

# High-tech canopy maps reveal how tropical birds use Amazon forests

**New method helps land managers anticipate ecological change, prioritize conservation work**

By Joe Rojas-Burke, ASU News  
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Tropical forests may look like a uniform sea of green from above, but new research shows that carefully measured differences in forest structure and function can help explain how birds use existing habitats, how they respond to threats and which communities may be most at risk as forests change.

Using aircraft-mounted sensors, researchers mapped chemical and structural differences in forest canopies across Peru. They then compared those forest types with the ranges and traits of more than 1,300 forest-dependent bird species.

“By combining advanced airborne imaging spectroscopy with ecological data, we aren’t just mapping where the trees are; we are mapping the diversity and composition of the canopy itself and how the ecosystem functions,” said senior author [Greg Asner](#), director of the ASU Center for Global Discovery and Conservation in the [Julie Ann Wrigley Global Futures Laboratory](#).

“This approach provides a scalable way to identify distinct conservation risk areas across previously undocumented forest types, providing explanatory power far beyond traditional forest cover maps,” Asner said. He and co-authors at The Australian National University published the findings in [Nature Communications](#).

As deforestation, climate change and land-use pressures continue to reshape tropical forests, the researchers said the method could help land managers anticipate ecological change and prioritize strategies that protect both species diversity and ecosystem function.

“By linking newer high-tech maps of the chemical and functional traits of the forest canopy to avian ecology, we demonstrated that the composition of the trees exerts a big influence on the life-history strategies and vulnerabilities of the bird communities living there,” said first author George Olah, a DECRA fellow at the Fenner School of Environment and Society at The Australian National University.

The research builds on [a pioneering effort](#) by Asner and colleagues to map forests from the air by measuring chemical signatures of the tree canopy. Their aircraft-mounted spectrometer measured the wavelengths of light reflected by foliage. This allowed the researchers to measure seven features of forest canopies, including leaf nutrients, water content and plant compounds. The researchers used those measurements to sort Peru's forests into six broad forest types.

For the new study, the team looked at where 1,331 forest-dependent bird species live and measured how much of each species' range fell within those six forest types. They then compared those patterns with information about each bird, including body size, clutch size, where it feeds in the forest, conservation status and population trend.

The goal was to see whether differences in the forest canopy could help explain differences in the birds that live there, including which species may be more vulnerable as forests are cleared or changed.

Peru is home to about 18% of the world's bird species, many of them dependent on forest habitats that cover more than 60% of the country.

The researchers found that birds in northern Amazonian swamp forests tended to be larger-bodied and longer-lived, traits associated with slower reproductive strategies and potentially lower ecological resilience. Montane Andean forests were more often home to understory specialists, which can be more sensitive to habitat fragmentation and changes in temperature and humidity. Birds in lower Andean forests showed stronger links to cumulative human threats, while floodplain forest birds showed traits associated with greater tolerance of urbanization.

These findings can help focus conservation efforts to where they are most needed. If conservation networks prioritize areas based solely on total species richness or generic tree cover, they might overemphasize protections for resilient floodplain forests while leaving large-bodied birds of the swamp forests relatively unprotected.

Remotely sensed canopy traits can help scientists move beyond counting species to better understand the functional integrity and resilience of ecosystems. The approach could support expanded biodiversity monitoring across the Amazon basin, especially as satellite-based imaging spectroscopy becomes more widely available.

"By integrating habitat functionality with species traits, we can revolutionize conservation planning at the landscape scale," Olah said.

Asner said that mapping the biological and functional diversity of the Amazon canopy "is essential to safeguard the full spectrum of avian ecological roles, preventing the silent loss of animals as the forest is either protected or deforested."

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## Main image



Researchers mapped chemical and structural differences in forest canopies across Peru using the ASU Global Airborne Observatory. ASU photo

**Text image(s)**



Greg Asner