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Assessing the Amazon River's Sensitivity to Deforestation

Understanding how the Amazon River varies in time, what causes those variations, and how sensitive it will be to ongoing, and accelerating, deforestation is a focus of study for scientists at the Woods Hole Research Center. Population and development pressures in the last several decades have led to significant areas of deforestation in the Amazon, most in the eastern and southern portion of the basin. By using a combination of numerical models and data from several disciplines to assess the possible impacts of future human-induced land cover and land use change, researchers are investigating the causes of changes to stream hydrology and biogeochemistry.

The Amazon, one of the most important watersheds on the planet and the largest river in the world, includes a massive network of rivers, floodplains, streams and wetlands, all playing an important role in modulating the Earth's hydrologic and biogeochemical cycles. With nearly 20 percent of the Earth's freshwater discharge, the Amazon carries more water than the nine other largest rivers of the world combined. The first phase of the study, led by Marcos Costa at the University of Viçosa in Minas Gerais, Brazil and completed in 2002, put together an enormous collection of data describing the physical characteristics of the Amazon River Basin. The data included the first detailed representation of the stream network throughout the 6 and 1/2 million km2 basin, and by itself, took 5 people over nine months to create. Researchers all over the globe are now using this data.

The second phase, led by Michael Coe, an associate scientist with The Woods Hole Research Center, was to build the first comprehensive computer model of the Amazon River and floodplain. This model, built over the course of several years and just recently completed, simulates the inter-connected river and floodplain system for the entire 6.5 million km2 basin. According to Coe, "The problem has always been that there simply aren't enough observations over a long enough time period for us to understand the River system. So this model, by letting us simulate the entire river through time, has helped us learn much about how the river flow and flooded area react to year-to-year variations in climate."

Currently entering a third phase of study, a model of the Amazon River and floodplain will be combined with estimates of future deforestation to understand how humans may be affecting the Amazon. Coe says, "This research will provide us with a better understanding of how sensitive the Amazon river is to human activities and can provide government managers and civil society with a tool for analyzing the costs and benefits of different land-use policies and help plan future settlement, land use and conservation priorities."

"This third phase is particularly exciting because we are now combining what we have learned about the physical River with human activities on the land surface, such as deforestation and agriculture," says Coe. This novel linkage of social and physical sciences will provide a better understanding of the consequences for the River of a range of land use policy options in Amazonia, from current business-as-usual development trends to improved governance strategies leading into the mid-21st century. "It is that improved understanding of how human decisions about land use directly impact the River and its ecosystems, which can help people make more informed decisions for the future of Amazonia," he adds.

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