sierras, this bird resurvey will provide a comprehensive picture of how over 150 bird species have changed their elevational distributions over the last century in California.

To test for the relationship between shifts in elevational range and changes in climate over the last century, I will use two methods. First, associated with an average warming over the entire state, we would expect that elevational shifts be unidirectional toward higher elevation. This hypothesis will be tested explicitly. Second, a method known as Occupancy Modeling will be used to examine the direct relationship between where species are expanding or contracting and how the climate has changed in that locale over the last century.

Altogether, this research will show not only how bird species have changed their distributions in California over the last century, but also how these changes may be directly related to our currently changing climate. This type of knowledge will be critical as we go forth and plan policy, conservation, and monitoring programs.