Institution: University of Cambridge

Unit of Assessment: UoA5

Title of case study: Integrating biodiversity considerations into REDD+ (Reducing Emissions from Deforestation and Degradation)

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

The UN Reducing Emissions from Deforestation and Forest Degradation (REDD+) programme offers developing countries incentives to reduce carbon emissions from forested lands. Work on carbon storage and sequestration led by researchers in the Department of Zoology has had demonstrable impacts on international development, via the REDD+ programme and two associated UN Conventions; Climate Change (UNFCCC) and Biodiversity (UN CBD), and on national level policy development in Tanzania and Brazil. It has improved the quality of data collection and monitoring necessary for successful implementation of REDD+, and has led to international investment. The work has also had direct impacts in a number of developing countries, through capacity building, employment generation, and enabling local communities to better adapt to climate change.

2. Underpinning research (indicative maximum 500 words)

In recent years, a growing recognition of the value of the economic benefits and services provided by ecosystems has strengthened the case for long-term investment. For the past decade, members of the Conservation Science Group (CSG), Department of Zoology, have made significant contributions to the provision of spatially-explicit information on where such services (including carbon sequestration, hydrological services and biodiversity conservation) are generated, and how the benefits they deliver can be maximised[1]. Given that tropical forest loss is responsible for an estimated 15% of all human-caused greenhouse gas emissions, the research has been of particular relevance to the UN Reduction of Emissions from Deforestation and forest Degradation (REDD) programme (see section 4).

The work has been led by Professor Andrew Balmford (Professor since 2007) and Dr Toby Gardner (PDRA, 2009-present), with significant contributions from Dr Neil Burgess (2006-2012, Leverhulme Trust and WWF-US PDRA), Dr Ana Rodrigues (2005-2008, EU Marie Curie Fellow and EC/ IEEP-funded PDRA), Dr Ruth Swetnam (2007-2011, Leverhulme Trust PDRA), Dr Julian Bayliss (2008-2011, Leverhulme Trust PDRA), and Phil Platts (2011-2012 Leverhulme Trust RA).

In 2006, a five-year grant from the Leverhulme Trust enabled the CSG to develop their conceptual approach to the study of ecosystem services and to undertake a practical case study to demonstrate its workability. 'Valuing the Arc' (VTA), coordinated and led by the CSG, commenced in the Eastern Arc Mountains (EAM) of Tanzania in January 2007 as a partnership of five UK and two Tanzanian universities, the World Wildlife Fund Tanzanian Office, and the Natural Capital Project (United States). Quantification of carbon storage in the EAM formed a major part of the VTA project. Analysis of existing global datasets of carbon sequestration, carbon storage, grassland production of livestock and water provision by the CSG and their VTA collaborators demonstrated that regions with high levels of biodiversity generally provide no more ecosystem services than regions chosen randomly[2]. However, the work also revealed that more rigorous quantification and mapping of ecosystem services can identify regions important for both, useful in reconciling potentially competing conservation objectives. Further work[3] on the degree of co-location between biodiversity and carbon storage revealed a strong but unevenly distributed synergy, suggesting that policies to mitigate climate change could offer additional gains for biodiversity without compromising their own effectiveness. The CSG and their VTA collaborators also demonstrated that effective policy mechanisms to limit deforestation and forest degradation are likely to cost more than typical estimates suggest due to the costs of ensuring deforestation isn't just displaced to other locations[4], with obvious budgetary implications for the design and effective delivery of such interventions.

In parallel to the VTA project, Toby Gardner co-founded the Sustainable Amazon Network (RAS in Portuguese, 2009), with funding from NERC, the Royal Society, the Brazilian Federal Government and The Nature Conservancy. RAS has collected a globally unique database to quantify changes in biodiversity, carbon storage, soil fertility as related to different land-use activities in the Brazilian Amazon, and to identify trade-offs and synergies between conservation and development. In 2012,

Gardner and RAS colleagues demonstrated how forest fires (both deliberate and accidental) affect carbon payment schemes by compromising carbon permanence, undermining reforestation activities and threatening biodiversity[5]. At the same time, Gardner led an international team to develop the first framework for integrating biodiversity concerns into national level intervention programmes[6]. This set out how biodiversity data could be incorporated into the strategic planning process in order to identify priority areas and activities for investment to deliver maximum returns for both carbon storage and biodiversity. Gardner also helped lead a Global Expert Panel review on Biodiversity, Carbon, Forests and People convened by the International Union of Forest Research Organizations (IUFRO). The main findings included that biodiversity is a key determinant of a forest's capacity to provide ecosystem services; that REDD+ programmes need to be regionally tailored due to variable impacts and trade-offs; and that impacts on people should be considered early on[7].

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

1. **Balmford, A.**, A. Bruner, P. Cooper, R. Costanza, S. Farber, **R. E. Green**, M. Jenkins, P. Jefferiss, V. Jessamy, **J. Madden, K. Munro**, N. Myers, S. Naeem, J. Paavola, M. Rayment, S. Rosendo, J. Roughgarden, **K. Trumper** & R. K. Turner. 2002. Economic reasons for conserving wild nature. *Science* **297:** 950-953. DOI: 10.1126/science.1073947
2. Naidoo, R., **A. Balmford**, R. Costanza, B. Fisher, **R. Green**, T. Malcolm & T. Ricketts. 2008. Global mapping of ecosystem services and conservation priorities. *PNAS* **105:** 9495-9500. doi: 10.1073/pnas.0707823105
3. Strassburg, B.B.N., A. Kelly, **A. Balmford**, R.G. Davies, H.K. Gibbs, A. Lovett, L. Miles, C.D.L. Orme, J. Price, R.K. Turner & **A.S.L. Rodrigues**. 2010. Global congruence of carbon storage and biodiversity in terrestrial ecosystems. *Conserv. Lett.***3:** 98-105. doi: 10.1111/j.1755-263X.2009.00092.x
4. Fisher, B., Lewis, S. L., **Burgess, N. D.,** Malimbwi, R. E., Munishi, P. K., **Swetnam, R. D.,** Willcock, S., **Balmford, A**. 2011. Implementation and opportunity costs of reducing deforestation and forest degradation in Tanzania. 2011. *Nature Climate Change*, **1**: 161-164. doi:10.1038/nclimate1119
5. Barlow, J., Parry, L., **Gardner, T.A.**, Ferreira, J., Aragao, L.E.O.C., Carmenta, R., Berenguer, E., Vieira, I.C.G., Souza, C., and Cochrane, M.A. (2012). The critical importance of considering fire in REDD+ programs. Biological Conservation, 154, 1-8. doi:10.1016/j.biocon.2012.03.034
6. **Gardner, T.A.**, **Burgess, N.D.,** Aguiar-Amuschastegui, N., Barlow, J., Berenguer, E., Clements, T., Danielsen, F., Ferreira, J., Foden, W., Kapos, V., Khan, S.M., Lees, A.C., Parry, L., Roman-Cuesta, R.M., Schmitt, C.B., Strange, N., Theilade, I., Vieira, I.C.G. (2012). A framework for integrating biodiversity concerns into national REDD+ programmes. Biological Conservation, 154, 61-71. *Distributed as an official Information Document in English, French and Spanish to parties of the Convention on Biological Diversity.* doi:10.1016/j.biocon.2011.11.018
7. Understanding relationships between biodiversity, carbon, forests and people: the key to achieving REDD+ objectives, pp 13-20, eds Parrotta, J.A., Wildburger, C., and Mansourian, S. A Global Assessment Report. Prepared by the Global Forest Expert Panel on Biodiversity, Forest Management, and REDD+. IUFRO World Series Volume 31. Vienna. 161 p. **Toby Gardner - Coordinating Lead Author** for Chapter 3, and **Lead Author** for Chapters 1, 2 and 6.

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

The CSG's work on carbon sequestration and storage and the links between carbon conservation, biodiversity and other ecosystem services has underpinned high-level guidance on improving the assessment and reporting mechanisms that are necessary to ensure REDD+ programs are environmentally and socially sustainable. REDD assists developing countries prepare and implement REDD strategies, and is central to two of the three 'Rio Conventions' adopted at the 1992 Rio Earth Summit, the UN Framework Convention on Climate Change (UNFCCC) and the UN Convention on Biological Diversity (UN CBD). However, it depends on knowing where carbon is stored, robust estimates of likely losses in the absence of REDD payments, and the capacity to track carbon storage through time. The research has also therefore had impact on the work of the UNFCCC and the UN CBD, and on international development in the countries in which it works, and beyond.

Impacts on international development: International agencies or institutions have been influenced by research

With approximately 40% of its land covered by forest and woodland, Tanzania is one of the UN's pilot countries for REDD implementation. The spatially explicit maps of carbon storage in Tanzania produced by the CSG-led VTA project were used by the Tanzanian Government's Intergovernmental Panel on Climate Change (IPCC) delegation at the 2009 Conference of the Parties (COP) to the UNFCCC[1]. This led directly to the Norwegian Government granting $1.86 million to the World Wildlife Fund to expand the carbon mapping project across all of Tanzania[2], with a significant local training component (see below).

Gardner et al.'s 2012 Framework (ref 6, section 3) was distributed as an Official Information Document for the Sixteenth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice for the UN CBD in May 2012, ahead of the 11th COP to the CBD[3]. The impact on the CBD Secretariat has been stated by a number of third party stakeholders. For example:

- The World Wildlife Fund: '*WWF welcomes that the CBD Secretariat considered the findings [of Gardner et al.]. This approach does allow the integration of biodiversity safeguards into national REDD+ programs allowing a step-wise approach which can be improved over time regarding the strategic planning and assessment of biodiversity safeguards on a national level. COP should encourage REDD+ countries to apply a gradual, phased approach for integrating biodiversity concerns into REDD+ programs as proposed by Gardner, T.A. et al.*'[4]

Impacts on international development: provision of international financial support and training, impacting on quality of life

The training provided by both the VTA project (two Tanzanian universities, the University of Dar es Salaam and Sokoine University of Agriculture are project partners) and the follow-on country-wide mapping project has significantly enhanced Tanzania's in-country capacity to monitor the effectiveness of future REDD payments. For example:
'The inception phase planned recruitment and trainings at village and district level. The project [is building] the capacity of 20 district staff in respective districts, and 10 Tanzanian research and training institutions, to carry out field carbon assessment, data analysis and monitoring. The pilot aimed to demonstrate that civil society participation in REDD+ readiness contributes to an effective and equitable national programme, and this has been achieved.'[5]

VTA also underpinned the foundation of other investments in sustainable development in Tanzania. For example, in an address to Rio+20 (the UN Conference on Sustainable Development, 2012), the Tanzanian Minister of State in the Vice President's Office (Environment) stated: '*these results* [from Valuing the Arc] *gave us a better understanding of ecosystems and natural capital, and are used for natural capital management initiatives, such as the Southern Agricultural Growth Corridor of Tanzania, which is a public-private partnership to benefit domestic food supply, smallholder farmers, and local communities*.'[6] SAGCOT covers approximately one third of mainland Tanzania, and is fostering inclusive, commercially successful agribusinesses, whilst improving food security, reducing rural poverty and ensuring environmental sustainability.

The work of RAS has contributed directly, through Gardner's official advisory capacity, to the development of the Brazilian state government of Para's Green County (Municipio Verde) program. This is a flagship initiative to shift land-management strategies in the eastern Amazon to a more sustainable trajectory and data and findings from RAS are contributing towards guidance on the management of secondary forests, fire management and the development of responsible agriculture programs.

Impacts on practitioners and services: practitioners/professional have used research findings in conducting their work

Based on his research above, Gardner has published 'Monitoring Forest Biodiversity'[7], which has become a primary reference guide for the monitoring of forest degradation and biodiversity by

international forestry and REDD+ practitioners. For example:

- The UN-REDD 'Annotated Guide to useful resources for monitoring the impacts of REDD+ on biodiversity and ecosystem services'[8] (p13): "*a comprehensive 'textbook' on monitoring forest biodiversity. This book … could therefore be of particular use for monitoring biodiversity under REDD+.*"
- UN Food and Agriculture Organisation[9]: *"This book is a timely and accessible guide for biodiversity researchers, policy-makers and forest managers."*

The IUFRO report that Gardner co-led (section 3, ref 7) has received widespread and positive coverage from the conservation community[10]. It was formally launched at COP 18 of the UNFCCC (December 2012) where a senior figure at the Global Environment Facility (GEF) noted that it provided a unique trans-disciplinary assessment of the environmental, social, economic and policy issues associated with REDD+[11]. Based on the strength of the report's reception, the lead editor was invited to advise the GEF on the formulation of their 2014-2018 Sustainable Forest Management strategy, and to ensure that it reflects the report's key conclusions[11,12].

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

1. www.ecosystemmarketplace.com/pages/dynamic/article.page.php?page_id=8934&section=news_articles&eod=1
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5. www.theredddesk.org/fr/node/4172 (archived article available as .mht file)
6. Speech by Tanzanian Minister of State, Vice President's Office for Environment
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9. www.fao.org/docrep/013/i2015e/i2015e10.pdf
10. http://blog.cifor.org/11135/global-forest-expert-panel-presents-key-findings-on-link-between-biodiversity-and-carbon/#.UJkbWPU20g4
11. Personal communication to TG from the Global Forest Expert Panel on Biodiversity team leader
12. Draft GEF-6 Programming Directions. (Global Environment Facility Secretariat). GEF/R.6/07, March 2013