Institution: University of East Anglia

Unit of Assessment: 7 – Earth Systems and Environmental Sciences

Title of case study:

Management Strategies for Biodiversity Conservation

1. Summary of the impact

The creation of an evidenced-based framework for biodiversity conservation has profoundly altered approaches to conservation policy and practice, both in the UK and globally. Our research has underpinned strategic management that has supported tropical biodiversity resilience and mitigated ecosystem impacts in the face of changes in land-use, rural livelihoods and forest resource extraction. Our research on biodiversity and conservation management has had impact on governmental and non-governmental policy and practice at national (UK) and international (Brazil, Cambodia) scales, including directly influencing a forestry conservation Bill in Brazil.

2. Underpinning research

We report a body of research dating back to 2000 which under-pins the management and mitigation of detrimental anthropogenic effects on biodiversity. Through inter-disciplinary collaboration with social scientists, environmental economists and numerous NGOs, **Peres** (at UEA since 1997) and **Dolman** (since 1996) have investigated large-scale human, economic and policy impacts on tropical and temperate biodiversity, providing an evidence-base for sustainable management.

Dolman with others helped introduce the necessity for, and a model of, evidence-based approaches to biodiversity conservation [1]. Quantitative research demonstrated that existing conservation approaches were largely based on uncorroborated anecdotal evidence. An evidence-based approach to conservation intervention was advocated, applying the Cochrane medical framework for evidence of the effectiveness of interventions. **Dolman** has since conducted a large body of research providing the evidence-base for conservation management issues in several vulnerable habitats.

Despite widespread adoption of evidence-based approaches to interventions, strategic biodiversity conservation policy remains largely incomplete in the UK; in terms of what biodiversity is prioritised and the poor integration of species into habitat- or landscape-scale approaches. **Dolman** developed an innovative Biodiversity Audit Approach – a framework to quantify regional biodiversity and objectively identify priorities [2]. This demonstrated that numbers of priority species were one or two orders of magnitude greater than recognised in Biodiversity Action Planning and provided a novel methodology that defined integrated guilds of priority species, supporting cost-effective evidence-based management for multiple taxa [2].

Peres leads a major tropical forest conservation science programme resulting in highly-cited papers that are used by lobbyists and advocates to influence policy at national (e.g. Brazil) and global scales. Research has focused on the biodiversity consequences of land-use and subsistence game hunting (e.g. [3]) and the ramifying ecosystem effects of community-based extraction of non-timber forest products (NTFPs) on forest dynamics. Demographic studies on non-timber extraction systems in tropical forests (e.g. [4]) have informed management plans of Extractive Reserves throughout lowland Amazonia and introduced new guidelines to the way sustainable use forest reserves are managed. Landscape ecology studies in a highly fragmented forest region of southern Amazonia (e.g. [5]) provided evidence to the Brazilian National Senate and Lower House to refute disastrous legislative reforms of the Brazilian Forest Bill, which would erode minimum forest set-asides that are legally required within 5.3 million rural properties within Brazil's 8.5M km^2.

In Asia and Africa, **Dolman** has demonstrated dependence of a suite of critically threatened tropical species on traditional livelihoods in farmed or pastoral landscapes within developing countries [6]. This challenged the more common focus of conservation in tropical anthropogenic

landscapes of mitigating human impacts in natural ecosystems, particularly forests. It offers win-win synergies by linking conservation delivery to livelihood entitlements of marginalised rural communities, both of which are often threatened by inappropriate development and land sequestration.

3. References to the research

(UEA authors in bold) {citations from Scopus}

[1] Sutherland, W.J., Pullin, A.S., **Dolman, P.M.,** Knight, T.M. (2004) The need for evidence-based conservation. *Trends in Ecology and Evolution* **19** 305-308 doi:10.1016/j.tree.2004.03.018 {440}

[2] **Dolman, P.M., Panter, C.J., Mossman, H.L.** (2012) The Biodiversity Audit Approach challenges regional priorities and identifies a mismatch in conservation. *Journal of Applied Ecology* **49** 986–997 doi:10.1111/j.1365-2664.2012.02174.x {2}

[3] **Peres, C.A.** (2001) Synergistic effects of subsistence hunting and habitat fragmentation on Amazonian forest vertebrates. *Conservation Biology* **15** 1490-1505 doi:10.1046/j.1523-1739.2001.01089.x {262}

Barlow, J, … and **C.A. Peres** (2007) Quantifying the biodiversity value of tropical primary, secondary and plantation forests. Proc. Nat. Acad. Sci. **104** 18555-18560 doi:10.1073/pnas.0703333104 {297}

[4] **Peres, C.A**. et al. (2003) Demographic threats to the sustainability of Brazil nut exploitation. *Science* **302** 2112-2114 doi:10.1126/science.1091698 {150}

[5] Lees, A.C. & **Peres, C.A.** (2008) Conservation value of remnant riparian forest corridors of varying quality for Amazonian birds and mammals. *Conservation Biology* **22** 439-449 doi:10.1111/j.1523-1739.2007.00870.x {82}

[6] Wright, H.L, **Lake, I.R., Dolman, P.M.** (2012) Agriculture – a key element for conservation in the developing world. *Conservation Letters* **5** 11-19 doi:10.1111/j.1755-263X.2011.00208.x {7}

4. Details of the impact

The work undertaken by the School on an evidence-based model for conservation has profoundly influenced the policy, practice, public accountability and cost-effectiveness of UK statutory agencies and international NGOs in recent years. Since 2004, evidence-based strategic delivery has been adopted as core policy by Defra, the Joint Nature Conservation Committee and Natural England, as indicated by strategic statements between 2007 and 2011; for example the Defra 2011 strategic policy for biodiversity [7] states:

> *"A good evidence base is an essential element of delivering the strategy effectively. It will help us make sure we are doing the right thing in the right place, and using our resources effectively, focusing on action that will have the most impact."*

And Natural England [8] states:

> *"All Natural England's work, from strategy to delivery, is underpinned and supported by sound evidence"*.

The School's underpinning research contributed to the UK Government Parliamentary Office of Science & Technology (POST) briefing [9] and has galvanised international conservation organisations to adopt an evidence-based approach to global conservation interventions and policy (e.g. [10]).

The Biodiversity Audit Approach, developed in 2010-11, had immediate impact, assisted by knowledge transfer and engagement with Natural England, Defra, Institute of Ecology and Environmental Management, Local Authorities and stakeholders including CLA (Country Land and Business Assocation), National Farmers Union and Wildlife Trusts. It was cited as a case study in POST 379 [9; see Box 2]; provided the evidence-base for the Forestry Commission to create an open-habitat ecological network in Breckland, totalling 278 km^2, and led to subsequent Biodiversity Audits that were commissioned to underpin strategic biodiversity policy across The Broads (850

km^2, 2011), the Fens (3,800 km^2, 2012) and the Brecks (2012) [11].

The School's research on biodiversity conservation in Less Developed Countries has changed national forest policy in Brazil (the world's largest tropical country) and, to a lesser extent, in Cambodia. Through engagement, local community outreach and participation in governmental and inter-governmental working groups, and adoption of research findings by environmental advocates **Peres**' research has had demonstrable impacts on global, neotropical and national (Brazilian) forestry and carbon policy, including:

- Key evidence for legislative proposals of the Brazilian Forestry Code in 2012 to retain wider forest buffers along rivers and perennial streams (riparian ecosystems) within Brazil's 5.3M private landholdings, in the face of intense counter-lobbying from the agro-business sector who sought to remove all protection [12]. This resulted in the Law Project 3460/2008 of 27 May 2008 [13].
- On the basis of [14], a consultation process with Secretaria do Meio Ambiente do Estado do Amazonas (CEUC-SDS) resulted in the geographic selection and design of Amazonian forest reserves, and the creation of 12 new protected areas in Amazonia (from 2000-2010) accounting for an additional ~12 million hectares of forest reserves [15]; this comprises one third of the global expansion of all terrestrial protected areas in the last two decades.
- state government implementation of minimum management standards of nontimber forest resources, such as Brazil nut trees, in some 21 million hectares of Amazonian Extractive Reserves [16].

Through advisory work with the Brazilian Ministry of Environment (MMA), **Peres** has attended numerous conservation planning workshops, the impacts of these include defining: (a) a protocol for long-term biodiversity monitoring in Amazonian forest reserves within Programa ARPA [15]), which manages 52Mha of forest within 95 Amazonian protected areas; and (b) biodiversity assessment protocols for Reduced-Impact Logging (RIL; [16]) concessions, upon which large-scale environmental licensing and certification have become conditional.

Impacts of **Dolman**'s recent work on livelihood-dependent tropical biodiversity [6] include the establishment in Cambodia protected areas by Ministerial Decree (2010) covering 173 km^2 of floodplain grassland, and 138 km^2 of non-breeding forest habitat to prevent extinction of the critically endangered Bengal Florican [17, 18].

5. Sources to corroborate the impact

[7] Defra (2011) *Biodiversity 2020: A Strategy for Englands Wildlife and Ecosystem Services*
See: pages 7, 32

[8] See: http://www.naturalengland.org.uk/information_for/researchers/default.aspx

[9] UK Government Parliamentary Office of Science & Technology (2011): POST Number 379 *Evidence-Based Conservation*
See: p1, the 2004 case study was work by **Dolman**; Box 2 refers to Biodiversity Audit work led by **Dolman** and publishedin research reference [2]

[10] Sunderland, T.C.G., Sayer, J., Hoang, M.-H. (2012) *Evidence-based Conservation: Lessons from the Lower Mekong*. Routledge, Taylor & Francis, ISBN-10: 1849713944.

[11] Biodiversity audits:
a) Broads Authority available at: http://www.broads-authority.gov.uk/broads/live/authority/publications/conservation-publications/Broads_Biodiversity_Summary_Report.pdf
b) Fens available at:
http://www.cperc.org.uk/downloads/5_Fens_Biodiversity_Audit_FINAL_Report_24-10-2012.pdf
Forestry Commission update for the Brecks available at:
http://mediafiles.thedms.co.uk/Publication/EE-Breck/cms/pdf/Neal%20Armour-Chelu%20Brecks%20Forum%20Presentation%2019-09-2012.pdf

[12] Google Search of "Carlos Peres" AND "Codigo Florestal" returns **3,790** hits; "Carlos Peres"

and "Codigo Florestal" returns **1,720** hits (at 29-09-2013), evidencing repeated citation of this research by journalists and environmental advocates.

[13] a) Brazilian Government changing devices Law No 4,771 (1965): *Forest Code - increasing the width of the permanent preservation areas along streams and around springs*.
This explicitly references underpinning research by **Peres** [pp 2-4], as translated here:

> *"The most recent, conducted in the municipality of Alta Floresta (MT) published in the journal Conservation Biology … shows that the preserved vegetation along watercourses needs to double,.. According to reputable biologist Brazilian **Carlos Peres**, study author and professor at the **University of East Anglia**, in England… ideal width of 200 meters on either side of small watercourses, much greater … The researcher says that this analysis shows that the ideal width of riparian forest buffer strips would be 400 meters.*

Taken from: *PROJETO DE LEI No , DE 2008, (do Sr. CARLOS BEZERRA): Altera dispositivos da Lei nº 4.771, de 15 de setembro de 1965 (Código Florestal), aumentando a largura das áreas de preservação permanente ao longo dos cursos d'água e em torno das nascentes.* Available from: Câmara dos Deputados Federais Projetos de Leis e Outras Proposições

b) Testimonial from the **Chief Environmental Consultant for the Brazilian National Senate** (2013):

> *"UEA research carried out in the state of Mato Grosso, located in the southern border of Brazilian Amazonia, influenced congressmen in an attempt to tighten Forest Code land use restrictions via Bill No 3460/2008. The Bill (which can be viewed at http://www.camara.gov.br/proposicoesWeb/fichadetramitacao?idProposicao=396480) introduced by Mato Grosso representative, Mr. Carlos Bezerra, who at the time read some media coverage on the Lees & Peres 2008 paper, was one of the proposals recently discussed prior to the enactment of Brazilian new Forest Code, Law 12.651/2012. The bill's author justified as the reason for increasing farmland set asides, that "According to renowned Brazilian ecologist Carlos Peres, author of the paper and professor at University of East Anglia, the ideal forest strip width should be … greater than currently demanded by the Forest Code".*

[14] a) Peres (2005) Why we need megareserves in Amazonia. *Conservation Biology* **19** 728-733 doi: 10.1111/j.1523-1739.2005.00691.x
b) Peres and Terborgh (1995) Amazonian nature reserves: an analysis of the defensibility status of existing conservation units and design criteria for the future. *Conservation Biol.* **9** 34-46 doi: 10.1046/j.1523-1739.1995.09010034.x

[15] Programa ARPA for the Protection and Implementation of Amazonian Forest Reserves

[16] a) This work resulted in "best-standard" management practices of natural Brazil nut populations in Amazonian forest reserves (see for example: http://www.agricultura.gov.br/MapaPortalInternet/consultarpublicacao/editConsultarPublicacaoGrupo1.do?op=downloadArquivo&url=/desenvolvimento-sustentavel/organicos/publicacao&publicacao.arquivo.idArquivo=9824);
b) A Google search returns 3,760 hits on the combined terms Peres, ICMBio (the Brazilian Protected Areas Agency) and castanheira (the vernacular name of Brazil nut trees);

[17] Packman, C.E., Collar, N.J., Showler, D.A., Son Virak, Mahood, S.P., Handschuh M., Evans, T.D., Hong Chamnan, **Dolman**, P.M. (in press) Rapid decline of the largest remaining population of Bengal Florican *Houbaropsis bengalensis* and recommendations for its conservation. *Bird Conservation International*

[18] Wildlife Without Borders Success Stories: see *Grassland Restoration and Community Engagement Plays a Critical Role in Preventing Africa's First Bird Extinction*