# Study finds links between deforestation and fisheries yields in the Amazon

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A fisherman holds a tambaqui, a large species of freshwater fish that is highly prized. It feeds mainly on tree fruits found in floodplain forests. Photo by Leandro Castello. Credit: Leandro Castello, Virginia Tech

The conversion of tropical forests to crop and pastureland has long been a concern for scientists, as forest loss can lead to decreased rainfall, increased droughts, and degraded freshwater ecosystems. A new study points to another unexpected consequence: changes in fish production.

The study, led by Leandro Castello, assistant professor of fisheries in Virginia Tech's College of Natural Resources and Environment, explores how deforestation along the Amazon River floodplain affects fisheries yields. The study was published online Dec. 13 by the journal *Fish and Fisheries*.

"The conflict between raising cattle and managing fisheries is a concern that is shared with floodplain residents, but there had been no rigorous studies of how loss of forest affects the productivity of floodplain fisheries," explained co-author David McGrath, deputy director of the Earth Innovation Institute.

Roughly one-third of the global wild-caught fish yield comes from the tropics. Inland fisheries are vital to that food production. The quality of the area of land adjacent to a river, referred to as a floodplain, can play a large part in fisheries production.

"Floodplain forests can provide structures that protect fish and their offspring, and provide habitat for insects that many fish rely on for food. Those forests also produce plant material on which fish may also feed," said Castello, who is affiliated with the Global Change Center, housed in Virginia Tech's Fralin Life Science Institute.

Co-author Victoria Isaac, professor at the Federal University of Pará in Brazil, was responsible for collecting fisheries data. "The study has direct implications for the management and conservation of the Amazon," she said. "Unplanned land use and other human projects are drastically changing the landscape of the Amazon. Policies to protect the

environment and avoid deforestation should be stronger to guarantee food security of local populations and fishery yields."

To determine just how much of a link exists between fish populations and floodplain forests, the researchers compiled two sets of data. The first included fisheries yields over a 12-year period in the 1,000-square-kilometer study area. The researchers created a map of the region's 1,500 lakes and interviewed local fishermen about the types and quantities of fish caught in different areas. Using this data, the team determined which specific areas yielded the most fish.



Fishermen take a break on a deforested lakeshore, where forests have been replaced by grasses. Photo by Leandro Castello. Credit: Leandro Castello, Virginia Tech

"We collected roughly 36,000 separate data points that were plotted in order to make a map of where the fish were coming from," Castello said.

The researchers used images from NASA satellites to compile a second data set on habitat features in the same area to determine if the presence of floodplain forests made an impact on fish yields.

"Essentially, we wanted to know if fish yields in areas with forested floodplains are greater, the same, or less than areas where forests have been cut down," Castello explained.

"Our results indicated that lakes with floodplain forests provided fishers with greater fish yields," he continued. "This allows us to infer that if you cut down the forests, fish yields in those lakes would decrease. Tropical deforestation is not only a terrestrial issue—it can also decrease the number of fish available to some of the world's poorest populations."

Co-author Laura Hess, associate researcher with the Earth Research Institute at the University of California, Santa Barbara, added, "A fisheries and land-cover study at this scale had not been done before in the Amazon, so it was very satisfying when we found strong evidence for a relationship."

In the future, the researchers hope to expand their scope to include other variables that may affect fisheries yields, such as the depth and connectivity of the lakes studied. For now, however, Castello explains that the policy implications of the study are clear.

"You have to protect these habitats if you want to maintain the food production and the income that rivers provide," Castello said. "River floodplains produce more fish than any other freshwater system in the world. Right now, the Amazon is unique in that most of its floodplains are still intact, but if forests continue to be cut down and habitats are

changed, that will decrease the amount of fish people have to eat and make their living. If we don't protect these areas, we lose the rivers and we lose the fish."

McGrath added, "This paper gives us the tools we need to show the trade-offs between raising cattle and managing floodplain fisheries. We can use this work to show communities what they lose by not controlling cattle densities on floodplains and converting forest to pasture."

Provided by Virginia Tech

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