Institution: University of Sussex

Unit of Assessment: 5 – Biological Sciences

Title of case study: Establishing conservation, economic and health initiatives in local communities in Papua New Guinea and Ecuador

Period when the underpinning research was undertaken: 2001 – 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:
Dr Alan Stewart	Reader in Biology	1993 – present
Dr Mika Peck	Senior Lecturer in Biology	2005 – present
Jo Middleton	Research Fellow	2014 – present

Period when the claimed impact occurred: 2013 – 2020

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

1. Summary of the impact

Peck, Stewart and Middleton are engaged in research projects in Papua New Guinea (PNG) and Ecuador that have established forest conservation areas and sustainably improved the lives of local communities. Impacts include:

- Conservation of more than 16,000ha of forest in Ecuador and PNG, protecting them from logging.
- Generation of sustainable livelihoods for forest communities by providing well-paid local employment for 'para-ecologists' to support biodiversity research, establishment of Fairtrade organic chocolate production, and developing ecotourism.
- Health service provision for indigenous forest communities, including establishment of a permanent nurse-staffed aid post, to incentivise and expand forest conservation.

2. Underpinning research

Ecuador is a 'hyperdiverse country' with the highest density of mammalian species worldwide, the highest deforestation rate in South America and 2,301 species at risk of extinction - the highest globally. In response, in 2005, Dr Peck created an international team that worked with forest communities to pioneer the 'paraecologist approach' and generate the scientific information needed to conserve Ecuador's threatened wildlife. Focusing on the brown-headed spider monkey, one of the top 25 most-endangered primates globally, they faced the challenge of identifying remaining populations of a rare primate in large areas of rainforest. His group used a combination of satellite imagery, computer modelling and mapping of threats to identify potential forest harbouring the primate [R1]. Having narrowed down the search, the team then applied an innovative rapid-assessment method (based on audio responses) to confirm the presence and numbers of primates remaining in the wild. This combination of analyses allowed his team to identify a priority area in NW Ecuador requiring urgent protection – now the 2,000ha Tesoro Escondido Spider Monkey Reserve (TESMR) – established by Peck and the local community [R1]. The TESMR model integrates community in conservation, building on the experience of the 730 ha Santa Lucia Reserve Research Station (SLRRS) in the Ecuadorian Andes also established by Peck. The protected areas generate scientific information on biodiversity to guide sustainable development [S5] and create local income and training for paraecologists, students and researchers.

The island of New Guinea includes the world's third largest rainforest, supporting 5% of global biodiversity. However, 24% of PNG's forest has been cleared or degraded in the last 30 years. Furthermore, medical neglect, especially in remote areas, has left the most prevalent causes of health problems mostly unchanged for fifteen years; life expectancy is low and maternal and infant mortality rates are high. Since 2001, Dr Stewart has been part of an international collaboration of ecologists working in PNG (funded by the UK Government's Darwin Initiative) that has: (i) established and trained teams of para-ecologists to study the hyper-diverse forest ecosystems [R2]; (ii) studied patterns of insect diversity and host-plant specificity [R3] in tropical forests; (iii) estimated carbon preserved by protecting 10,000ha of primary forest equivalent to the carbon footprint of 1.47 million transatlantic flights [R4]; (iv) established a Complete Altitudinal Rainforest Transect (CART), running from near sea-level to the tree-line (3,700m) with 8 research stations at 500m intervals, designed to act as a proxy for the impacts of climate

change on various taxonomic groups [S4]; (v) assessed the health needs of remote village communities [R5] to inform Stewart and Middleton's establishment of health services for approximately 2,000 people [R6].

This community-based 'para-ecologist model' has proved to be an efficient way to conduct data gathering and research by integrating local and scientific knowledge. In effect, the model has built local engagement and employment around the research process itself, generating world-leading research outputs in tropical ecology [R3, R4] and health [R5, R6], embedding evidence-based conservation at the community level [R2], bringing critically endangered species back from the brink of extinction and winning international recognition for its approach [S2, S3, S4].

3. References to the research

R1. **Peck, M.R**., Tirira, D., Thorn, J., Baird, A. and Kniveton, D. (2011) 'Focusing conservation efforts for the critically endangered brown-headed spider monkey (*Ateles fusciceps*) using remote sensing, modeling and playback survey methods', *International Journal of Primatology*, 32(1): 134–148. DOI https://doi.org/10.1007/s10764-010-9445-z (48 Citations)

R2. 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. DOI https://doi.org/10.1111/j.1365-2664.2004.00878.x (133 Citations)

R3. 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): 692–695. DOI https://doi.org/10.1038/nature06021 (262 Citations)

R4. **Peck, M. R**., Kaina, G. S., Hazell, R. J., Isua, B., Alok, C., Paul, L., & **Stewart, A. J.** (2017). Estimating carbon stock in lowland Papua New Guinean forest: Low density of large trees results in lower than global average carbon stock. *Austral Ecology*, *42*(8), 964-975.. ISSN 1442-9985 DOI https://doi.org/10.1111/aec.12525 (4 Citations)

R5. **Middleton, J**., Abdad, M.Y., Beauchamp, E., Colthart, G., Cooper, M.J.F., Dem, F., Fairhead, J., Grundy, C., Head, M.G.H., Inacio, J., Jimbudo, M., Jones, C.I., Konecna, M., Laman, M., Macgregor, H., Novotny, V., **Peck, M**., Paliau, J., Philip, J., Pomat, W., Roberts, C., Sui, S., **Stewart, A.J.A.**, Walker, S.L., Cassell, J.A.1 (2020) Health service needs and perspectives of remote forest communities in Papua New Guinea: study protocol for combined clinical and rapid anthropological assessments with parallel treatment of urgent cases. *BMJ Open 10*(10), e041784. DOI http://dx.doi.org/10.1136/bmjopen-2020-041784

R6. **Middleton, J**., Cassell J.A., Colthart G., Dem, F., Fairhead, J., Head, M.G., Inacio, J., Jimbudo, M., Laman, M., Novotny, V., **Peck, M**., Philip, J., Pomat, W., Sui, S., West-Oram, P., and **Stewart, A.J.A**. (2020) Rationale, experience and ethical considerations underpinning integrated actions to further global goals for health and land biodiversity in Papua New Guinea. *Sustainability Science* 15: 1653-1664. DOI https://doi.org/10.1007/s11625-020-00805-x

Citation data from Google Scholar.

4. Details of the impact

Conservation of tropical forests and their exceptionally high biodiversity in Ecuador and Papua New Guinea presents unique challenges due to poor central governance and traditional land ownership residing predominantly with remote village communities. Establishment of protected areas therefore requires community engagement, which the team has achieved through education, training, developing novel employment opportunities, alternative livelihoods and health services provision.

Establishment, expansion and enhancement of Protected Areas

Research to identify the priority area for conservation of the critically endangered brown headed spider monkey in NW Ecuador [R1] underpinned successful Royal Geographical Society funding to work with forest communities to identify conservation strategies in 2012 [S1], including establishment of a protected area. This co-produced research [R1, S1] was key to Peck sourcing initial funding for land purchase in 2015 (GBP800,000, Scott Rasmussen Foundation) and

initiating land purchase through the University of Sussex and local partners Cambugan Foundation [S2]. With 2,000ha of forest purchased by 2016, the Tesoro Escondido Spider Monkey Reserve was transferred to a local non-governmental organisation (Jocotoco Foundation) in 2019 with a clear mandate for autonomous community-based management [S2], which was identified as critical following community engagement research [S1]. It now protects approximately 150 brown-headed spider monkey individuals (60% of the global population) in addition to other critically endangered and endangered species (i.e. Canandé Magnolia, Mache Glass Frog, Great Green Macaw, Baudó Guan, Banded Ground-cuckoo, Ecuadendron Tree) in this global biodiversity hotspot. The project is recognised by the IUCN, where the Tesoro Reserve, "working under a community participation model … now protects 20 km^2 [2,000ha] of rainforest habitat and has brought the species [brown-headed spider monkey] back from the brink of extinction" (Diego Tirira, lead of the Primates IUCN Specialist Group) [S3]. The importance of research is highlighted by Dr Citlalli Morelos: "the existence of this reserve and the conservation of almost 20 km^2 of forest in one of the most biologically important forest systems globally, where over 95% of the forest has been lost, can be attributed to the research and active conservation work undertaken by Dr Peck" [S2].

In PNG, Stewart helped establish Binatang Research Center (BRC) in 2001 which supported the remote village of Wanang in declaring two-thirds (10,000ha) of its rainforest as a legal entity in 2005 (Wanang Conservation Area, WCA), protecting it from logging operations that completely surround it. This collaboration has continued to impact on conservation efforts in the current REF period, as described by BRC collaborator Prof Novotny:

> "As a direct result of this collaboration, the PNG Conservation and Environment Protection Agency is now planning its [the WCA's] designation as a national protected area. Further, our joint projects have also [in 2018] facilitated mapping and preparation of another 20,000 ha rainforest conservation along a 41km complete altitudinal transect from the lowlands to Mt. Wilhelm, the PNG's highest mountain. The Sussex University research has also been the main driver for establishing health service provision in the Wanang community [since 2016, see below], thereby incentivising the protection of an additional 4,500 ha of forest from further logging or conversion to agriculture. This includes the creation of buffer zones around the WCA and enhanced protection and monitoring of vulnerable species within it. … The joint projects with the Sussex University represent one of the most sustained and impactful collaborations in biodiversity research and conservation in PNG in the past 20 years." [S4]

Enhanced sustainable livelihoods in challenging remote settings

Ecological research in hyper-diverse tropical forest communities requires large teams of skilled staff. Stewart and Peck helped pioneer the concept of 'para-ecologists' [R2]: locally recruited staff who receive training to complete tasks such as: collecting field data, conducting experiments, databasing and preliminary analysis. These highly motivated nationals then become the best advocates for conservation in their communities. In conflict situations, local community involvement has ensured protection, eliminating the need for park guards as local communities engage directly to address threats. Stewart and Peck have applied the para-ecologist concept at the BRC [S4] in PNG (one of the three top para-ecologist teams in the world [S4]), the community-owned SLRRS [S5] and the TESMR [S2], in NW Ecuador, resulting in benefits for science and local communities:

1. Providing attractive careers for para-ecologists through training in research and conservation within the community: since August 2013, approximately 75 trained in PNG, more than 100 in Ecuador, and 8 PNG nationals brought to the UK for intensive training. Many have progressed to other posts in science, including several prestigious senior positions. In Ecuador the TESMR is now a "pioneer in empowering local people long-term to transition to sustainable livelihoods and conservation of their environments through our paraecologist programme" [S2]. Dr Bito, trained by Sussex as a PNG Masters student, and appointed in 2018 as Principal Entomologist to the Queen Alexandra Bridwin Butterfly conservation project in PNG, reflects that "my early years at BRC, including those working on Dr Stewart's project, provided a crucial launchpad for where my career took me

subsequently… My career is an exemplar of the broad impacts that come from research that is fully embedded in the community and fully invests in the people that are involved" [S4].

2. Sustainably improving local economies, through supporting biodiversity research by visiting scientists, students, volunteers and ecotourists, who pay land fees for forest access, employ local research assistants and guides and pay for food and accommodation. This sustainable livelihood model has gained international recognition for impact by winning the prestigious 2015 United Nations Development Programme's Equator Prize for the Wanang community [S6]. In Ecuador, the SLRRS in 2019 generated 70% (USD95,000) of their annual income through 'scientific tourism' [S5], hosting over 380 undergraduate and postgraduate students from 2014 – 2020 that has resulted in "the community-run cooperative to finally establish and maintain stable work conditions for community and other staff members. For the first in time in the history of Santa Lucía the cooperative was able to offer long-term contracts, including public health insurance" [S5].
3. Leveraging additional finance from private sources. In Ecuador, ongoing annual funding of USD120,000, initially sourced by Peck from Synchronicity Earth (2015), allows the TESMR to "employ 5 full-time paraecologists, cover costs of our research programme and administration, and cover my [reserve director] salaries" [S2].
4. Translating scientific research into educational outreach programmes, informing policy at local and national levels and underpinning practical, grassroots conservation action and livelihoods. Research into alternative livelihood options for communities in and around the TESMR by Peck and Client Earth [S7] in 2013 identified opportunities to simultaneously boost income and conservation; working with local cacao producers, they helped establish the 'Washu' Chocolate Project [S7] in 2015, which works with Ecuadorian farmers to ensure fair prices in return for halting deforestation and engaging in reforestation around Tesoro Reserve. Martin Simmoneau of the Washu Project comments: "Dr Peck, the University of Sussex … can be very proud of what they've achieved in terms of meeting development and conservation targets ... This project is a great example of a success story that goes beyond stats and impact. It is as much about using compassion, solidarity and the diversity in human cultures and knowledge to achieve conservation targets" [S7]. Since 2017 the TESMR has also addressed food security by training 30 local women in agroecology and permaculture (1-year course) that now includes collaboration with the Ministry of Education to include 11 schools (700 pupils/teacher training). Commenting on the influence of the research collaboration with Sussex in PNG, Prof Novotny concludes that "overall, it is a testament to the impact that ongoing research programmes can have on conservation of key habitats, but also on a community that is integrated into the scientific work" [S4].

Health service provision for remote communities

Building on existing collaborations with the Wanang community, Stewart and Middleton have introduced medical services to improve community health and incentivise continued forest protection and conservation area expansion. In 2016 research by Stewart and Peck the Wanang community identified "health care, absent from the village … as the main missing service at present" [S8]. In response, in 2018 Middleton led a combined clinical and rapid anthropological assessment of health service needs [R5]. This was the first time a doctor had ever been to Wanang; over half the community were examined and 63 urgent cases were treated on-site (including malaria, tropical skin diseases, respiratory infections). Data from this assessment provided the evidence of medical need for a nurse-staffed clinic which opened in 2020, built and staffed with funds obtained by Stewart and Middleton [proposal, S9]. This is providing primary care for the first time for 2,000 people in 10 remote villages where the nearest pharmacy or hospital is a two-day walk away [R6]. The Aid Post was registered with Madang Provincial Health Authority in 2020, securing its long-term funding beyond the existing Sussex-held research grant from the Darwin Initiative which is evaluating its impact on conservation outcomes and community health [S9]. As there is no ambulance service in the area, Middleton trained and supplied a new 11-strong evacuation team for the Wanang area in 2019, consisting of parabiologists from BRC [S9]. New conservation and no-impact areas were declared in 2020 as a consequence of the University of Sussex health intervention [map, S9].

This success in PNG has also been paralleled in Ecuador where, since 2017, the Tesoro Escondido Reserve has provided medical training to local health centre medics and annual first aid training to 30 people (3-month course). The significance of this impact in both locations is expressed by Filip Damen, Chair of the Wanang Health Committee:

> "the Wanang community appreciate and thank Alan Stewart, Jo Middleton, and Mika Peck of the University of Sussex SSRP-Darwin funded project for the health needs assessment and urgent treatments in 2018 and the resultant newly build Aid post. University of Sussex has taken the initiative to give this Aid post to Wanang community that is very unique and outstanding in most of the rural areas in PNG ... University of Sussex's involvement in the community, and its contribution will encourage us, our people and our children in Wanang community to work in collaboration to support and look after our forest, rivers and land to maintain this conservation project." [testimonial, S9]

5. Sources to corroborate the impact

S1. Peck & Moscoso (2012) A conservation strategy for the critically endangered Brown-headed Spider Monkey (*Ateles fusciceps,* Primates, Atelidae) in the Coop Tesoro (NW Ecuador). Report to the Royal Geographical Society. [PDF]

S2. Web link to Tesoro Escondido Spider Monkey Reserve and Director's testimonial including map and links to official land purchase deeds (October 2020). Corroborates Dr Peck's involvement in establishing the reserve and research station. [PDF]

S3. Primate Specialist Group, International Union for Conservation of Nature (IUCN) Diego Tirira, mastozoologist lead Testimonial Letter (November 2020). Corroborates capacity building and research outputs generated by Ecuadorian researchers supported, and mentored by Peck, and impact of protected areas on survival of critically endangered primates in Ecuador. [PDF]

S4. Research collaboration with the Binatang Research Center, Papua New Guinea. Abstract and weblink for currently funded Darwin Initiative project; Testimonial letters of Professor Vojtech Novotny (November 2020) and Dr Darren Bito (January 2021); Web link to Wanang Conservation Area (WCA); Web link to Wanang 50ha forest plot; Web link to Mount Wilhelm Conservation Area (including altitudinal transect); Laurence (2013) paper. Corroborates Dr Stewart's involvement in establishing the BRC research station, an NGO in PNG for training Papua New Guineans to advance local biodiversity research and develop educational and biodiversity conservation programmes, targeting grassroots audiences. [PDF]

S5. Web site for Santa Lucia Field Station and Community President Testimonial (December 2020) corroborates Dr Peck's involvement in establishing this research station, which creates a sustainable local economy and forest conservation by means of a well-run ecotourism business based on training and research. [PDF]

S6. United Nations Development Programme (UNDP) Equator Prize 2015 awarded to the Wanang community for establishment of the Wanang Conservation Area. [PDF]

S7. Weblink to Washu Chocolate Project, Client Earth SUSTAIN Project Report 2013 and testimonial from Martin Simmoneau, Washu Project (November 2020) corroborating Dr Peck's involvement in research and work to support establishment the sustainable chocolate project. [PDF]

S8. Creating sustainable livelihoods whilst protecting rainforest in Papua New Guinea (PNG) from logging. 2016 Report to the Waterloo Foundation. Research by Stewart and Peck in which the Wanang community identified health services as something to enable their continued conservation efforts. [PDF]

S9. Wanang heath service related testimonial and evidence: Abstract and url for funded application to Darwin Initiative; Testimonial from Wanang Heath Committee (December 2020); Snapshot of diagnoses, treatments, referrals and vaccinations at Sussex built and funded nurse-staffed Aid Post (2020); Summary of Sussex evacuation and first aid training at Wanang (2019); Conservation areas declared as a result of University of Sussex health Intervention (2020). [PDF]