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Loss of Species Large and Small Threatens Human Health, Study Finds

The loss of biodiversity -- from beneficial bacteria to charismatic mammals -- threatens human health. That's the conclusion of a study published this week in the journal Nature by scientists who study biodiversity and infectious diseases.

The work reveals a critical connection between conservation and disease. Species losses in ecosystems such as forests and fields result in increases in pathogens -- disease-causing organisms -- the researchers found.

The animals, plants, and microbes most likely to disappear as biodiversity is lost are often those that buffer infectious disease transmission. Those that remain tend to be species that magnify the transmission of infectious diseases like West Nile virus, Lyme disease, and hantavirus.

"We knew of specific cases in which declines in biodiversity increase the incidence of disease," says Felicia Keesing, an Ecologist at Bard College in Annandale, N.Y., and first author of the paper. "But we've learned that the pattern is much more general: biodiversity loss tends to increase pathogen transmission across a wide range of infectious disease systems."

The pattern holds true for various types of pathogens -- viruses, bacteria, fungi -- and for many types of hosts, whether humans, other animals, or plants.

"When a clinical trial of a drug shows that it works," says Keesing, "the trial is halted so the drug can be made available. In a similar way, the protective effect of biodiversity is clear enough that we need to implement policies to preserve it now."

In the case of Lyme disease, says co-author Richard Ostfeld of the Cary Institute of Ecosystem Studies in Millbrook, N.Y., "strongly buffering species like the opossum are lost, when forests are fragmented, but white-footed mice thrive. The mice increase numbers of both the blacklegged tick vector and the pathogen that causes Lyme disease."

Scientists don't yet know, Ostfeld says, why the most resilient species -- "the last ones standing when biodiversity is lost" -- are the ones that also amplify pathogens. Preserving natural habitats, the authors argue, is the best way to prevent this effect.

Global biodiversity has declined at an unprecedented pace since the 1950s. Current extinction rates are estimated at 100 to 1,000 times higher than in past epochs, and are projected to increase at least a thousand times more in the next 50 years. Expanding human populations can increase contact with novel pathogens through activities such as land-clearing for agriculture and hunting for wildlife.

Identifying the variables involved in infectious disease emergence is difficult but critical, says co-author Andrew Dobson of Princeton University.

Biodiversity is an important factor, but so are land use changes and human population growth and behavior, he says. "When biological diversity declines and contact with humans increases, you have a perfect recipe for infectious disease outbreaks."

The authors call for careful monitoring of areas in which large numbers of domesticated animals are raised or fish are farmed. "That would reduce the likelihood of an infectious disease jumping from wildlife to livestock, then to humans," says Keesing.

For humans and other species to remain healthy, it will take more than a village -- we need an entire planet, the scientists say, one with its diversity thriving.

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Other co-authors are: Samuel Myers of Harvard Medical School; Charles Mitchell of the University of North Carolina at Chapel Hill; Kate Jones of the Zoological Society of London; Anna Jolles of Oregon State University; Peter Hudson of Penn State University; Robert Holt of the University of Florida at Gainesville; Drew Harvell of Cornell University; Peter Daszak and Tiffany Bogich of EcoHealth Alliance (formerly Wildlife Trust) in New York City; and Lisa Belden of Virginia Tech.