Researchers use big data to better understand birds' coexisting tactics

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Muhabura is an inactive volcano on the border between Rwanda and Uganda, part of the Albertine Rift. Credit: To A. Plumptre/KBA Secretariat

Birds likely hold smart insights about coexisting in popular habitats, especially as climate change looms. But tapping into that knowledge has a big hurdle: knowing how numerous birds live successfully together in vast environments.

In a paper titled, "An environmental habitat gradient and within-habitat segregation enable the co-existence of ecologically similar bird species," in the *Proceedings of the Royal Society B*, scientists at Michigan State University (MSU) peeled back layer upon layer of big data to tease out real-life answers that until now have been explored mostly in small-scale experiments.

Sam Ayebare, a Ph.D. candidate from Uganda, has led the work that is the first steps to understanding how so many birds can coexist in the vast Albertine Rift ecosystem region in east-central Africa. More birds live in this biodiversity hotspot in than anywhere else on the African continent—a veritable teeming feathered metropolis.

"We want to understand how species—in this case birds—coexist without driving each other to extinction," Ayebare said. "To protect a species, you must first understand where they are and why."

Past methods to understand how animals, birds or insects used space relied on experiments in laboratories or on small plots of land. Create a desirable space, then see what creature comes or stays.

But Ayebare, as part of MSU's Quantitative Ecology Lab, understood more truth was hidden in the vast amounts of data collected by scientists at 519 sampling sites across a montane forest in the diverse region of the Albertine Rift. Scientists strategically selected points of land across huge elevation and environmental gradients and recorded all birds seen or heard over a fixed period of time. That led to the identification of over 6,000 individuals across 129 species.

That observational data was cross referenced with specific information about temperature, rainfall, and databases that track species dietary preferences, activity patterns, body sizes, and use of the forest canopy for food and shelter.

Sunbirds are among the 129 species identified in a Michigan State University biodiversity study in eastern Africa. Credit: A. Plumptre/KBA Secretariat

Managing enormous amounts of information from many different sources is like digging into a treasure chest and finding the gems hidden in a huge, complicated puzzle. The Quantitative Ecology Lab, led by Elise Zipkin, an associate professor of integrative biology, pioneers statistical models to unravel some of the world's most alarming natural mysteries at the intersection of ecology, conservation biology, and the management of biodiversity. The mission: to understand and predict how and why nature is changing, the consequences of those changes, and what can be done to mitigate biodiversity loss.

"We're interested in the circumstances that allow biodiversity to flourish—what makes species co-existence possible?" Zipkin said. "There's is a lot of pressure on biodiversity in the modern age. It helps to understand what types of conditions, at very small to very large scales, can facilitate the protection of species."

By examining new insights into the birds' habitat with another question and more data, Ayebare and his team teased out where different species were, and how they were managing to coexist.

Among their findings were that birds partition their habitat use along environmental gradients: temperature, precipitation, and forest vegetation types. Within the prime habitats for various species groups, the scientists could see that birds of similar species will divide up territory within the habitat—some using the canopy, others staking a claim to lower levels of a forest. The data revealed a sense of the different strategies the birds adopt to survive.

"Species have organized themselves over millions of years," Ayebare said. "We want to develop ways figure out what they will do next to survive."

Translating big data into big insights demands tenacity, Zipkin said. "Sam's familiarity with the area enabled him to really feel the questions of how bird species in the Albertine rift coexist across spatial scales."

Zipkin is director of MSU's Ecology, Evolution, and Behavior Program of which Ayebare is a member, along with co-author Jeffrey Doser. The paper was also authored by Andrew J. Plumptre of BirdLife International and Cambridge University, Isaiah Owiunji of Kabale University in Uganda and Hamlet Mugabe of Wildlife Conservation Society in Uganda.

More information: An environmental habitat gradient and within-habitat segregation enable co-existence of ecologically similar bird species, *Proceedings of the Royal Society B: Biological Sciences* (2023). DOI: 10.1098/rspb.2023.0467. royalsocietypublishing.org/doi … .1098/rspb.2023.0467

Provided by Michigan State University

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