Extinction most likely for rare trees in the Amazon rainforest

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Common tree species in the Amazon will survive even grim scenarios of deforestation and road-building, but rare trees could suffer extinction rates of up to 50 percent, predict Smithsonian scientists and colleagues in the Aug. 12 issue of the journal Proceedings of the National Academy of Science.

How resilient will natural systems prove to be as they weather the next several decades of severe, human-induced global change? The debate is on between proponents of models that maximize and minimize extinction rates.

The Amazon basin contains about 40 percent of the world's remaining rainforest. One of the fundamental characteristics of tropical forests is the presence of very rare tree species. Competing models of relative species abundance, one based on Fisher's alpha statistic and the other based on Preston's lognormal curve, yield different proportions of rare trees in the forest.

Thirty years ago Stephen P. Hubbell, senior scientist at the Center for Tropical Forest Science of the Smithsonian Tropical Research Institute and distinguished professor in the Department of Ecology and Evolution at the University of California, Los Angeles, and his colleague Robin Foster, now at the Field Museum in Chicago, set up a unique experiment to monitor the growth, birth and death of more than 250,000 tropical trees on Panama's Barro Colorado Island. This large "forest dynamics plot" would generate the data needed to build good models that include rare species.

Today the Center for Tropical Forest Science coordinates a Global Earth Observatory—a network of 20 such forest study sites in 17 countries, which maintains "actuarial tables" for more than 3 million trees.

Hubbell works with data from the network to develop and test his neutral theory of biodiversity—an attempt to find a unified explanation of large, complex biological systems that accurately predicts the outcome of major ecological and evolutionary forces of change.

In this offering, the authors use the neutral theory to predict the number of tree species and to test predictions of the Millenium Ecosystems Assessment that forecasts major tree extinctions in the Amazon over the next several decades. First, they estimate that the Brazilian Amazon has (or had) 11,210 large tree species, and, of these, 5,308 species are classified as rare.

Based on optimistic and non-optimistic scenarios for road construction in the Amazon published by the Smithsonian's William Laurance and colleagues in the journal Science in 2004, they predict that the rare species will suffer between 37 and 50 percent extinction, whereas the extinction rate for all trees could be from 20 to 33 percent overall.

Would a simpler Amazon forest lacking many of its rarer trees function? Will the extinction of species other than trees—pollinators, seed predators, carnivores—contribute significantly to the lost of rainforest resilience? This and other biological quandaries remain. The authors exhort: "Although it is an old scientific chestnut, we must once again emphasize how important it is to support continuing basic science on tropical forests."

Ref: Stephen P. Hubbell, Fangliang He, Richard Condit, Luis Borda-de-Agua, and Hans ter Steege. 2008. How many tree species are there in the Amazon and how many of them will go extinct? Proceedings of the National Academy of Science, August 12 early online edition.

Source: Smithsonian Tropical Research Institute