Unlocking the secrets of the Amazon

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The world's largest and most species rich forests are changing faster than we thought. We know the Amazonian rainforests are disappearing – around a fifth has been lost to logging and cattle ranging – but University geographers have discovered that the forests are changing at a remarkable rate. Their findings suggest we still don't understand exactly how long the rainforests can continue to be the planet's 'lung' or even how they really work.

Geographers and earth scientists have just returned from a two-month field trip deep in the rainforests of Amazonian Peru with colleagues from Peru, Germany, Spain, Taiwan and Colombia. "We're very interested in the role of tropical forests in the global carbon cycle," said Natural Environment Research Council fellow Dr Tim Baker. "These forests store large amounts of carbon. It's vital to understand exactly how much carbon they're holding and how this may change over time."

An important aim of the RAINFOR project is to show how Amazonian forests are not all the same. The team has been measuring the diameter of the same trees in over 100 plots every four to five years since the early 1980s. This enables them to calculate how much carbon is stored in the tree, and the forest as a whole, and how this has changed since the project began.

"There's a lot of variation in how much carbon is stored in these forests in different sites," said Dr Baker. "Trees in Peru have lower density wood than those in Brazil, so the forest stores less carbon. We believe this is related to the soil quality rather than the climate – on the generally

richer soils in Peru, faster growing species with lower density wood have a ‘competitive’ advantage.”

They have also discovered that trees are dying at an increased rate. However, although they’re dying quicker, their growth rates have also increased, with the overall effect that the amount of carbon stored in the Amazon forests has also gone up slightly. An increased biomass (a bigger tree) means more carbon has been taken out of the atmosphere, so these trees have been helping to slow climate change.

The researchers believe that, ironically, the faster growth and increased biomass is because the extra CO2 in the atmosphere is ‘fertilising’ the forests – the rainforests are responding to man-made climate change.

“Overall, this would seem to be very good news,” said tropical ecology reader Dr Oliver Phillips. “But we don’t know what’s going to happen in the long-term. Obviously if trees continue to die at younger ages then we can expect biomass to start to fall. It may also have a negative effect on the biodiversity of the forests.

“For example, there’s a real worry that faster growth rates will favour more ‘weedy’ tree species which have less dense wood and therefore store less carbon. We are already seeing some changes: for example fast-growing lianas, woody vines of the kind favoured by Tarzan, are becoming more dominant.”

The team is using a database of 2,500 kinds of tree to see whether species and particular characteristics of the forest are changing on a widespread basis. Species such as balsa are lower density, so contain less carbon. Heavy wood, like that of the brazil nut or mahogany trees, is much better in terms of acting as a carbon store so a decrease in the number of these types of trees could have environmentally disastrous implications.

Changes in biodiversity – the patterns over the last 25 years, what is likely to happen, and the effect this will have on climate change – are the focus of the team's new NERC-funded initiative, as part of the wider RAINFOR project, which began in October 2004. However, understanding the basic principles of how the rainforest works remains crucial to this. "We've just discovered a new forest type that turns conventional wisdom about the plant species composition of Amazon forests on its head," explains Dr Baker.

"Previous work has found a strong east/west divide in the kinds of trees found in Amazonia. But on unusual soils in the far western limit of Amazonia, we have discovered vegetation that is essentially eastern Amazonian in composition." New plots in Peru have species more similar to those found in Brazil than in neighbouring forests.

The big question for the team now is: what controls the forests – current ecological processes or historical patterns of evolution? "Understanding these patterns will inform the kinds of changes we can expect from global environmental change," said Dr Baker.

Leeds is top of a list of successful bidders for 'blue skies awards' from NERC to support high quality research, one of which is funding this project. The RAINFOR team's findings show the importance of unlocking the secrets of the Amazon.

"These forests are absorbing more than twice the amount of carbon dioxide emissions produced by the UK every year," said Dr Baker. "Understanding their future is of global importance."

Source: University of Leeds