

# Spillover: Why germs jump species from animals to people

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When a disease spreads from one species to another it is known as a "spillover event." Although not yet confirmed, preliminary evidence suggests that the virus that causes COVID-19, the 2019 coronavirus disease, may have originated in horseshoe bats in China. It may have spread to another species which in turn infected humans at a Wuhan live

animal market, or "wet market."

Thomas Gillespie, associate professor in Emory University's Department of Environmental Sciences, is a disease ecologist who studies how germs jump between [wild animals](#), domesticated animals and people. Through this "One Health" approach, he aims to protect humans, ecosystems and biodiversity.

Most of Gillespie's research is focused in Africa and Latin America where his team is characterizing the diversity of new viruses and other [pathogens](#) in [tropical forests](#). In the following interview, Gillespie explains how shrinking [natural habitats](#) and changing human and animal behaviors can add to the risks of spillover events.

## **Bats are linked to outbreaks of Hendra, Marburg and Nipah viruses, the Ebola virus outbreak in West Africa in 2014 and the SARS virus outbreak in China in 2002. Why do bats keep cropping up as prime suspects?**

One quarter of mammal [species](#) overall are bats. And in tropical systems, bats make up 50 percent of the mammalian diversity. Most bats feed on insects or fruit, but there's a huge range of bat behaviors. There are bats that eat other bats, bats that eat fish and bats that drink blood. We are still discovering new species of bats. And each of these myriad bat species carries a suite of different pathogens. Bats are able to host different viruses without getting sick.

So bats, and the pathogens that bats carry, are numerous. And bats and humans are both mammals. This relatedness means we're more likely to get a pathogen from a bat than from a cricket, for instance.

## **Why are wet markets hot spots for disease spillover?**

Wet markets bring together a really broad range of animal species from different parts of the world. These animals are not eating what they would normally eat in the wild. They are stressed, which lowers their immunity and makes them more susceptible to pathogens. They are kept in cages where they are defecating on one another and, perhaps, through the cages onto other species of animals. They are also being butchered at the markets. Cutting up an animal and getting its blood on you is a good way to get a pathogen. All these factors make wet markets a perfect storm for cross-species transmission.

Whenever you have novel interactions with a diverse range of species in one place—whether that's in a natural environment like a tropical forest or in an artificially created environment like a wet market—you can have a spillover event.

## **How are land use changes driving spillover?**

Major landscape changes are causing wildlife to lose habitats, which means more species may become crowded together while also coming into closer contact with humans. We see this in the United States, where suburbs fragmenting forests raise the risk of humans catching Lyme disease. Altering the ecosystem affects the complex cycle of the Lyme pathogen, which involves ticks, mice and deer. And people living close by are more likely to get bitten by a tick carrying Lyme bacteria.

Logging and subsistence agriculture in Africa are reducing habitat for wild primates. They have less forest to forage in. That can make them unhealthy and more susceptible to disease. And it may drive them to risk encounters with humans, raising risks of the exchange of pathogens. In Uganda, for instance, crop raiding by red-tailed guenon monkeys led

farmers to put cattle feces on their corn to make it less attractive to the monkeys.

And everyone is talking about the problem of the wet [market](#) in Wuhan, but what about the effects of the nearby Three Gorges Dam project? It is the world's largest hydroelectric power station, built on the Yangtze River in an area that was previously a mix of secondary forest and agricultural land. Many of the [animals](#) that used to live in that area likely died when their habitat was destroyed, but bats can fly. Where did they go? How did they adapt?

## **How does your research address these kinds of problems?**

Most people don't realize that we haven't yet cataloged the full diversity of life, everything from viruses to mammals. At the same time, we need to understand more about how changing landscapes and novel interactions between humans and other species influence spillover. Why has one pathogen jumped across species while another one hasn't? It's important to gather data so we can use it to identify potential hot spots and risky behaviors. That may help us reduce the number of major spillover events, saving lives and preventing enormous economic losses.

Provided by Emory University

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