Survival of the coolest nests: Birds, heat waves, and conservation in working landscapes

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When we convert natural landscapes into farms, it's easy to assume that birds will have a tougher time raising their young. To some extent, that's true: many bird species struggle to survive and reproduce in farmlands. Others, however, are more flexible. Some of these species consume agricultural pests and maintain a functioning food web even in human-dominated landscapes. Thank you, birds!

However, these adaptable farm-dwelling birds face temperatures that can be about 10 degrees Celsius higher than nearby forests. Farms usually lack the shady spots that forests offer, making them much hotter. The combination of increased temperatures caused by loss of shade and rising heat from climate change can be tough on bird nestlings. It may dehydrate nestlings, slow their growth, and even prove lethal for young birds.

Our team at the University of California, Davis set out to understand how extreme heat affects bird nest success and whether this impact differs between farm and forest settings. To do this, we tapped into the valuable data from the Cornell Laboratory's NestWatch project. We are so grateful to the many people contributing their nesting observations to the project across the United States! We used about 150,000 nesting observations of 58 species across 20 years to measure nest success. We investigated how the type of land where each nest was located, along with the local temperature during nesting, influenced the likelihood of birds to successfully rear at least one chick. We also wanted to understand why birds might be sensitive to heat, so we investigated how nest style (cup or cavity) and conservation status affected birds’ vulnerability to heat. Lastly, we used climate models to predict how nest success might change by the year 2100, considering the expected rise in average and extreme temperatures.

When extreme heat waves hit, birds nesting in farmlands were 30% less likely to successfully raise at least one chick. Surprisingly, the opposite was true for birds in forests: extreme heat events increased their chances of success. Forests might be crucial refuges for birds, even those that sometimes nest in farmland or open landscapes. Vulnerable bird species of high conservation concern were particularly affected by heat waves in farmlands. Offering protection from extreme heat in farmlands could be especially critical for these species. Finally, we discovered that birds with cavity nests had a better chance of fledging offspring during extreme heat compared to those with exposed cup nests. So, the type of nest matters!

When we projected nest success for the year 2100 under a business-as-usual emissions scenario (Representative Carbon Pathway, or RCP 8.5), we estimated that birds nesting in farmlands would see a 4.4% reduction in nest success compared to today. However, under a reduced emissions scenario (RCP 4.5), the reduction was only 1.1%. Lowering emissions could help birds continue to reproduce in farmland, potentially sustaining agricultural ecosystems into the future.

Taken together, our research underscores the importance of maintaining shade and cool spots for birds to nest in farmland. It's essential to remember that our study focused on bird species that nest in various habitats. For birds exclusively nesting in natural open areas like grasslands, adding trees to their habitat might cause harm. However, for the birds we studied, strategies such as providing shade for nest boxes, preserving trees in farmlands, and safeguarding nearby forest patches could help them cope with rising temperatures. These interventions could help birds cope with extreme temperatures and enable them to thrive alongside us in agricultural landscapes.