Institution: Aberystwyth University

Unit of Assessment: 19: Business and Management Studies

Title of case study: Economic value of ecosystem services and biodiversity.

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

AU Research has had impact through the shaping of policies, practices and behaviours affecting biodiversity and ecosystem services (ESS) across a wide range of beneficiaries. The research has involved developing methods for valuing ESS, and subsequently mainstreaming this ESS framework to:

- *Local communities*: AU research has empowered indigenous communities in the Solomon Islands to use their forest resource more sustainably;
- *UK policy*: AU research has directly influenced the shape UK biodiversity conservation policies;
- *International policy*: AU research has led to international policy commitments from countries to better conserve global biodiversity.

2. Underpinning research (indicative maximum 500 words)

Biodiversity underpins ecosystem functioning and the provision of ESS that are essential in supporting human existence, for health, well-being and the provision of livelihoods[3.1, 3.2]. Despite significant local, national and international conservation efforts, biodiversity continues to decline. It is now recognised that much of this decline has been due to the failure of individuals, businesses and policy makers to fully account for ESS values in their decisions[3.1, 3.2]. AU research (led by Christie and funded by Defra, RCUK, UNEP and others) has addressed these issues by estimating the economic value of the ESS delivered by biodiversity and feeding this evidence into local, national and internationally policies. Research has included:

Developing novel approaches to value ecosystem services.

The research led by Christie has been at the forefront of developing and refining approaches to valuing biodiversity and ESS.

Much of this research has involved developing novel econometric approaches to allow more refined analysis of choice experiments (CE) by identifying and accounting for: attribute non-attendance[3.5] and respondent's 'ability to choose' [3.10]. In both cases, we were able to demonstrate the our econometric approaches helped to improve value elicitation[3.5].

Research has also reviewed how valuation methods (which have predominantly been developed in rich countries) might best be adapted for application in developing countries[3.7]. The best-practice guidelines proposed in Output 3.7 were then tested in an empirical valuation study that aimed to value the ESS benefits that indigenous people in the Solomon Islands derive from their surrounding forests[3.8, 3.9]. Key outcomes from this work has been the development of novel 'valuation workshops' that embed deliberative, participative and action research methods into the valuation survey instrument[3.7, 3.8], which Christie demonstrates can more effectively uncover people's implicit and experiential knowledge and understanding of the complex environmental goods, and thus improve value elicitation[3.7, 3.8, 3.9].

Evidence of the value of ecosystem services associated with biodiversity.

Christie has led a number of Defra-funded studies that have assessed the economic value of the ESS delivered by a range of UK biodiversity conservation policies, including agri-environmental schemes[3.4], UK BAP[3.5], and SSSIs[3.6]. Other valuation studies have included an assessment of the ESS benefits that indigenous communities in the Solomon Islands derived from their surrounding forests[3.8, 3.9]. All of these studies required inter-disciplinary teams of ecologists and economists to (i) assess changes to ESS associated with alternative management scenarios and (ii) value (predominantly using choice experiments) the economic costs / benefits associated with these changes.

Christie was also one of the lead authors to the TEEB (The Economics of Ecosystems and Biodiversity) report[3.1, 3.2, 3.3], which provided a state-of-the-art review of approaches to value ESS, as well as an application of value transfer techniques to provide an assessment of the global costs of biodiversity loss and ecosystem degradation.

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

3.1. De Groot D, **Christie M** et al. (2010). TEEB Chapter 1: Integrating the ecological and economic dimensions in biodiversity and ecosystem service valuation. In TEEB (2010). *The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations*. Earthscan, London and Washington. (ISBN: 978-1-84971-212-5).

3.2. Pascal U, **Christie M** et al. (2010). TEEB Chapter 5: The economics of valuing ecosystem services and biodiversity. In TEEB (2010). *The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations*. Earthscan, London and Washington. (ISBN: 978-1-84971-212-5).

3.3. De Groot D, **Christie M** et al. (2010). Appendix 3: A3.7 Monetary values of ecosystem services provided by tropical forests. In TEEB (2010). *The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations*. Earthscan, London. (ISBN: 978-1-84971-212-5).

3.4. **Christie M,** Hanley, N, Warren, J, Murphy K, Wright R and Hyde T. (2006) Valuing the diversity of biodiversity *Ecological Economics.* 58(2), 304-317. DOI: 10.1016/j.ecolecon.2005.07.034

3.5. Colombo S, **Christie M** and Hanley N (2013) What are the consequences of ignoring attributes in choice experiments? Implications for ecosystem service valuation. *Ecological Economics* 96, 25-35. DOI:10.1016/JECOLECON.2013.08.016 (REF2 submitted).

3.6. **Christie M** and Rayment M (2012) An economic assessment of the ecosystem service benefits derived from the SSSI biodiversity conservation policy in England and Wales. *Ecosystem Services* 1, 70-84. DOI:10.1016/j.ecoser.2012.07.004

3.7. **Christie M**, Fazey I, Cooper R, Hyde H and Kenter JO. (2012) An Evaluation of Monetary and Non-monetary Techniques for Assessing the Importance of Biodiversity and Ecosystem Services to People in countries with developing economies. *Ecological Economics,* 83, 69-80. DOI:10.1016/j.ecolecon.2012.08.012 (REF2 submitted).

3.8. Kenter J, Hyde T, **Christie M** and Fazey I (2011). The importance of deliberation in valuing ecosystem services in developing countries – evidence from the Solomon Islands. *Global Environmental Change Human and Policy Dimensions, 21(2), 505-521*. DOI:10.1016/j.gloenvcha.2011.01.001 (REF2 submitted).

3.9. Fazey, I, Kesby, M, Evely, A, Latham, I, Wagatora, D, Hagasua, J-E, Reed, M, S, **Christie, M** (2010). A three-tiered approach to participatory vulnerability assessment in the Solomon Islands. *Global Environmental Change*. 20, 713-728. DOI:10.1016/j.gloenvcha.2010.04.011

3.10. **Christie M** and Gibbons J (2011). The effect of individual 'ability to choose' (scale heterogeneity) on the valuation of environmental goods. *Ecological Ec*onomics. 70. 2250-2257. DOI: 10.1016.j.ecolecon.2011.07.011

Outputs 3.1 – 3.3, the TEEB report, was commissioned by an international consortia of governments, headed up by UNEP. **Christie** is a Lead Author of Chapter 1[(3.1)] and Appendix 3[(3.3)], and also a Contributing Author of Chapter 5[(3.2)]. Christie also led several high-level UNEP-supported TEEB follow-up capacity building workshops in Asia, Africa, Latin America and the Caribbean that aimed to mainstream TEEB ideas into national and international policy.

Outputs 3.4 to 3.10 are all articles in peer-reviewed journals and are either internationally recognised or internationally excellent. Item 3.4 is the 21st most cited article (out of ~5000 articles) in Ecological Economics since the article's publication in 2006, while Item 3.8 is the 35th most cited article (out of ~225) in Global Environmental Change since it's publication in 2011.

Outputs 3.4 – 3.7 were respectively funded by Defra grants led by Christie: *Developing measures for valuing changes in biodiversity*[(3.4)] (EPES 0405/6, £100k: 2002-2004); evaluations of ESS benefits associated with the UK Biodiversity Action Plan and SSSIs conservation projects[(3.5, 3.6)] (SFFSD 0702 AND CR0459, £225k; 2007 – 2009); and an assessment of monetary and non-monetary techniques for valuing ESS in developing countries[(3.7)] (CR0391, £50k, 2008).

Items 3.8 and 3.9 were led by then AU staff (Fazey), with Christie leading the design, administration and analysis of the deliberative choice experiment.

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

The research outlined in Section 2 has had impact through the shaping of policies, practices and behaviours affecting biodiversity and ecosystem services (ESS) across a wide range of beneficiaries.

(1) *Local communities*: AU research has empowered indigenous communities in the Solomon Islands to use their forest resource more sustainably

Research outputs 3.7, 3.8 and 3.9 aimed to assess the vulnerability of indigenous forest-dwelling communities in the Solomon Islands to environmental and social change and to raise local awareness and cultural understanding of issues affecting the sustainable use of the forest. The research was very much impact led: a key aim of the Output 3.9 was to assess '*whether, how and to what extent a vulnerability assessment could be conducted in a way that enabled co-learning and action for change in study communities*' (3.9: p714). An evaluation of the impact of our approach concluded '*The more exciting result was the degree to which the KA and communities took ownership of the project and of the process of exploring social and environmental vulnerability, and the extent of the learning and action for change that occurred as a consequence*' (3.9, p726): KA is the Kahua Association which represents 4500 people in 40 communities of the Kahua region. Our research has empowered KA communities, allowing them to make more effective and equitable cross-community decisions when, for example, communities have been approached by logging and mining companies. These impacts are demonstrated by the following quotes from KA Council members (Output 3.9, p724).

> *"The programme increased confidence in (our) own knowledge. We are realising that we can organise and deal with problems ourselves. With the programme, it sparked off a traditional inherited ability (to do this)." KA Council Member, July 2008*

> *"It was a learning process. People think it is a good process. It gives opportunities for participation and people are able to learn then we can analyse problems for ourselves." KA Council Member, July 2008*

A further significant outcome of our research process was that it reminded community elders of four moral 'Kahua Principles', and a set of rules governing individual, family and community life called '*Ramata*'. The KA is now promoting these principles within the KA communities.

(2) *UK policy*: AU research has directly influenced UK biodiversity conservation policies.

Natural Environment White paper: The TEEB report (Output 3.1, 3.2 and 3.3) was central to the adoption of Commitments 40 and 84 in Defra's Natural Environment White paper[(5.1)]. The Defra reports underlying Output 3.5 was also used to support the White Paper[(5.2, 5.6)].

England Biodiversity Strategy: Outputs 3.5 and 3.6 provided key evidence on the value of biodiversity to support Defra's arguments for adopting its England Biodiversity 2020 strategy[(5.2, 5.6)].

Biodiversity Offsetting: Output 3.5 was used by Defra to demonstrated that the benefits of offsetting biodiversity were likely to outweigh costs, which in turn was crucial to Defra attaining clearance to run its offsetting trails in England[(5.2, 5.3)].

Impact assessment of Defra's regulatory stock: AU evidence on the societal benefits of SSSIs (Output 3.6) was used by Defra to demonstrate the impacts of it's biodiversity conservation policies[(5.4)], which in turn helped to secure future funding for these policies[(5.2)].

Ecosystems Approach: Output 3.5 was commissioned as part of Defra's research programme that aimed to '*explore the extent to which valuation of ecosystem services could be integrated into existing decision-making process*'[(5.5)]; an approach which Defra is now pushing to mainstream across all government departments[(5.2)].

Public awareness: Defra have used AU research to communicate the benefits of biodiversity to the public, including in a 2011 Press Release where they state that AU value evidence has proven useful in capturing public attention and allowing Defra to highlight the broader benefits of investing in nature and accounting for its values[(5.2, 5.6)].

(3) *International policy: AU research has led to international policy commitments for countries to better conserve global biodiversity*.

The TEEB study (Output 3.1, 3.2 and 3.3) has been highly influential in the development of international policy commitments to conserve biodiversity.

EU's Biodiversity Strategy to 2020[(5.7)]: TEEB forms the basis of Remark 56 of the Strategy, in which it

urges member states to '*take account of the recommendations made in the TEEB study … in dealing with the complex European and national legislation aimed at protecting nature* '.

Convention of Biological Diversity: TEEB was also tabled at the COP10 meeting of the CBD, from which Decision X/2 '*Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets*'[(5.8)] explicitly *Requests* the Executive Secretary to:
'*17(e) Building on the results of TEEB … [to] develop implementing tools for the integration of economic aspects of biodiversity and ecosystem services'* and
'*17(f) Through capacity-building workshops, to support countries in making use of the findings of TEEB and in integrating the values of biodiversity into relevant national and local policies, programmes and planning processes*'.

To fulfil Request 17f, Christie was commissioned by UNEP to lead four high-level capacity building workshops on TEEB[(5.10)]. These workshops were attended by over 200 senior Government representatives from over 50 countries of the Caribbean, Latin America, Africa and Asia. The outcome from these workshops is that these countries now have enhanced capacity to meet their commitments under the CBD Decision X/2[(5.8, 5.9, 5.10)].

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

5.1. Defra (2012) Natural Environment White Paper 'The Natural Choice: securing the value of nature'. Defra: London. http://www.official-documents.gov.uk/document/cm80/8082/8082.pdf. The TEEB report is instrumental in Commitment 40 to '*support new international coalition of businesses and businesses organisations to follow up on the 'TEEB for Business' report … to help businesses from the UK and elsewhere, to understand and address their environmental impacts*'; and Commitment 84 '*apply TEEB principles to the development of National Strategic Biodiversity Plans'*.

5.2. Corroboration of the impacts that Christie's research on the value of biodiversity has had in terms of influencing Defra's biodiversity conservation policies can be found in the letter from Defra's economist in its 'International Biodiversity, Ecosystems and Evidence' unit

5.3. Defra (2011) 'Options stage impact assessment: Offsetting the impact of development on biodiversity' report: http://www.archive.defra.gov.uk/environment/natural/documents/newp-ia-offsets-110607.pdf Christie's report on the value of the UKBAP (which forms the basis of Output 3) provided key evidence for this impact assessment.

5.4. Defra (2011) report on 'The costs and benefits of Defra's regulatory stock', in which the Christie study on the value of SSSIs (Output 4) provided evidence on the value of biodiversity (page 16 and 41) http://www.defra.gov.uk/publications/files/pb13623-costs-benefits-defra-regulatory-stock110816.pdf

5.5. Defra (2007) 'Securing a health natural environment: An Action Plan for embedding an ecosystems approach' Action A15a (page 23) outlines Defra's 'Action for the practical application of ecosystem service valuation', which includes the 'Valuation of the benefits from the implementation of the UK Biodiversity' project that was led by Christie. http://archive.defra.gov.uk/environment/policy/natural-environ/documents/eco-actionplan.pdf Also see Source 2 above for the impact that this research has had on Defra policy.

5.6. Defra press release that uses our research on the value of the UK BAP and SSSI to highlight the benefits of investing in nature. The press release also states that the two reports support the Natural Environment White Paper and England Biodiversity Strategy: http://www.defra.gov.uk/news/2011/08/23/nature-health-wealth-and-happiness/

5.7. The European Parliament resolution on the EU Biodiversity Strategy to 2020 http://ec.europa.eu/environment/nature/biodiversity/comm2006/pdf/EP_resolution_april2012.pdf

5.8. Details of the Convention on Biological Diversity COP 10, Decision X/2 '*Strategic Plan for Biodiversity 2011-2020*' can be found at http://www.cbd.int/decisions/cop/?m=cop-10 .

5.9. Corroboration of Christie's contribution to the TEEB report and subsequent capacity building workshops, along with a statement of the impact of these can be attained in the letter from the Chief of UNEP's Ecosystem Services Economics Unit, Division of Environment Programme Implementation, UNEP, Nairobi.

5.10. Concept note for the UNEP capacity building workshop on TEEB held for Caribbean and Latin American countries. The programme demonstrates the high level of involvement of Christie in running this workshop. Note that similar workshops were also organised in Africa, Asia.