Why lizards need elephants to survive

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Somewhere in Africa, a lizard survives thanks to an elephant. Ecosystems are nuanced arrangements, and it isn't always obvious how the different pieces of the ecological puzzle snap into place. Lizards, it turns out, rely on the debris created by elephants as they trample trees. Shards of wood and leaves haphazardly left behind by marching pachyderms provide good cover for a small lizard to escape the piercing talons of a hungry raptor. Kill the elephants, and the lizards could suffer.

Some 10,000 years ago as the Pleistocene unfolded across the planet, 80 percent of mega-herbivores – those critters larger than 1,000 kilograms, like modern elephants – would become wiped out. Some of them suffered due to climate-related changes that swept across the globe, but many of them were ultimately driven to extinction through overhunting. In the late Pleistocene, there were some 42 such mega-herbivores. Today, only eight remain. Together with other large herbivores (between 100 and 1,000 kilograms), Earth's plant eaters are in serious decline. Indeed, the waves of extinction and biodiversity loss that began in the Pleistocene may be continuing today in Africa and in Southeast Asia, where the very recent extinction of Western black rhinos is a salient reminder of our own species' disproportionate affect on our planet's wildlife.

Today, there are 74 herbivores larger than 100 kilograms still grazing and browsing the leaves, branches, and stems of our pale blue dot. Earlier this month in the journal *Science Advances*, a group of researchers led by Oregon State University ecologist William J. Ripple reviewed the conservation status of those mammals, outlining both the threats they face as well as the consequences of their extinction or extirpation.

Of those 74 mammalian herbivores, nearly two-thirds (44 species) are listed as threatened with extinction, including 12 that are either critically endangered or extinct in the wild. These

74 species represent just four taxonomic orders (Proboscidea, Primates, Cetartiodactyla, and Perissodactyla) and 11 families (Elephantidae, Rhinocerotidae, Hippopotamidae, Giraffidae, Bovidae, Camelidae, Tapiridae, Equidae, Cervidae, Suidae, and Hominidae).

While some are quite literally on the brink of disappearing forever (there are fewer than 100 Javan rhinos left), Eurasian elk number more than one million. Each of those threatened species, importantly, makes its home in developing countries in Africa and Southeast Asia. Only one threatened species is primarily found in the developed world: the European bison. That might seem promising for large herbivores in the West, but the unfortunate truth is that those nations have simply already lost most of their large herbivores.

Grazers like the Eurasian elk notwithstanding, the outlook for our planet's large herbivores is grim. Most of them occupy a range that's less than 20 percent the size of the area they once roamed. And many of them are woefully understudied. In large part, that's because they are found in less exotic, poorer countries, but it's also because many of them are not as charismatic as elephants or rhinos. Even still, the best understood species are game animals in wealthy nations, like red deer, reindeer, elk, and moose. Meanwhile 18 other species have fewer than ten published papers each about them, including the critically endangered tamaraw, Visayan warty pig, and walia ibex, as well as the endangered Oliver's warty pig, mountain anoa, lowland anoa, and mountain tapir.

Moreover, the loss of large herbivores affects entire ecosystems. Theirs drives predators like hyenas to focus their efforts on smaller herbivores, which may not have evolved to account for a heavy, sustained predation pressure of that intensity. Some large herbivores are important seed dispersers. Others help shape watersheds.

Elephants, for example, move seeds vast distances in their dung. They also transform woodland into shrubland as they march through trampling the trees, which provides important food for impala. That has the compound effect of providing large predators like lions access through previously impenetrable thickets to new prey animals (including black rhinos and the aforementioned impala). And then they help lizards stay safe.

White rhinos, on the other hand, selective lawnmowers that they are, help to maintain short grasses. That, in turn, provides food for other grazers like impala, wildebeest, zebras, and more. By keeping grasses short, rhinos also maintain the fire regime for which the vegetation and wildlife in their habitats have evolved to withstand.

The list goes on. Herbivores, like any other type of animal, play important roles in balancing their ecosystems. When those massive mammals are removed, things have the potential to go topsy-turvy. Fuel builds up, so wildfires are more intense and last longer. Some animals decline because they have fewer places to hide from predators, or less to eat. Other animals increase because their own predators decline. When large herbivores are excluded from a landscape, rodents flourish, and with them, their disease-carrying fleas. And that, in turn, increases the likelihood that diseases can pass from wildlife to people and their livestock.

Is there anything that can be done to mitigate or ameliorate the onward march to extinction on which so many of our planet's large herbivores seem to be? There are of course the usual answers: expanding protected landscapes, funding the enforcement of wildlife-related laws, creating wildlife corridors to allow for wildlife movement and genetic mixing, reducing the demand for products made of ivory and rhino horn, climate change mitigation, and so on.

But "[t]he ultimate forces behind declining large mammal populations are a rising human population and increasing per capita resource consumption," writes Ripple with his colleagues. That means that reducing human birth rates is central to wildlife conservation. "Educational and development opportunities, particularly for young women," they say, are central to attaining those goals.

In addition, decreased consumption of animal flesh – whether wild or domestic – is also a central strategy. "Increasing levels of human carnivory are at the crux of the problem," they plainly say. Reducing the consumption of wild herbivores ("bushmeat") is part of the answer, ranging from the giraffes slaughtered to feed elephant poachers to the gorillas slaughtered for trophies and meat. More importantly, if the demand for domestic ruminants (like cows, goats, and sheep) goes down, then demand will also go down for forage, water, and feed crops, allowing more food, water, and space to be used by wild herbivores. Ultimately, we need to reduce our desire for hamburgers and steaks. Where wildlife is exploited for human use, sustainable, empirical management strategies, like male-only harvests, age-specific harvests, and quotas are also going to be important, both for conservation as well as for food security.

The researchers also advocate for a special fund to finance graduate students who can conduct empirical research on basic ecological questions of the least studied large herbivores, as well as on the socioeconomic factors associated with their exploitation.

"Now is the time to act boldly," the researchers conclude, "because without radical changes in these trends, the extinctions that eliminated most of the world's largest herbivores 10,000 to 50,000 years ago will only have been postponed for these last few remaining giants." At one time, ecologists warned that habitat loss, exploitation, and human conflict would result in an "empty forest," but the continuing loss of our largest, most magnificant herbivores herald an era where not only is the forest empty, but also the desert, grassland, and savannah. **– Jason G. Goldman | 22 May 2015**

Source: Ripple, W. J., et al. (2015). Collapse of the world's largest herbivores. *Science Advances, 1*(4), e1400103.

Header image: Visayan warty piglet via Wikimedia Commons/Calle Eklund.