

Graduate students explore the effect climate change has on local bird populations

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Four loggerhead shrike nestlings very close to leaving their nest in a juniper tree on Kirtland Air Force Base. Credit: Corrie Borgman

Two University of New Mexico alumni have discovered that our changing climate is having a serious impact on population size and reproductive success of several bird species found around Albuquerque. Corrie Borgman and Kirsten Cruz-McDonnell graduated with master's degrees from UNM's Department of Biology in 2015, using this research for their theses.

The longtime friends had been looking into the connection for years before coming to UNM. The pair worked for the nonprofit, Envirolological Services, and were contracted by the federal government to monitor and study the wildlife at Kirtland Air Force Base.

For years, Borgman and Cruz-McDonnell collected data on two bird

species, the loggerhead shrike and the burrowing owl. They looked at population size as well as several reproductive factors, like nest success, the number of nests formed, the amount chicks hatched, and the timing of reproductive activity. After completing several reports for the Air Force, the two started noticing the impact their work could have.

"After a number of years collecting this data you start to realize that it is unique and it is interesting, but it's never going to be available to the public unless we make it so," said Borgman.

That's what led them to UNM and to biology Professor Blair Wolf. The two decided to enroll in the master's program to further their research on the connection between the climate, which according to data continues to get hotter and dryer, and what they saw happening within these avian communities.

Loggerhead Shrike

The loggerhead shrike is an aggressive, medium-sized predatory bird that traditionally lives in open habitats throughout much of North America. Unfortunately, shrike populations have dramatically declined over the last 40 years, according to Borgman's research paper, 'The indirect effects of climate variability on the reproductive dynamics and productivity of an avian predator in the arid Southwest,' published in *Oecologia* in 2015.

"The possible contribution of climate change to this serious decline in shrike population has not been looked at," said Borgman, a big reason why she and Cruz-McDonnell decided to look further into the correlation.

Borgman collected six years of data, from 2007 through 2012, for the loggerhead shrike community living on Kirtland Air Force Base. Over

that time, Borgman said the gradual increase in temperature and decrease in precipitation had a significant effect on the shrike population.

The data showed the total number of shrikes in the area increased while the number of chicks making it out of the nest, also called nest success, was well below average. So, how can you have more birds in the area if there are less making it out of the nest?

"The main thing that we can think of is that perhaps some birds that are migrating from Mexico in the springtime are possibly stopping at more southerly latitudes because of warmer temperatures associated with climate change," said Borgman, who added that is simply hypothetical and has no data yet to support it.



An adult borrowing owl

In the case of nest success, Borgman said the drop there was directly driven by higher temperatures and lower precipitation. Less rainfall means less prey for the shrikes to feed on. In regards to temperature, Borgman said hotter weather leads to increased activity in certain predators that hunt shrike chicks and eggs.

The research also shows shrikes breeding earlier depending on the weather. Borgman said the hotter it was, the earlier the birds breed.

"The majority of studies show an advance of breeding, and it sort of makes sense," she said.

But what was previously undocumented, was the extreme shift temperature has on breeding patterns for shrikes. Over six years, as temperatures increased, the shrikes bred 20 days earlier, a much more drastic rate than any other documented [bird species](#).

Burrowing Owl

The burrowing owl is a small, ground-dwelling species that lives throughout North American deserts and grasslands. Similar to the loggerhead shrike, research has shown a decline in the burrowing owl population since the 1960s, according to Cruz-McDonnell's paper, 'Rapid warming and drought negatively impact [population size](#) and reproductive dynamics of an avian predator in the arid southwest,' published in *Global Change Biology* in 2015.

Cruz-McDonnell collected data on a local owl community on Kirtland Air Force Base for nine years. That research, along with seven additional years of data, showed a massive decline in the local owl population.

"It went from 52 pairs [of owls] to one pair over 16 years," said Cruz-McDonnell. "That's significantly related to an increase in temperatures and a decrease in precipitation."

Along with the extreme decrease in number of burrowing owls, the research also showed a decline in nest success and a decline in the number of baby owls being produced. Again, issues related to the changing climate according to Cruz-McDonnell.



Borgman with a loggerhead shrike

Another concern that surfaced with the data was a change in body mass in the owl population. Cruz-McDonnell said, over time, adult and juvenile mass declined, which is a problem for their long term survivability.

"Birds in poorer condition have decreased survival while birds with larger energy reserves have increased survival, as they are better equipped to handle harsh weather or food shortages, for example," she said. "It's a serious result because not only are we seeing fewer owls that are producing fewer young, but they're also at a lower mass putting them at an increased risk of mortality."

Cruz-McDonnell said this measure is again, related to hotter temperatures and lower precipitation. Less rainfall means less plant

growth and insect prey, and hotter temperatures put a bigger strain on the animal's physiology.

What's next?



While much of the findings were previously undocumented, making the research an important contribution to understanding how this ecosystem functions, the two biologists hope their years of work lead to an increase in conservation efforts for the two avian populations.

"Both of these are species that are known to be declining, species of concern. And if [climate change] is contributing to their decline, then maybe we should take their management more seriously," said Cruz-McDonnell.



Borgman said one idea could be to put a bigger emphasis on habitat conservation. Like with most species at risk, the loggerhead shrike and burrowing owl populations have seen big changes to their natural habitats over the years. Borgman said making sure certain communities are protected could go a long way in helping maintain overall population numbers.

Their work hasn't stopped since receiving their master's degrees and publishing the species specific papers either. Both Borgman and Cruz-McDonnell have continued to collect data on both bird communities and are currently working together to write another paper that compares and contrasts their earlier findings and looks at how factors such as natural history and a bird's physiology can affect their response to [climate change](#).



Cruz-McDonnell with a burrowing owl

Provided by University of New Mexico

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