Human-driven change on Argentine forests

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This great kiskadee chick was infected with botfly larvae. Credit: Dario Manzoli

A new report by the Wildlife Conservation Society (WCS) and the Disease Ecology Laboratory of Instituto de Ciencias Veterinarias del Litoral, Argentina (ICIVET LITORAL, UNL-CONICET) shows that increases in precipitation and changes in vegetative structure in Argentine forests – factors driven by climate change and deforestation in the region – are leading to increased parasitism of young nesting birds by

fly larvae (botflies) of the species *Philornis torquans*.

In temperate and tropical areas of the Americas, wild bird chicks are the target of parasitic flies whose larvae burrow under the skin of the baby birds to feed, causing a disease known as subcutaneous myiasis. In the study, scientists examined the circumstances that drive the abundance of these parasites and found that slight changes in precipitation and vegetation structure, coupled with crowding of nests resulted in large increases in the number of parasites per chick.

The report, Multi-level Determinants of Parasitic Fly Infection in Forest Passerines, appears in the current online edition of *PLOS ONE*. Authors include Pablo Beldomenico of WCS's Global Health Program and Director of the Disease Ecology Laboratory, and Dario Ezequiel Manzoli, Leandro Raúl Antoniazzi, Maria José Saravia, Leonardo Silvestri, and David Rorhmann, all of ICIVET LITORAL, UNL-CONICET.

During the six-year investigation of the epidemiology of myiasis in wild birds, repeated observations of more than 4,000 chicks were recorded. The *Philornis torquans* larvae were present in 22 of 57 bird species examined, with the highest prevalence of parasitism observed in the great kiskadee (41.2 percent), greater thornbird (12.6 percent), and lesser thornbird (10.6 percent).

After considering the affects of variables on parasite abundance at multiple levels (including in individual nestlings, broods, communities in a given week, and communities in a given year) the researchers made the following determinations:

- Results of the individual nestling analysis indicated that infection was determined by the species and age of the host. Researchers found that the adult flies sought the great kiskadee as the

preferred host but adapted to other species when this bird was unavailable. Mean larval abundance, defined as the number of larvae per chick, peaked at different chick ages depending on the host species.

- The main driver of parasite abundance analyzed at the microhabitat level was the average height of the surrounding forest. While nest height did not make a difference, slight increases in the forest height resulted in a large reduction of the mean larval abundance. While it is unknown why this is the case, a study to measure the humidity and temperature of forests of the same tree species, but of different heights, is planned.
- At the community level, climate variables, namely precipitation and temperature, were positively associated with larvae numbers. One month after a heavy rainfall, the mean larval abundance increased considerably. Overall, rainy years brought heavy botfly burdens.
- In addition, host density was a major contributing factor; increases in the number of chicks per hectare were followed by greater burdens of larvae per chick.

Previous studies conducted jointly by WCS and the Disease Ecology Laboratory indicate that the more larvae the baby birds carried, the higher the impact on growth rates and incidence of mortality. Parasitism by ten larvae, for example, doubled the chances of death within a three-day period.

The investigation also showed evidence that fragmentation of forests results in overcrowding of broods. The authors believe that expected increases in precipitation and temperature from climate change and continued deforestation are a reason for further concern.

"If we analyze these results together with those of previous studies, the prospects are ideal for parasites and terrible for birds," said Dr. Pablo

Beldomenico. "Climate change projections for the region anticipate greater rainfall and higher temperatures. Birds are running out of forest habitat to nest in, and as a result, their broods are crowded together. This scenario favors parasite proliferation and baby birds suffering the cost."

"As we continue to alter the climate, cut down and disturb native forests, and so on, we continue to see the impacts of those actions affecting the health of wildlife. Eventually, we will see them affecting our own species," said ICIVET LITORAL veterinarian Darío Manzoli.

The researchers are planning new studies to investigate how the trends of this parasitic disease evolve and unveil the mechanisms underlying the effects observed. This knowledge will be critical to informing timely preventative and mitigating actions.

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