Institution: University of Sussex

Unit of Assessment: 5 Biological Sciences

Title of case study: The Conservation of Tropical Rainforests in Papua New Guinea and Ecuador

1. Summary of the impact

Drs Peck and Stewart are actively engaged in conservation projects in Papua New Guinea (PNG) and Ecuador and have established conservation areas that are now protected from logging and which provide a sustainable income for local communities. These impacts are:

- The preservation of more than 10,000ha of priority forest habitat in NW Ecuador and PNG, for forest conservation.
- Engagement with indigenous and forest communities through 'para-biologist' networks, providing well-paid local employment, social and economic support within the region, and scientific credibility and sustainability for conservation policies.
- The generation of sustainable livelihoods for forest conservation through 'ecotourism' and the establishment of local non-governmental conservation organisations (NGOs) for mammal conservation.

2. Underpinning research

The research from Drs Peck and Stewart that has resulted in this impact is described below.

- Ecuador has the highest density of mammalian species worldwide. Unfortunately, it also suffers from the highest rate of deforestation in South America and, consequently, has the highest number of species at risk of global extinction (IUCN Red list 2010). In response, since 2005, Dr Peck has created an international team to generate the scientific information needed to conserve Ecuador's threatened wildlife, including the brown-headed spider monkey (*Ateles fusciceps*) – now recognised as one of the top 25 most-endangered primates. Identifying remaining populations of a rare primate and determining their habitat requirements in large areas of rainforest is a real challenge. His group used a combination of satellite imagery, computer modelling and the mapping of threats to identify forest likely to still harbour the primate. Having narrowed down the search for this elusive species, the team then applied an innovative rapid-assessment method (based on audio response) to confirm the presence and numbers of primates still remaining in the wild. This combination of field and satellite analysis has allowed his team to identify priority areas that needed urgent conservation action (see R1, R2 and R3 in the next section).

- Similarly, since 2001, Dr Stewart has been part of an international collaboration of ecologists working with teams of para-biologists (R7) on patterns of insect diversity and host-plant specificity (R4, R5) in the tropical forests of PNG and Fiji. The group has discovered that the species composition of rainforest insect communities changes much less than expected across large areas (>500km) of tropical lowland rainforest (Novotny *et al*. 2007) (R6). This enables the calculation of how many insect species are estimated to exist at a regional and, ultimately, global scale. It also has important implications for strategic conservation planning and, in particular, the optimal size and geographical distribution of protected areas such as national parks.

Key researchers and dates:

- Dr Alan Stewart (University of Sussex: 1993–present)

- Dr Mika Peck (University of Sussex: 2005–present)

3. References to the research

R1 **Peck, M.R**., Tirira, D., Thorne, J., Baird, A. and Kniveton, D. (2011) 'Focusing conservation efforts for the critically endangered brown-headed spider monkey (*Ateles fusciceps*) using remote sensing, modelling and playback survey methods', *International Journal of Primatology*, 32(1): 134–148.

R2 **Peck, M.R.**, Mariscal, A., Cane, T., Padbury, M. and Kniveton, D. (2012) 'Identifying tropical Ecuadorian Andean trees from inter-crown pixel distributions in hyperspatial aerial imagery', *Applied Vegetation Science*, 15(4): 548–559.

R3 Shanee, S. and **Peck, M.R.** (2008) 'Elevational changes in a neotropical Fig (Ficus spp.) community in North Western Ecuador', *iForest*, 1: 104–106.

R4 Novotny, V., Miller, S.E., Hrcek, J., Baje, L., Basset, Y., Lewis, O.T., **Stewart. A.J.A.** and Weiblen, G.D. (2012) 'Insects on plants: explaining the paradox of low diversity within specialist herbivore guilds', *American Naturalist*,179(3): 351–362.

R5 Novotny, V., Miller, S.E., Baje, L., Balagawi, S., Basset, Y., Cizek, L., Craft, K., Dem, F., Drew, R.A.I., Hulcr, J., Leps, J., Lewis, O.T., Pokon, R., **Stewart. A.J.A.** and Weiblen, G.D. (2010) 'Guild-specific patterns of species richness and host specialization in plant-herbivore food webs from a tropical forest, *Journal of Animal Ecology*, 79(6): 1193–1203.

R6 Novotny, V., Miller, S.E., Hulcr, J., Drew, R.A.I., Basset, Y., Janda, M., Setliff, G.P., Darrow, K., **Stewart, A.J.A.**, Auga, J., Isua, B., Molem, K., Manumbor, M., Tamtiai, E., Mogia, M. and Weiblen, G.D. (2007) 'Low beta diversity of herbivorous insects in tropical forests', *Nature* 448(7154): 692–696.

R7 Bassett, Y., Novotny, V., Miller, S.E., Weiblen, G.D., Missa, O. and **Stewart, A.J.A.** (2004) 'Conservation and biological monitoring of tropical forests: the role of parataxonomists', *Journal of Applied Ecology*, 41(1): 163–174.

Outputs can be supplied by the University on request

Key grants:

- PRIMENET Darwin Initiative, DEFRA, 2005–2008 (£236,000)
- Earthwatch 'Climate Change, canopies and wildlife', 2008–2013 (£210,687)
- Holly Hill Trust – SURVIVE Camera trapping project, 2008–2012 (£74,000)
- DEFRA, Darwin Initiative: 5 grants on building biodiversity research and survey capacity to protect rainforest in PNG and Fiji, 2001–2015 (total: £891,458)

4. Details of the impact

Socio-economic impact:

Drs Stewart and Peck helped to pioneer the concept of teams of 'para-biologists' (Section 3, R7): locally recruited staff who receive special training to carry out technical tasks ranging from the collection of field data following a standard protocol, to the preparation, digital imaging and preliminary identification of specimens, databasing and the initial analyses of results. As an approach to the scientific study of hyper-diverse ecological communities, this model is now being

copied widely around the world (see Section 5, C1). It has not only proved to be a most efficient way to conduct conservation research but has also, in itself, resulted in significant social and economic benefits within the local community that are tangible and far-reaching. For example, as a result of the parabiologist concept, Drs Stewart and Peck have established the *Binatang Research Center* in Papua New Guinea – one of the three top parabiologist teams in the world – and the *Santa Lucia Research Station* in Ecuador, a community-owned reserve that hosts the largest biodiversity database for plants and animals in North West Ecuador (C2, C3). These centres provide a sustainable income stream for conservation programmes for the local community by:

- Providing training in research and conservation within the local community. For example, the parabiologist training scheme (C3) and the Darwin Initiative projects have enabled Dr Stewart to bring 14 PNG nationals (12 parabiologists and 2 MSc graduates) to the UK for intensive training at major institutions such as The Natural History Museum in London and the Royal Botanic Gardens Herbarium at Kew. On return to PNG, most have taken up posts in biology-/conservation-related employment, including several prestigious senior positions. Similarly, through Dr Peck's PRIMENET project, 80 community-level 'parabiologists' from indigenous and forest communities were trained between 2008 and 2012, giving them a voice through direct links with NGOs, scientists, and local and national government (http://en.wikiversity.org/wiki/Topic:Parabiology). Participants in the PRIMENET project have also now established *Neotropical Primate Conservation* (http://www.neoprimate.org/), an NGO that addresses impacts on primates throughout South America.
- Encouraging other researchers – either international scientists or volunteer researchers coming as ecotourists – to come to the centres. Visiting scientists pay land fees for forest use, employ local research assistants, as well as and pay subsistence. The Santa Lucia Research Station provides a sustainable livelihood from the general public, who engage via the Earthwatch Project. They pay to participate in and support on-going research and for their food and accommodation during their stay. Between 2008 and 2012, 350 volunteer scientists and 85 undergraduate students attended bespoke training courses contributing 25 per cent of the community-run reserve's annual income. These activities provide a sustainable income to the local communities (C4, C5, C6, C7 and C8).
- Establishing conservation charities that manage outreach programmes and attract additional income for conservation and infrastructure within the local community, including from the private sector. For example, staff employed on Dr Peck's PRIMENET research project founded two Ecuadorian conservation charities, *Fundación Mamíferos y Conservació* (Mammal conservation foundation) and the *Cambugan Foundation*. These organisations have translated the scientific information generated by research into educational outreach, have informed policy at local and national levels, and have underpinned practical, grassroots conservation action**.** In addition, Dr Stewart's projects in PNG have leveraged additional finance for direct conservation action, including private sources such as John Swire & Sons (PNG) Ltd. and Steamships Trading Co. Ltd. (who provided US$200,000 for infrastructure, direct conservation and research). This work has transformed the village social structure in Wanang, including infrastructure support for a new school (for 130 children in 5 classes from 7 local villages for whom there was previously no school) and the development of a 50ha forest research plot that is part of the global network of 42 such plots coordinated by the Smithsonian Center for Tropical Forest Science (http://www.ctfs.si.edu/site/Wanang).

Ecological/conservation impact:

By improving our knowledge and understanding of biological diversity in the tropics, Drs Stewart and Peck have enabled non-governmental and governmental organisations to plan conservation efforts more strategically. For example, the Darwin Initiative projects in PNG were instrumental in initiating the process whereby the Binatang Research Center assisted one remote village community to set up 10,000ha of its lowland rainforest as a legal entity (the Wanang Conservation Area, WCA) thereby protecting it from logging. As a direct consequence of Dr Stewart's work, a proposal has been submitted to the PNG Department of Environment

and Conservation for designating the WCA as a government protected area (C9). This village lies within vast lowland rainforests on the floodplain of the Ramu River, where concessions have been granted to log 110,000ha of forest. Active logging started in 2006, has been expanding ever since, and now completely surrounds the WCA. Similarly, Dr Peck's research describing risks to spider-monkey habitats was sent to the Ecuadorian government as part of an environmental impacts assessment. As a result, in August 2008, an area of 18,000ha was declared the first municipal protected area (C10, C11 and C12).

5. Sources to corroborate the impact

C1 Education and training para-biologists in the local community; Simons, C. (2011) 'Uncertain future for tropical ecology', *Science* 332(6027): 298–299. This paper (a News Focus item) refers to the Binatang Research Center as one of the leading centres for pioneering the para-biologist approach, and highlights the importance of Darwin funding on tropical biology in general.

C2 Web site for Santa Lucia Field Station (http://www.santaluciascience.webeden.co.uk/#/our-supporters/4551379382); web link corroborates Dr Peck's involvement in this research station, which creates a sustainable local economy and forest conservation by means of a well-run ecotourism business.

C3 Web site for Binatang Research Center (http://www.entu.cas.cz/png/parataxoweb.htm). Web link corroborates Dr Stewart's involvement in this research station, which is an NGO in PNG for training Papua New Guineans to advance local biodiversity research and develop educational and nature conservation programmes, targeting grassroots audiences.

C4 Centre records available for audit.

C5 Earthwatch project; http://www.earthwatch.org/exped/peck.html

C6 Santa Lucia reserve (www.santaluciaecuador.com/)

C7 Peck evidence to the House of Lords House of Commons Joint Committee on Human Rights First Report of Session 2009: 119–212. http://books.google.co.uk/books?id=Vxv4mOkheooC&pg=PA119&lpg=PA119&dq=Peck+primenet&source=bl&ots=lv5ApEyqEa&sig=n6HwHewt_KDKLzlED-mIUaAJYAg&hl=en#v=onepage&q=Peck%20primenet&f=false

C8 Letter from Director of Santa Lucia Cooperative.

C9 Copy of proposal available for audit.

C10 Laurance W. (2013) 'Does research help to safeguard protected areas?', *TREE*, 28(5): 261–266.

C11 Press Web Report (2008) http://www.decoin.org/2008/08/new-protected-area-in-junin-area-nueva-area-protegia-en-area-de-junin/

C12 *DECOIN Letters* (2008 and 2011) http://www.decoin.org/2008/08/new-protected-area-in-junin-area-nueva-area-protegia-en-area-de-junin/