

# Loss of land-based vertebrates is accelerating, study finds

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The Sumatran rhino (*Dicerorhinus sumatrensis*) is one of the most endangered mammals on Earth. Approximately 80 individuals remain in northern Sumatra, Indonesia, but poaching for their tusks and habitat loss threaten them with

extinction. Credit: Rhett Buttler / Mongabay

In 2015, Stanford biologist Paul Ehrlich coauthored a study declaring the world's sixth mass extinction was underway. Five years later, Ehrlich and colleagues at other institutions have a grim update: the extinction rate is likely much higher than previously thought and is eroding nature's ability to provide vital services to people.

Their new paper, published this week in *Proceedings of the National Academy of Sciences*, indicates the wildlife trade and other [human impacts](#) have wiped out hundreds of [species](#) and pushed many more to the brink of extinction at an unprecedented rate.

For perspective, scientists estimate that in the entire twentieth century, at least 543 land [vertebrate species](#) went extinct. Ehrlich and his coauthors estimate that nearly the same number of species are likely to go extinct in the next two decades alone.

The trend's cascading effects include an intensification of human health threats, such as COVID-19, according to the researchers. "When humanity exterminates populations and species of other creatures, it is sawing off the limb on which it is sitting, destroying working parts of our own life-support system," said Ehrlich, the Bing Professor of Population Studies, emeritus, at the Stanford School of Humanities and Sciences and a senior fellow, emeritus, at the Stanford Woods Institute for the Environment. "The conservation of endangered species should be elevated to a national and global emergency for governments and institutions, equal to climate disruption to which it is linked."

The study comes in the wake of an April 7 letter from a bipartisan group of senators urging the Trump administration to close markets that sell

[live animals](#) for food and unregulated wildlife markets, among other measures to stop the trade in illegal wildlife and wildlife products.

Human pressures, such as population growth, habitat destruction, the wildlife trade, pollution and climate change, critically threaten thousands of species around the world. Ecosystems ranging from coral reefs and mangrove forests to jungles and deserts depend on these species' long-evolved relationships to maintain their functioning and make them resilient to change. Without this robustness, ecosystems are less and less able to preserve a stable climate, provide freshwater, pollinate crops and protect humanity from natural disasters and disease.

## **Final opportunity**

To better understand the extinction crisis, the researchers looked at the abundance and distribution of critically endangered species. They found that 515 species of terrestrial vertebrates— 1.7 percent of all the species they analyzed— are on the brink of extinction, meaning they have fewer than 1,000 individuals remaining. About half of the species studied have fewer than 250 individuals left. Most of the highly endangered species are concentrated in tropical and subtropical regions that are affected by human encroachment, according to the study.



The variable harlequin frog (*Atelopus varius*) was widespread in Costa Rica and Panama until an introduced fungus from Asia decimated its populations. Credit: Gerardo Ceballos

In addition to rising extinction rates, the cumulative loss of populations—individual, localized groups of a particular species- and geographic range has led to the extinction of more than 237,000 populations of those 515 species since 1900, according the researchers' estimates. With fewer populations, species are unable to serve their function in an ecosystem, which can have rippling effects. For example, when overhunting of [sea otters](#)—the main predator of kelp-eating sea urchins—led to kelp die-offs in the 1700s, the kelp-eating sea cow went extinct.

"What we do to deal with the current extinction crisis in the next two decades will define the fate of millions of species," said study lead author Gerardo Ceballos, a senior researcher at the National Autonomous University of Mexico's Institute of Ecology. "We are facing our final opportunity to ensure that the many services nature provides us do not get irretrievably sabotaged."

The loss of endangered creatures could have a domino effect on other species, according to the researchers. The vast majority—84 percent—of species with populations under 5,000 live in the same areas as species with populations under 1,000. This creates the conditions for a chain reaction in which the extinction of one species destabilizes the ecosystem, putting other species at higher risk of extinction.

"Extinction breeds extinction," the study authors write. Because of this threat, they call for all species with populations under 5,000 to be listed as critically endangered on the International Union for Conservation of Nature Red List, an international database used to inform conservation action on a global scale.



The Española Giant Tortoise (*Chelonoidis hoodensis*), a species endemic to the Galapagos island, is threatened by introduced species. Recent conservation efforts have increased the number of tortoises, but only about 200 remain. Credit: Gerardo Ceballos

## **Timely implications**

These findings could aid conservation efforts by highlighting the species and geographic regions that require the most immediate attention. Understanding what species are at risk can also help identify what factors might be most responsible for rising [extinction](#) rates.

Among other actions, the researchers propose a global agreement to ban the trade of wild species. They argue the illegal capture or hunting of wild animals for food, pets and medicine is a fundamental ongoing threat

not only to species on the brink, but also to human health. COVID-19, which is thought to have originated in bats and been transmitted to humans through another creature in a live animal market, is an example of how the [wildlife trade](#) can hurt humans, according to the researchers. They point out that wild animals have transmitted many other infectious diseases to humans and domestic animals in recent decades due to habitat encroachment and wildlife harvesting for food.

"It's up to us to decide what kind of a world we want to leave to coming generations—a sustainable one, or a desolate one in which the civilization we have built disintegrates rather than builds on past successes," said study coauthor Peter Raven, president emeritus of the Missouri Botanical Garden.

**More information:** Gerardo Ceballos et al., "Vertebrates on the brink as indicators of biological annihilation and the sixth mass extinction," *PNAS* (2020). [www.pnas.org/cgi/doi/10.1073/pnas.1922686117](http://www.pnas.org/cgi/doi/10.1073/pnas.1922686117)

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