

Studying vampire bats to predict the next pandemic

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Assistant Professor Luis Escobar (at center) holds a vampire bat as Karen Sarmientos, a student at Universidad Distrital in Colombia, feeds it a sugar water solution through a dropper before returning it to the wild. Photo courtesy of Laura V. Avila Vargas. Credit: Virginia Tech

In June, Virginia Tech Assistant Professor Luis Escobar led a team of students into the Andes Mountains and lowlands of Colombia to understand how vampire bats can help predict and prevent the next big epidemic.

Escobar is an expert in assessing how diseases respond to climate and landscape change in the College of Natural Resources and Environment's Department of Fish and Wildlife Conservation. With a \$358,000 grant from the National Science Foundation and support from the Centers for Disease Control and Prevention (CDC), his latest project examines how vampire bats carrying the rabies virus can help scientists forecast areas where wildlife virus transmission might occur in the coming years.

The study documents in-depth how the confluence of geography, population traits, and climate change affect the spread of infectious disease from bats to other species and proposes new models for predicting when and where such spillover events will occur. The findings could shed light on what environmental conditions increase the likelihood of transmission of rabies as well as other diseases that are transmitted from animals to humans, such as coronavirus and the Ebola virus.

Colombia's varied climate and topography—from the cold, arid elevations of the Andes Mountains down to the hot, humid lowlands and coastal areas—offer the ideal setting for such research.

"Climate change and rising temperatures increase the risk of spreading infectious disease," Escobar said. "Colombia provides a great system to see the effects of extreme temperatures up close without having to wait for climate change to unfold. We are monitoring large areas and different climates and elevations to create a big-picture study of the factors behind the geography of spillover to answer the question: Can we predict spillover across spatial areas?"

Vampire bats are ideal wildlife hosts for studying disease transmission. They are a frequent source of pathogen spillover in Latin America, where livestock deaths from the rabies virus are common. As bats and bat-borne infections creep farther north due to warming temperatures, vampire bat rabies represents a significant threat to cattle, livestock, and other animals in the southern United States.

"Many epidemic-causing pathogens come from bats, which can infect a wide range of species from carnivores to livestock and humans," Escobar said. "We have learned many lessons about disease thanks to rabies, which makes rabies an excellent model for understanding how the ongoing climate change can trigger the next pandemic. If we can get a good idea of how conditions of the environment—landscape, temperature, rain, urbanization—increase or decrease disease transmission, then we can better understand how pathogens cross species lines to spread into the public and cause epidemics and even pandemics like COVID-19."

As lead investigator in the study, Escobar, who is an affiliated faculty member with the Global Change Center and the Center for Emerging, Zoonotic, and Arthropod-borne Pathogens, is conducting all field research in addition to handling general project oversight and management.

His colleague, Professor Eric Hallerman from the Department of Fish and Wildlife Conservation, will conduct a population genetic assessment from the vampire bat samples. He also will examine the relationships among different vampire bat populations to determine whether they share genes or have independent colonies, which may help the team better understand transmission processes.

Co-principal investigator Lauren Childs, associate professor of mathematics in the College of Science, will put together different data

patterns, creating a mathematical modeling framework to reconstruct and help project future spillover events.

The Virginia Tech scientists are partnering in the effort with senior scientists from the U.S. Centers for Disease Control and Prevention, Universidad de La Salle in Colombia, and officials from the Colombian Departments of Health and Agriculture.

Students find the chance to excel in fieldwork

To collect the first field data in June, Escobar assembled and trained a team of Virginia Tech students, including one graduate student and three undergraduates. The team, joined by students from four Colombian universities, visited four sites with differing elevations, temperatures, and ecological conditions to trap and sample more than 250 vampire bats.

Working at night, when bats are most active, they caught bats in large rectangular mist nets in forests and farmlands. They also learned how to descend into caves wearing biohazard suits, gloves, and masks to capture bats during the day. The bats were placed in bags and taken back to a mobile lab, where Escobar and the students identified the species, measured them, drew blood samples, tagged them, and fed them a sugar water solution before releasing them.

The opportunity to acquire hands-on experience in research and fieldwork is a priority for the college. Students studying in the Department of Fish and Wildlife Conservation are expected to complete an experiential learning experience before graduation; one option for fulfilling this requirement is undergraduate research.

The college and department also value inclusion and opportunity, and Escobar specifically encouraged applications from students from

underrepresented and underserved backgrounds in disease ecology.

Dyess Harp, from Berryville, Virginia, who graduated in June with a degree in fish and wildlife conservation, said the experience affirmed her interest in pursuing a master's degree in the field.

"The opportunity to get hands-on experience in biodiversity, disease ecology, and bats, and be part of such a multicultural, supportive team was a dream come true," said Harp. "For me, this was a really encouraging thing because queer people, especially transgender people, have historically not been included in field research trips of this scope."

Quan Dong, a senior from Annandale, Virginia, majoring in wildlife conservation and biological sciences, called it "the trip of a lifetime."

"This was by far my best college experience to date," he said. "Field work is a unique experience that cannot really be replicated any other way. I was able to learn skills related to the physical aspects of field work, such as the techniques for setting up a mist net and pacing yourself for a day of hiking through the mountains. I was also able to learn how to be an effective researcher, providing critical feedback and collaborating with others. I expect these skills to stay with me throughout my life and help to stimulate a fruitful career in wildlife conservation."

Dong also formulated his own separate research project on bat acoustics and echolocation activity. He recorded bat vocalizations and is now investigating the unique and common languages of [vampire bats](#) across various regions.

Escobar and a new group of students will return next year to collect more samples and complete the study. In the meantime, the team is analyzing a century's worth of historical data from Latin America, looking for patterns in climate change and rabies spillover that may be helpful in

predicting future transmission events.

"Students who study [wildlife conservation](#) in the College of Natural Resources and Environment have a unique opportunity not only to get mud on their boots, but also to conduct work with the CDC and other health agencies that study wildlife diseases," Escobar said. "Through projects like this, we are filling a critical niche: the empirical study of [climate change](#) effects on disease emergence."

"Student success is the central focus of our department, and gaining research experience working in new environments and with pressing environmental issues is a great way for students to expand their resume and ensure their success as they move beyond Virginia Tech," said Joel Snodgrass, department head and professor in the Department of Fish and Wildlife Conservation. "Dr. Escobar's work represents just such an opportunity and clearly demonstrates the benefits to our students of a diverse faculty and student body."

Provided by Virginia Tech

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