

Impact case study (REF3b)

Institution: University of Leeds
Unit of Assessment: C-17
Title of case study: Case 4 - Influencing international climate mitigation strategies by understanding the role of tropical forests.
<p>1. Summary of the impact (indicative maximum 100 words)</p> <p>Research led by the School of Geography at the University of Leeds has enabled, for the first time, the use of on-the-ground observations to evaluate directly the role of tropical forests in the global carbon cycle and to assess their sensitivity to change. Findings from the research have had a significant impact on international debates on the future trajectory of climate change and appropriate policy responses, and are influencing national-scale efforts across the tropics to manage forests in the face of climate change and to reduce carbon emissions resulting from deforestation [D, E, G, H, J]. The success of this Leeds-led initiative has been achieved through the extensive network of scientists involved in this global forest observatory: more than 250 scientists from over 50 institutions across more than 30 countries are now involved.</p>
<p>2. Underpinning research</p> <p>Tropical forests store 300 billion tonnes of carbon, annually process 30 billion tonnes and occupy an area of more than 10 million km². Small differences in the carbon balance of the forests can therefore have big impacts on the global carbon cycle and climate. Before 1998 it was generally accepted that undisturbed forests were static stores of carbon: that the rate of decay was equivalent to the rate of growth. Since 1998, Oliver Phillips, Professor in the School of Geography, has led an international team to make on-the-ground observations and measurements (e.g. tree size, diversity) of permanent forest plots and showed for the first time that undisturbed forests in Amazonia were continuing to take in, or sequester, carbon [4]. A key part of the work was to develop, for the first time, a standardised package of techniques (biomass, production, biodiversity, soil, biogeochemistry, and a database server to the world's foresters: www.forestplots.net), and to train an extensive network of scientists in many countries to use these techniques, thereby establishing a unique, robust and scientifically credible global observatory of permanent plots of intact tropical forests.</p> <p>The network established for Amazonia, the Amazon Forest Inventory Network (RAINFOR), allowed Phillips and collaborators to make the first field-based estimate of the tropical carbon sink [4, 5] and the first demonstration of increasing growth in tropical forests likely to be caused by an increase in atmospheric CO₂ [2]. In Africa, an equivalent organisation (AfriTRON) led by Lewis that unites European and African scientists similarly demonstrated the existence of a significant carbon sink in intact African tropical forests [3]. The research networks (RAINFOR, AfriTRON, AMAZONICA) coordinated by Leeds School of Geography now involve over 50 institutions, and more than 300 participants from more than 30 nations. The combined, multi-continental monitoring led by Leeds shows that tropical forests remove 4.8 billion tonnes of CO₂ emissions from the atmosphere every year.</p> <p>The 2005 Amazon drought allowed the Leeds-led team to measure the first on-the-ground determination of drought sensitivity of forests and trees in Amazonia [5] and showed that the drought increased CO₂ emissions by 5 billion tonnes from tree mortality. These results have allowed the first estimation of the risk that climate change poses for projects that aim to receive payments for conserving the carbon stocks of these ecosystems [1].</p> <p><u>Key researchers:</u> Oliver Phillips (NERC Research Fellow 1996–9; Lecturer 1999–2003; Reader 2003–6; Professor since 2006); Simon Lewis (Royal Society Research Fellow since 2000); Tim Baker (NERC Research Fellow, RCUK Research Fellow, 2005–2010, Lecturer 2010–12, Associate Professor 2013–); Gabriela Lopez-Gonzalez (Database Analyst since 2005); Emanuel Gloor (Leeds since 2007; Professor since 2008); Roel Brienen (RAINFOR Research Fellow 2008-11, NERC Fellow 2011-Present); Ted Feldpausch (Research fellow, left Leeds in 2013 for Exeter); Nikos Fyllas (Marie Curie Intra-European Fellow 2009-11, left Leeds in 2012 for University of Athens).</p>

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3. References to the research (indicative maximum of five references)

The research – supported by major grant funding – has produced a range of outputs in leading, rigorously peer reviewed international journals. Outputs 1, 3 and 5 are included in REF2.

Grants awarded:

The work by **Phillips** and colleagues has attracted major grants (>£7M), including invited grant awards by charitable foundations, such as the Gordon and Betty Moore Foundation, “RAINFOR: a proposal to understand the carbon balance of Amazon forests”, PI **Phillips** (\$4.4M to Leeds, 2008–12).

NERC funding includes Integrated Carbon Analysis of Amazonia , AMAZONICA , PI **Gloor** (£1,268,880, 2008–2014); NE/I028122/1, co-PI **Baker** (£258,552, 2012–2015) ; NE/D000300/1, PI **Lewis** (£51,754, 2005–2009); NE/G00840X/1, PI **Baker** (£70,557, 2009).

EU: ERC Advanced Grant to **Phillips** (T-FORCES, €1,824,905, 2012 – 2017), AMAZALERT, PIs **Baker/Gloor** (FP7, €227,999, 2011-2014) GEOCARBON projects (FP7, €565,244, 2011–2014). Royal Society Fellowships, **Lewis** (£250,830, 2004–2009 and £280,863, 2009-2013).

Selected key publications from this research include the following:

1. **Baker TR** and 7 others (2010). How can ecologists help realise the potential of payments for carbon in tropical forest countries? *Journal of Applied Ecology* **47**: 1159–1165. doi: 10.1111/j.1365-2664.2010.01885.x
2. **Lewis SL, Phillips OL, Baker TR**, and 14 others (2004). Concerted changes in tropical forest structure and dynamics: evidence from 50 South American long-term plots. *Philosophical Transactions of the Royal Society, Series B* **359**: 421–436. doi: 10.1098/rstb.2003.1431
3. **Lewis SL** with Phillips OL, Gloor, E, Baker, TR, Lopez-Gonzalez, G and 27 others (2009) Increasing carbon storage in intact African tropical forests, *Nature* **457**: 1003–1006. doi: 10.1038/nature07771
4. **Phillips OL** and 10 others (1998). Changes in the carbon balance of tropical forest: evidence from long-term plots. *Science* **282**: 439–442. doi: 10.1126/science.282.5388.439
5. **Phillips OL** with Lewis SL, Baker TR, Gloor E, Lopez-Gonzalez G and 60 others (2009). Drought sensitivity of the Amazon rainforest. *Science* **323**: 1344–1347. doi: 10.1126/science.1164033

4. Details of the impact (indicative maximum 750 words)Impacts on international climate change policy

The Leeds-led research has played a significant role in shaping key contributions of the global scientific community that inform and impact international climate change policy. Our research was cited in the ‘Copenhagen Diagnosis’ climate science report that synthesised the most policy-relevant science prior to the United Nations Framework Convention on Climate Change (UNFCCC) in 2009 **[A]**, and embedded in the InterAcademies Panel statement on tropical forests and climate change that was given to all delegates at UNFCCC in 2009 **[B]**.

Impacts on mapping carbon stocks and forest science in tropical countries

In Gabon, Peru, and Colombia, training provided by projects led by Leeds has allowed in-country organisations to participate in mapping tropical forest carbon stocks **[C, D, E]**. For example, the World Wildlife Fund (WWF) Peru attests: ‘Collaboration with the School of Geography, University of Leeds has been fundamental for completing the forest biomass analysis of Madre de Dios and San Martin. The high quality of the science and methods, and the extensive experience in tropical forest ecology provided by Leeds staff has significantly contributed to building local support for developing regional maps of forest carbon stocks’ **[D]**. In all three countries, our teams have ground-truthed carbon stock maps based on remote sensing.

NASA has used the Leeds-developed standardised carbon stock data to produce the first consistent, baseline carbon map of the world’s tropical forests **[F]**.

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Following Leeds-led research analysing forest inventory data from the region of Madre de Dios in southern Peru funded by WWF-Peru, the Madre de Dios regional government awarded a contract to WWF-Peru to produce a map of the carbon stocks of the region to support the development of REDD+ (see below for an explanation of the REDD scheme) in the region [D].

The sophisticated data management utility developed by RAINFOR (www.forestplots.net) allows analysis of forest dynamics worldwide, and is in demand as the tool of choice for NGOs and forest managers (439 registered users, 7717 unique visitors; up to October 2013).

Impacts on research, training and policy strategies of non-HE organisations and agencies

Training courses run by Leeds during research projects have been repeated at universities in Peru and Colombia and have been used to design a vocational diploma programme by WWF-Peru to train forest managers [D, E].

In Colombia, the Botanic Garden in Medellin has used Leeds training materials to develop a REDD+ project, in collaboration with government organisations and NGOs [E].

In Peru, IIAP (Institute for Peruvian Amazon Research) is using the carbon assessment approach that Leeds has developed across the Loreto region in the northern Peruvian Amazon [G], and SERNANP (National Service for Protected Areas) is adopting RAINFOR monitoring strategies in protected areas in Amazonia [H].

In Brazil, NGOs have used criteria and indicators for evaluating the environmental and social benefits of REDD projects that were developed as part of Leeds-led research in the Peruvian Amazon, to develop principles for implementing these types of project in Brazil [I].

In Gabon, ANPN (Gabon's National Park Service) and the US Forest Service organised a workshop and group to make recommendations to plan Gabon's national carbon monitoring programme. Our carbon assessment approach was selected to be used, including training Gabon's national carbon inventory field teams, overseen by Lewis [C]. Research by Lewis and colleagues has been a direct input into the National Climate Plan of Gabon [J].

Impacts on governmental strategies for obtaining REDD+ financing

The UN REDD programme, and REDD+ in developing countries, will provide a mechanism to support activities that maximise the carbon storage of forests and minimise deforestation and forest degradation through the provision of finance to pay countries the opportunity costs associated with not deforesting; alternatively, these can be seen as payments for the carbon storage service that these ecosystems provide. Following publication of Lewis et al. (2009), the Gabon Government won a \$500K grant from the Moore and Packard foundations to map carbon across the Congo Basin. This resulted in a grant to Leeds School of Geography from the government of Gabon (US\$73,342) [C] to work with NASA to produce the first wall-to-wall carbon map of an African country in time for the UN climate change summit in Copenhagen in December 2009. The project enabled the Gabon Government and the Central African negotiating block in the UN to demonstrate that they had the technical capability to monitor the carbon in their forests, removing a key obstacle in the UN negotiations.

Lewis presented at Copenhagen, on behalf of the government of Gabon, the wall-to-wall carbon map of the country [C]. As part of this scientific case Lewis attended the Copenhagen talks as an advisory member of the Gabon Government delegation. Lewis also played a similar role as part of the Gabonese delegation at the UN Climate Summits in Cancun, Mexico in December 2010, in Durban in November 2011, and represented Gabon at the UNESCO summit in Paris in September 2011. Similarly, in February 2010, Lewis acted as a technical advisor to the Gabon Government at the Central African Forest Commission (COMIFAC) to discuss how carbon storage and carbon fluxes in the Congo Basin should be monitored.

5. Sources to corroborate the impact (indicative maximum of 10 references)

- A. The Copenhagen Diagnosis cites reference [5] above on p.19.
<http://www.copenhagendiagnosis.com/> [Available on request].
- B. The InterAcademies Report, paragraph 2 - based on reference [3] above and written by Lewis.
<http://www.interacademies.net/File.aspx?id=10070> [Available on request].
- C. Grant Award Letter Agreement for the University of Leeds from Gabon Government for US\$73,342, awarded to S.L. Lewis; dated 23 June 2009. [Available on request].
- D. Letter from Conservation Director of WWF-Peru letter to corroborate research methods impact on a Peruvian non-governmental organization; dated 2 July 2013. [Available on request]
- E. Letter from the director of the Medellin Botanical Garden (Colombia), dated 25 June 2013 [Available on request]
- F. Letter from a senior researcher at NASA to corroborate research methods impact on national and pan-tropical carbon mapping; dated 13 August 2013. [Available on request].
- G. Letter from Head of Forest Management and Environmental Services Payment Programme at IIAP, The Institute for Research into the Peruvian Amazon; dated 5 July 2013. [Available on request].
- H. Letter from head of SERNANP, the state body responsible for protected areas in Peru; dated 5 March 2013. [Available on request]
- I. Leeds-led research is cited in a document produced by a consortium of NGOs in Brazil to establish carbon-conservation guidelines:
http://www.imaflora.org/downloads/biblioteca/PC_redd_imaflora_julho2010.pdf. Document in Portuguese. Leeds is referenced on page 4. [Available on request]
- J. Le Plan Climate National [The National Climate Plan] of Gabon cites Leeds-led research on pp. 39, 40, 42. Document in French. [Available on request]