Institution: The University of Leeds

Unit of Assessment: UOA14

Title of case study: Formal protection for South American and African peatlands secures carbon stocks and supports livelihoods

Period when the underpinning research was undertaken: 2010-2020

Details of staff conducting the underpinning research from the submitting unit:

Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Tim Baker	Prof. of Tropical Ecology and Conservation	2005-present
Simon Lewis	Prof. of Global Change Science	2005-present
Katy Roucoux	Lecturer in Physical Geography	2005-2014
Ian Lawson	Lecturer in Physical Geography	2003-2014
Freddie Draper	NERC PhD student, Marie Curie Global Fellow	2011-15 2018-present
Greta Dargie	NERC Open CASE PhD student NERC PDRA	2011-15 2018-present

Period when the claimed impact occurred: 2014-2020

Is this case study continued from a case study submitted in 2014? Y/**N**

1. Summary of the impact (indicative maximum 100 words)

Protecting terrestrial carbon stocks is crucial for reducing the rate of climate change. As one of the most carbon-dense ecosystems, tropical peatlands are a priority for conservation. Our work led to the discovery and mapping of previously unknown intact peatlands in both Amazonia and Africa. These findings subsequently catalysed the creation of the >35,600 km^2 Yaguas National Park in northern Peru, underpinned the Brazzaville Declaration signed by the Republic of Congo and Democratic Republic of Congo governments to protect the 145,500 km^2 of peatlands in the Congo basin, and led to USD 72,800,000 investment in sustainable management across the three countries.

2. Underpinning research (indicative maximum 500 words)

Reducing the rate of climate change requires the maintenance of terrestrial ecosystem carbon stocks. Tropical peatlands are a priority for protection as they contain some of the highest densities of carbon of any ecosystem. Understanding where tropical peatlands are found, and measuring how much carbon they contain, is therefore essential for designing effective policy to mitigate climate change. To address this need, since 2011 we led research to map and quantify the carbon stocks of tropical peatlands in Amazonia and Africa.

Pioneering work to map the extent and distribution of below ground peat was undertaken across the wetlands of the Pastaza Marañon basin, northern Peru. In 2014, we used new and existing

field data in combination with novel optical and radar-based remote sensing products to map and quantify carbon stored in this region **[1]**. This work demonstrated that the peatlands cover 35,600 km^2 - approximately twice the area of peat in Scotland - and form the largest peatland complex in Amazonia. It stores 3.14 (0.44–8.15) billion tonnes of carbon, equivalent to >60 years of fossil fuel emissions of Peru.

In 2017, we used a similar combination of new field data and novel remote sensing techniques to produce a map of the central Congo peatlands for the first time **[2]**. We showed that this region harbours the most extensive peatland ecosystems anywhere in the tropics, covering 145,500 km^2 – equivalent to the size of England – and contains 30.6 (6.3-46.8) billion tonnes of carbon. This discovery is equivalent to 20 years of current fossil fuel emissions from the USA and increased the known size of the pan-tropical peatland carbon pool by one-third.

Our research has also shown these peatlands have unique biodiversity. In the Peruvian Amazon, we discovered that peatlands harbour a combination of species which enhances the landscape-level (beta) diversity of the region, including rare tree species that were previously thought to be restricted to well-drained, white sand soils **[3]**.

Finally, our work has identified both the threats to these largely intact peatland ecosystems, and pathways to ensure they are conserved and managed sustainably **[4, 5]**. For peatlands of the Amazon and Congo basins, major threats lie in the development of transport infrastructure, hydroelectric power reservoirs and agricultural expansion **[4, 5]**. However, investments to protect the carbon stocks, and developing markets for products from these peatland landscapes, are routes to support and expand community-led conservation **[4, 6]**. For example, in Peru the palm *Mauritia flexuosa* or 'aguaje' naturally forms almost monodominant stands. The fruits are high in vitamin-A and have a range of uses as food, ice cream flavouring and oil for soaps/shampoo. Developing markets and supporting sustainable management, where trees are climbed rather than cut to harvest fruits, represents a pathway to protect carbon stocks and biodiversity whilst also supporting livelihoods **[4, 6]**. Overall, our research demonstrates that these newly mapped peatlands are national and international conservation priorities, and that sustainable management of these ecosystems should be a key component of climate change mitigation strategies.

Grants leading to research outputs **[1,2,3,5,6]** were awarded to and led by staff at the University of Leeds (Baker, Lewis, Roucoux and Lawson) in collaboration with the University of St Andrews (Roucoux and Lawson moved to St Andrews in mid-2014), the University of Edinburgh and UCL. Output **[4]** was led by Roucoux and Lawson at St Andrews in collaboration with Baker at Leeds.

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

[1] Draper, F.C., Roucoux, K.H., Lawson, I.T., Mitchard, E.T., Coronado, E.N.H., Lähteenoja, O., Montenegro, L.T., Sandoval, E.V., Zaráte, R. and **Baker, T.R**. 2014. The distribution and amount of carbon in the largest peatland complex in Amazonia. *Environmental Research Letters* **9**: 124017

[2] Dargie, G.C, Lewis, S.L., Lawson, I.T., Mitchard, E.T.A., Page, S.E., Bocko, Y.E., Ifo, A.S. 2017. Age, extent and carbon storage of the central Congo Basin peatland complex. *Nature* **542**: 86-90

[3] Draper, F.C., Honorio Coronado, E.N., **Roucoux, K.H., Lawson, I.T.,** Pitman, N.C.A., Fine, P.V.A., Phillips, O.L, Torres, L., Monteagudo, A., Valderrama Sandoval, E., Mesones, I., García-Villacorta, R., Ramirez Arévalo F.R., **Baker, T.R.** 2018. Peatland forests are the least diverse tree communities documented in Amazonia, but contribute to high regional beta-diversity. *Ecography* **41**: 1256-1269.

[4] Roucoux, K.H., Lawson, I.T., Baker, T.R., Del Castillo Torres, D., **Draper, F.C.**, Lähteenoja, O., Gilmore, M.P., Honorio Coronado, E.N., Kelly, T.J., Mitchard, E.T.A. & Vriesendorp, C.F. 2017. Threats to intact tropical peatlands and opportunities for their conservation. *Conservation Biology* **31**: 1283-1292.

[5] Dargie, G.C., Lawson, I.T., Rayden, T.J., Miles, L., Mitchard, E.T.A., Page, S.E., Averti, I.S., Bocko, Y., **Lewis, S.L.** 2019. Congo Basin peatlands: threats and conservation priorities. *Mitigation and Adaptation Strategies for Global Change* **24**, 669–686.

[6] Baker, T.R., Vicuña Miñano, E., Banda-R, K., del Castillo Torres, D., Farfan-Rios, W., **Lawson, I.T.,** Loja Alemán, E., Pallqui Camacho, N., Silman, M.R., **Roucoux, K.H**., Phillips, O.L., Honorio Coronado, E., Monteagudo Mendoza A., Rojas González, R. 2020. From plots to policy: How to ensure long-term forest plot data supports environmental management in intact tropical forest landscapes. *Plants, People, Planet*. doi.org/10.1002/ppp3.10154

4. Details of the impact (indicative maximum 750 words)

Impacts on conservation investment and policy development have occurred as a result of our research on tropical peatland ecosystems. These occurred following focused dissemination of our findings and long-term follow-up with national and international stakeholders and policymakers. We presented our map of Peruvian Amazon peatland carbon stocks at the UN Framework Convention on Climate Change (UNFCCC) Twentieth Conference of the Parties (COP20) in Lima, Peru, in December 2014, and our map of the Congo peatlands at a technical meeting of the UNFCCC in Bonn, Germany in May 2017 and at COP25 in Madrid, Spain in December 2019. Our research was also disseminated widely via international media (e.g. BBC; New York Times; Altmetric of **[1]** and **[2]** combined, 815). As a result, the research in both Peru and the Congo basin was used extensively by the United Nations Environment Programme (UNEP) 2017 report '*Smoke on Water: Countering Global Threats from Peatland Loss and Degradation*', to raise the profile of tropical peatland conservation in French and English **[A]**. We were commissioned to co-write a UNEP policy briefing on the importance of protecting the Congo basin peatlands also in French and English **[B]**. This report was delivered to heads of state and the Environment Ministers of the Republic of Congo (RoC) and Democratic Republic of Congo (DRC), where the central Congo peatlands are located, by the then head of UNEP.

Subsequently, the following impacts occurred:

1. Our estimates of peatland carbon stocks in the Peruvian Amazon were used to underpin the successful USD6,000,000 proposal by the Peruvian Trust Fund for National Parks and Protected Areas (PROFONANPE) to the UN-backed global Green Climate Fund (GCF) **[C]**. Our research was crucial for quantifying the impact of the project on carbon storage, and therefore for obtaining approval by the GCF as noted by the Executive Director of GCF-funded PROFONANPE:

'Our proposal…used the findings of Draper et al (2014) as the technical evidence to…argue for the relevance of the conservation of these wetlands…and for improving the capacities of indigenous communities…in the context of climate change mitigation' **[D]**

The PROFONANPE project, which started in 2017, was the first initiative to be funded by the GCF, which is the major international mechanism to fund adaptation and mitigation activities in response to climate change. The project is working with indigenous communities to establish bio-businesses marketing palm fruits that are harvested sustainably by climbing the trees. This project has improved the management and conservation of 343,000 hectares of peatlands and forest in 120 communities in the Peruvian Amazon.

2. Our peatland research in Peru catalysed the creation of the >800,000 ha (>35,600 km^2) Yaguas National Park by the Peruvian Protected Areas Authority (SERNANP) **[E]**. The recognition that the peatlands of this area were important because of their carbon stocks was an essential component of the justification for this protected area, in addition to its unique and high levels of biodiversity **[F]**. The creation of this major new National Park, which is equivalent in size to Yellowstone National Park, USA, subsequently attracted a donation of USD1,000,000 from the Andes Amazon fund. SERNANP also used our research to develop monitoring protocols and indicators of the health of populations of

the abundant and valuable *Mauritia flexuosa* palms in peatlands **[G]**. These protocols help to ensure that palm fruit harvesting in protected areas is sustainable.

3. Our discovery of the world's largest tropical peatland complex in the central Congo basin, its globally significant carbon stock, and our UN briefings **[A,B]** led to the Brazzaville Declaration, an international transboundary agreement signed by the governments of RoC and DRC in May 2018. This agreement is to increase cooperation and collaboration to protect the peatlands from future drainage **[H]**. The signing of the Brazzaville Declaration, described by the UN as 'historic' **[H]**, provides greater protection of the central Congo peatlands from unregulated agriculture, oil and gas mining, and logging concessions **[I]**.

Our carbon stock estimates and mapping of the Congo peatlands led to investments by two international funding bodies in protecting the peatlands and improving local livelihoods **[I]**. First, the German government's International Klimate Initiative (IKI) programme has invested EUR15,000,000 (c. USD18,000,000) in a peatland monitoring system to facilitate further protection of the Congo peatlands. Second, the Global Environment Facility invested USD41,770,855 into sustainable landscapes in central Africa centred on the peatlands, including USD6,083,151 dedicated to improving governance and sustainable livelihoods in the Republic of Congo **[I]**. Both investments have been made only because we discovered and mapped the central Congo peatlands.

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

[A] *Smoke on Water – Countering Global Threats from Peatland Loss and Degradation. A UNEP Rapid Response Assessment 2017*. A report co-authored by the coordinator of the Global Peatlands Initiative, United Nations Environment Programme: http://www.grida.no/publications/355

[B] UNEP-WCMC (2017). *Carbon, Biodiversity and Land-use in the Central Congo Peatlands*. Authors: Miles, L, Ravilious, C., García-Rangel, S., de Lamo, X., Dargie, G & Lewis, S.

[C] Proposal to the Green Climate Fund by the Peruvian Trust Fund for National Parks and Protected Areas, with prominent citations to [1]

[D] Executive Director of GCF-funded PROFONANPE project in Datum de Marañón, Lima, Peru, confirming the use of our research to inform a successful funding proposal by the Peruvian Trust Fund for National Parks and Protected Areas.

[E] Director of Strategic Development, SERNANP, Lima, Peru, corroborating that our research informed the protected area designation.

[F] Technical justification for the creation of the Yaguas National Park ('Parque Nacional Yaguas: Expediente Tecnico') with prominent citations to [1]

[G] Formal government approval for monitoring plan for *Mauritia flexuosa*, within protected areas of Peru, and approved protocol with citations to [1], [3] and [4]

[H] Brazzaville Declaration: https://www.unenvironment.org/resources/resolutions-treaties-and-decisions/brazzaville-declaration; UN statement: https://www.unenvironment.org/news-and-stories/press-release/historic-agreement-signed-protect-worlds-largest-tropical-peatland

[I] Letter from Her Excellency, Minister of Environment and Tourism, Republic of Congo, explaining how the research was used as the basis for the Brazzaville Declaration, and underpinning directed investments from international funding bodies to protect the peatlands.