

# Loss of large predators disrupting multiple plant, animal and human ecosystems

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A wolf in Yellowstone National Park. (Photo courtesy of Yellowstone National Park)

The enormous decline of large, apex predators and "consumers" ranging from wolves to lions, sharks and sea otters may represent the most powerful impacts humans have ever had on Earth's ecosystems, a group of 24 researchers concluded today in a new report in the journal *Science*.

The decline of such species around the world is much greater than previously understood and now affects many other [ecological processes](#) through what scientists call "trophic cascades," in which the loss of "top down" [predation](#) severely disrupts many other plant and [animal species](#).

Such disruption is sufficiently severe that it now affects everything from [habitat loss](#) to pollution, [carbon sequestration](#), wildfire, climate, [invasive](#)

[species](#) and spread of disease, the scientists said. It is also a driving force in the sixth mass extinction in Earth history, which the researchers said is now under way.

"We now have [overwhelming evidence](#) that large predators are hugely important in the function of nature, from the deepest oceans to the highest mountains, the tropics to the Arctic," said William Ripple, a professor of forestry at Oregon State University, co-author of the report and an international leader in this field of study as director of OSU's Trophic Cascades Program.

"In a broad view, the collapse of these ecosystems has reached a point where this doesn't just affect wolves or aspen trees, deforestation or soil or water," Ripple said. "These predators and processes ultimately protect humans. This isn't just about them, it's about us."

Historically there has been little appreciation of how large predators affected so many other species, the researchers said, and too often such processes were studied one plant or animal at a time in a small area, failing to appreciate the larger disruption under way.

Based on the new understanding that is emerging, the scientists argued that the burden of proof should now be shifted, to assume that top predators have major effects on ecosystems until proven otherwise.

"We propose that many of the ecological surprises that have confronted society over past centuries – pandemics, population collapses of species we value and eruptions of those we do not, major shifts in ecosystem states, and losses of diverse ecosystem services were caused or facilitated by altered top-down forcing regimes," the scientists wrote.

Pioneering research done in recent years at OSU and cited in this study, for instance, has outlined the effect that the loss of wolves had in

Yellowstone National Park. When wolves were removed, elk populations increased and elk behavior also changed, because they were no longer afraid of browsing young aspen trees in places where historically they might have been vulnerable to wolf attack.

Without wolves, the growth of young aspen trees and willow almost ground to a halt, and there were fewer beaver. Plant communities, tree growth and stream ecology all were affected. With the return of wolves, those areas are now returning to health, and in places, aspen and willow are recovering where they had been declining.

The scientists cited many examples in their study, both terrestrial and marine:

- Reduction of cougar in Utah led to an eruption of deer, loss of vegetation, altered stream channels, and a decline in biodiversity.
- Industrial whaling in the 20th century likely caused a killer whale diet shift and a dramatic decline of sea lions, seals and [sea otters](#).
- Decimation of sharks resulted in an outbreak of cow-nosed rays and the collapse of bay scallop fisheries.
- Sea otters enhance kelp abundance by limiting herbivorous sea urchins.
- The reduction of lions and leopards in Africa led to a population explosion in olive baboons, which bring intestinal parasites to humans who live in close proximity to them.

For too long, the researchers said, large animals have been seen as "riding atop the trophic pyramid" but not really affecting the species and structure below them. That's a fundamental misunderstanding of ecology, they said.

This report was done by scientists from 22 different institutions in six countries. Studies were supported by the Institute for Ocean

Conservation Science at Stony Brook University, National Science Foundation, Natural Sciences and Engineering Research Council of Canada, and other organizations.

"Top-down forcing must be included in conceptual overviews if there is to be any real hope for understanding and managing the workings of nature," they wrote in their conclusion.

Provided by Oregon State University

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