University of Leeds press release

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Forests absorb one-third of global fossil fuel emissions

The world's established forests remove 8.8 billion tonnes of carbon dioxide per year from the atmosphere – equivalent to nearly a third of annual fossil fuel emissions – according to new research published online today in the journal *Science*.

In addition, regrowth of trees on previously deforested lands in the tropics mopped up a further 6 billion tonnes of CO_2 annually between 1990 and 2007[1]. However, deforestation across the tropics released a huge 10.8 billion tonnes of CO_2 annually during this period, off-setting much of the uptake of CO_2 by the world's forests. For comparison, global fossil fuel emissions average 28 billion tonnes of CO_2 annually.

The findings suggest that the world's tropical, temperate and boreal[2] forests play a much larger role in the global cycling of carbon than previously thought, and that protecting them is vital in limiting the severity of future climate change.

Dr Simon Lewis, a tropical ecologist from the University of Leeds and co-author of the study, said: "Humans are altering the world's forests in a number of ways, from their outright destruction to the much more subtle impacts on even the most remote forests caused by global changes to the environment.

"Our research shows these changes are having globally important impacts, which highlights the critical role forests play in the global cycling of carbon and therefore the speed and severity of future climate change.

"The practical importance of this new information is that if schemes to reduce deforestation are successful they would have significant positive global impacts, as would similar efforts promoting forest restoration."

The international team of researchers, led by Dr Yude Pan from the United States Forest Service, used on-the-ground measurements of trees worldwide and statistical models to provide an updated picture of atmospheric carbon uptake and loss by boreal, temperate and tropical forests spanning a total of 3.9 billion hectares.

Dr Pan said, “By breaking the large-scale carbon dynamics of forests into their many components, we were able to separately analyse the large magnitudes of carbon fluxes, both sinks and sources, and gain an idea of the potential capacity for carbon sequestration by the world’s forests.”

After adding together all the sources and sinks, the researchers found that there was a net climate benefit of 4 billion tonnes of carbon dioxide each year absorbed by forests, as uptake out-stripped releases.

The study also provided two further new insights.

In the tropics, separating the carbon losses from deforestation and carbon uptake from regrowing forests shows that the figure usually reported for carbon emissions associated with tropical ‘land-use change’ hides these two much larger fluxes. “By separating them out, we see that carbon emissions from tropical deforestation are much larger than we thought, while uptake from forest re-growth in the tropics is also probably very large,” said Dr Lewis.

The second insight is that the newly reported total carbon uptake by boreal, temperate and remaining tropical forests together is equal to the total global land carbon sink[3]. “The large uptake of CO_2 by forests implies that the world’s agricultural lands, grasslands, desert and tundra each play a more limited role as globally significant carbon dioxide sources or sinks at present. This new information can help pinpoint where actions to conserve carbon sinks are likely to have most impact,” explains Dr Lewis.

However, Dr Lewis urged caution in the interpretation of the results: “We can't rely on forest management alone to halt the increase of CO_2 in the atmosphere and solve the problem of climate change. There is simply not enough land on Earth to store all the carbon released from ongoing fossil fuel emissions in trees.

“Forest management can help, but reducing fossil fuel emissions is essential. And, of course, forests won’t keep removing CO_2 from the atmosphere forever. The world’s remaining forests are providing a time-limited benefit to humanity.”

Study co-author Oliver Phillips, Professor of Tropical Ecology at the University of Leeds, emphasised the need for more research. He said: “We know the tropics are the most dynamic area of the world when considering the exchange of carbon between the land and atmosphere.

“Trees grow fast in the tropics, and widespread deforestation is the norm, yet our collective research effort is smaller in the tropics than elsewhere. What we need is serious investment in monitoring the world’s tropical forests to better understand their role in our rapidly changing global environment.”

Professor Phillips co-ordinates the RAINFOR network of long-term tropical forest monitoring sites across South America (www.rainfor.org). Dr Lewis co-ordinates a similar network across Africa (www.afritron.org). Both were used to estimate the carbon sink in remaining tropical forests reported in the study.

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For more information

The paper, ‘**A Large and Persistent Carbon Sink in the World’s Forests, 1990-2007’**, by: Pan Yude, Richard Birdsey, Jingyun Fang, Richard Houghton, Pekka Kauppi, Werner A. Kurz, Oliver L. Phillips, Anatoly Shvidenko, Simon L. Lewis, Josep G. Canadell, Philippe Ciais, Robert B. Jackson, Stephen Pacala, A David McGuire, Shilong Piao, Aapo Rautiainen, Stephen Sitch and, Daniel Hayes, is published in Science Express on 14 July 2011.

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1. **To convert the units** from carbon dioxide to carbon (as reported in the study, because it is a common unit, as trees store carbon, not carbon dioxide) divide by 3.67.

2. **Types of forest:** boreal forests are coniferous forests found in cold regions, mostly Canada and Russia; temperate forests have a more moderate climate and are found mostly in the USA, Europe, and China; and tropical forests are found mostly in the Amazon and Congo Basins.

3. **Calculation of total land carbon sink**: The total amount of carbon absorbed by the land surface is often calculated from the global emissions of carbon dioxide due to human activity, minus both the carbon staying in the atmosphere and the carbon taken up by the oceans. What is left is absorbed by the land. This equals 8.8 billion tonnes per year, which is identical to the sum of the carbon uptake by boreal, temperate and remaining tropical forests reported in the new study.

*The 2008 Research Assessment Exercise showed the **University of Leeds** to be the UK's eighth biggest research powerhouse. The University is one of the largest higher education institutions in the UK and a member of the Russell Group of research-intensive universities. The University's vision is to secure a place among the world's top 50 by 2015. www.leeds.ac.uk