

Over-hunting threatens Amazonian forest carbon stocks

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Over-hunting large mammals in tropical forests could make climate change worse. Credit: Carlos Peres, University of East Anglia

Over-hunting of large mammals in tropical forests could make climate change worse according to new research from the University of East

Anglia (UEA).

Tropical forests worldwide store more than 460 billion tonnes of [carbon](#). The Amazon is the largest and most species-rich tropical [forest](#) on Earth.

Researchers studied the large-scale impact of wildlife extinctions induced by over-hunting on [carbon storage](#) right across the Amazon.

The research shows that much of the above-ground carbon stock of Amazonian forests could be lost if large-bodied fruit-eating mammals continue to be hunted out, and that over-hunting adds to the Amazon's many threats which include deforestation, timber extraction and wildfires.

The research team included authors from UEA (UK), the National Institute of Amazonian Research and Fiocruz Amazônia (both in Brazil), and Oregon State University.

Lead researcher Prof Carlos Peres, from UEA's School of Environmental Sciences, said: "Amazonian forests provide globally important [ecosystem services](#), including carbon storage in the forest biomass.

"Our research shows that if people continue to overhunt large mammals, tropical forests could lose much of their capacity for carbon storage. This is because several large mammal species play a vital role in dispersing large-seeded trees associated with high wood density."



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The new study, published today in the journal *Proceedings of the National Academy of Sciences*, compares data from 166 wildlife surveys conducted across the Amazon basin to estimate the impact of hunting on game species with low reproductive rates, such as primates.

It shows how persistent over-hunting of large mammal populations leads to empty or half-empty forests. Based on nearly one million individually mapped rural households, the study shows that the total remaining forest area affected by hunting far exceeds the total area that has been

deforested to date. This in turn disrupts seed dispersal, and leads to long-term ripple effects for forest carbon stocks.

Prof Peres said: "Amazonian forest wildlife has been declining through a combination of habitat destruction, habitat degradation and overhunting since the 1950s, but until now there was a poor understanding of the status of wildlife populations in hunted forests that otherwise remain intact and free from other human disturbances.

"We show that dense-wooded, large-seeded Amazonian tree species are replaced by light-wooded trees that produce smaller seeds, which continue to be dispersed in overhunted forests by more resilient smaller mammal and bird species."

The study uses data from 2,345 one-hectare forest plots that were surveyed throughout the Brazilian Amazon, containing some 129,720 large trees. Simulations showed that between 77 and 88 per cent of all plots lose above-ground forest biomass in overhunted forests.



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The authors conservatively estimate that an average of 5.8 per cent of the above-ground carbon stock of Amazonian forests could be lost if vulnerable large-bodied fruit-eating mammal species continue to be hunted out, even if the forest is protected against other threats.

Tapirs are a key seed disperser that are sensitive to hunting. When tapirs are lost in addition to large primates, such as woolly monkeys and spider monkeys, nearly nine out of every 10 plots will lose forest biomass.

Considering the variation in biomass changes across plots, the potential economic value of such forest carbon loss in the world's carbon markets

could range between US\$5.9 trillion and US\$13.7 trillion.

Prof Peres said: "Fortunately Amazonian parks, sustainable-use reserves and indigenous territories now cover more than half of the Amazon basin, but these forest reserves should effectively protect the forest megafauna, rather than just the forest cover.

"Our research suggests that if properly managed, these protected areas could still protect most large animals, which are critical seed dispersers that maintain the full spectrum of tropical forest dynamics.

"There has been little evidence to date that the environmental services provided by tropical forests are really conditional on fully functional forest ecosystems that can retain a full complement of wildlife species, but this study shows that biodiversity and natural ecosystem services are inextricably linked.

"Tropical forest degradation has been entirely defined by REDD+ programs in terms of highly detectable forms of human disturbance, such as timber extraction and wildfires. Yet even apparently intact but otherwise defaunated forests should be considered as degraded because the insidious carbon erosion processes we highlight in this paper are already well underway.

"Even protected areas do not necessarily ensure the protection of large vertebrates in most remaining [tropical forests](#). Either we stand up and effectively protect these wildlife populations, or overhunting will erode their populations until we see major losses in both forest biodiversity and forest ecosystem services."

Taal Levi, from Oregon State University (USA), and an author on the study, said: "In recent decades, Amazonian countries have made major strides in expanding parks and strengthening indigenous land rights. And

our study shows that properly managing wildlife can have big benefits for biodiversity and forest ecosystem services.

"The loss of [forest biomass](#) may not sound like a lot but in an area as vast as the Amazon, the impact could be huge - a projected 313 billion kilograms of carbon not being absorbed."

More information: Dispersal limitation induces long-term biomass collapse in overhunted Amazonian forests, *Proceedings of the National Academy of Sciences*, www.pnas.org/cgi/doi/10.1073/pnas.1516525113

Provided by University of East Anglia

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