Mapping software tracks threats to endangered species

April 12 2016, by Danica Schaffer-Smith

The critically endangered San Martin titi monkey (*Callicebus oenanthe*) lives in small family groups in Peru. Credit: Proyecto Mono Tocón

Habitat mapping software and satellite imagery can help conservationists predict the movements of endangered species in remote or inaccessible

regions and pinpoint areas where conservation efforts should be prioritized, a new Duke University-led case study shows.

The Duke team used the software and images to assess recent forest loss restricting the movement of Peru's critically endangered San Martin titi monkey (*Callicebus oenanthe*) and identify the 10 percent of remaining forest in the species' range that presents the best opportunity for conservation.

"Using these tools, we were able to work with a local conservation organization to rapidly pinpoint areas where reforestation and conservation have the best chance of success," said Danica Schaffer-Smith, a doctoral student at Duke's Nicholas School of the Environment, who led the study. "Comprehensive on-the-ground assessments would have taken much more time and been cost-prohibitive given the inaccessibility of much of the terrain and the fragmented distribution and rare nature of this species."

The San Martin titi monkey inhabits an area about the size of Connecticut in the lowland forests of north central Peru. It was recently added to the International Union for Conservation of Nature's list of the 25 most endangered primates in the world.

A forest stand in Peru's Alto Mayo Valley is completely surrounded by encroaching farmland. Credit: Danica Schaffer-Smith, Duke

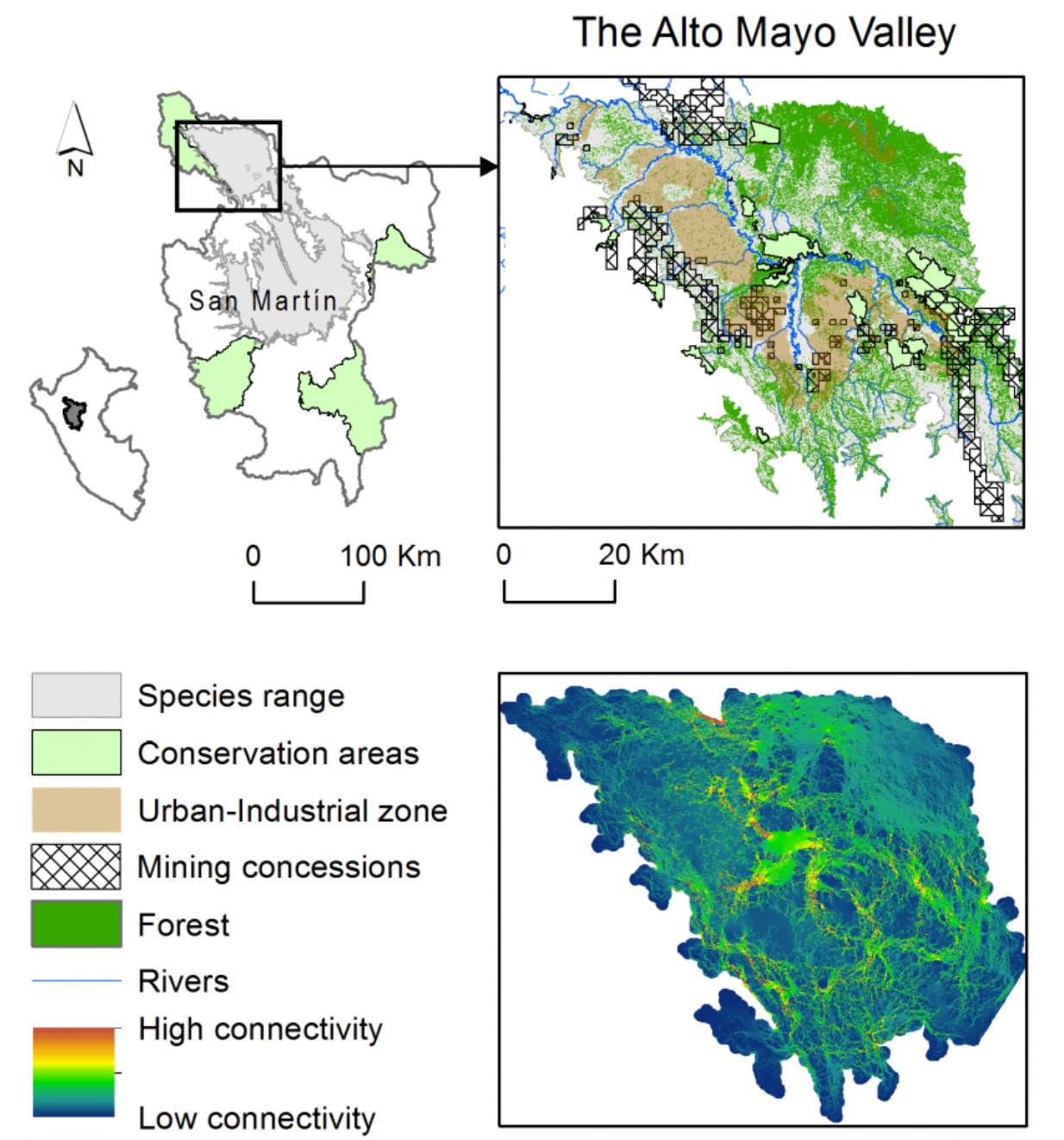
Increased farming, logging, mining and urbanization have fragmented forests across much of the monkey's once-remote native range and contributed to an estimated 80 percent decrease in its population over the last 25 years.

Titi monkeys travel an average of 663 meters a day, primarily moving from branch to branch to search for food, socialize or escape predators. Without well-connected tree canopies, they're less able to survive local threats and disturbances, or recolonize in suitable new habitats. The

diminutive species, which typically weighs just two to three pounds at maturity, mate for life and produce at most one offspring a year. Mated pairs are sometimes seen intertwining their long tails when sitting next to each other.

Armed with Aster and Landsat satellite images showing the pace and extent of recent forest loss, and GeoHAT, a downloadable geospatial habitat assessment toolkit developed at Duke, Schaffer-Smith worked with Antonio Bóveda-Penalba, program coordinator at thePeruvian NGO Proyecto Mono Tocón, to prioritize where conservation efforts should be focused.

"The images and software, combined with Proyecto Mono Tocón's detailed knowledge of the titi monkey's behaviors and habitats, allowed us to assess which patches and corridors of the remaining forest were the most critical to protect," said Jennifer Swenson, associate professor of the practice of geospatial analysis at Duke, who was part of the research team.



Habitat connectivity models identify high-priority areas for conservation Credit: Duke University

The team's analysis revealed that at least 34 percent of lowland forests in

the monkey's northern range, Peru's Alto Mayo Valley, have been lost. It also showed that nearly 95 percent of remaining habitat fragments are likely too small and poorly connected to support viable populations; and less than 8 percent of all remaining suitable habitats lie within existing conservation areas.

Areas the model showed had the highest connectivity comprise just 10 percent of the remaining forest in the northern range, along with small patches elsewhere. These forests present the best opportunities for giving the highly mobile titi monkey the protected paths for movement it needs to survive.

Based on this analysis, the team identified a 10-kilometer corridor between Peru's Morro de Calzada and Almendra conservation areas as a high priority for protection.

"For many rare species threatened by active habitat loss, the clock is literally ticking," Schaffer-Smith said. "Software tools like GeoHAT - or similar software such as CircuitScape - can spell the difference between acting in time to save them or waiting till it's too late."

Schaffer-Smith, Swenson and Bóveda-Penalba published their peer-reviewed research March 16 in the journal *Environmental Conservation*.

GeoHAT is a suite of ArcGIS geoprocessing tools designed to evaluate overall habitat quality and connectivity under changing land-use scenarios. It was developed by John Fay, an instructor in the Geospatial Analysis Program at Duke's Nicholas School, and can be used to assess habitats for a wide range of land-based species. (Learn More: http://sites.duke.edu/johnfay/projects/geohat/)

More information: "Rapid Conservation Assessment for Endangered Species Using Habitat Connectivity Models," Danica Schaffer-Smith,

Jennifer J. Swenson, Antonio J. Bóveda-Penalba. *Environmental Conservation*, March 16, 2016, DOI: 10.107/S0376892915000405