Institution: University of Southampton		
Unit of Assessment: 05 Biological Sciences		
Title of case study: 05-01 Toolkit for Ecosystem Service Site-based Assessment (TESSA v.2): practical tools for real-world conservation		
Period when the underpinning research was undertaken: February 2013 – July 2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s): Kelvin Peh	**Role(s) (e.g. job title):** Lecturer in Conservation Science	**Period(s) employed by submitting HEI:** February 2013 – present
Period when the claimed impact occurred: August 2013 – July 2020		
Is this case study continued from a case study submitted in 2014? N		

1. Summary of the impact

Toolkit for Ecosystem Service Site-based Assessment (TESSA) v.2 has enabled conservation practitioners to rapidly measure and evaluate the benefits, in the form of ecosystem services (**ES**s), provided by a site of biodiversity importance and to assess their sensitivity to land use change. The toolkit is recognised internationally as a policy support mechanism and has played a role in shaping global standards for documenting ESs of Key Biodiversity Areas. The use of TESSA v.2 has resulted an incorporation of biodiversity protection into the operational plan (legal document) of at least 45 community-managed forests in Nepal; and a firm policy commitment from Nepal's Department of Forest and Soil Conservation to introduce this revised community forest operation planning guidelines to all community managed forests in the country. The toolkit is recognised as an important ES assessment tool, and has been incorporated into at least three globally significant conservation "toolboxes" including the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services' Policy Portal, and capacity-building programmes including the Tropical Biology Association's training courses.

2. Underpinning research

Background to TESSA v.1

Intact ecosystems play a critical role in ensuring the continued delivery of benefits – ecosystem services (ESs) obtained from nature – for human wellbeing. Yet despite the recognition that wild nature is vital in limiting risks that local communities face from climate change and natural disasters, natural systems still face ongoing habitat conversion and degradation and the provision of ESs is now in serious decline. Conservation practitioners need to have reliable information about which areas of remaining natural habitat are most important for generating ESs and should, therefore, be priorities for conservation. Prior to 2010, there were only a handful of empirical studies on how and where ESs are generated, at the fine scale at which most land-use decisions are made. Hence, Dr Kelvin **Peh** (at the University of Cambridge 2010–2012) and Cambridge Conservation Initiative team (comprising leading internationally-focused biodiversity conservation organisations based in and around Cambridge) developed TESSA, aimed at, for the first time ever, putting a tool that generates this information directly into the hands of local practitioners. Early methods in TESSA (v.1) required refinement; the toolkit covered only five types of ESs (climate-change mitigation services, hydrological services, nature-based recreation and tourism, the harvest of wild goods and cultivated goods) and was not sufficient for a complete ES assessment.

The development and launch of TESSA v.2

Peh moved to the University of Southampton (UoS) in February 2013 and since then has worked with at least 60 ecosystem service experts, and undergraduate, Master's and PhD students (funded by UoS) to further develop and test (with Cambridge Conservation Initiative team) the beta version of the improved toolkit. The resultant TESSA v.2, launched in December 2017, incorporates three additional key ESs – coastal protection services, pollination services, and cultural ecosystem services – jointly developed at UoS. TESSA v.2 is more comprehensive, designed to guide non-specialists through state-of-the-art methods for the rapid assessment of a total of eight ESs at their site of interest [**3.1**]. The improved TESSA v.2 toolkit also emphasises the importance of making the same estimates for the most likely alternative state of the site, for

example after conversion to agriculture (i.e. TESSA approach). A key part of Peh's work has been to train an extensive network of conservation practitioners in many countries to use the TESSA approach and methods, thereby establishing a community of TESSA users, particularly in developing world contexts, to support biodiversity conservation.

Partnerships with international and local environmental non-governmental organisations (NGOs) allowed Peh and collaborators to pilot the beta methods in different habitats across the world, such as mountain forest in Nepal [**3.2, 3.3**], tropical forest in Monserrat [**3.4**], and fenland in the UK [**3.5**]. These field tests not only demonstrated the versatility of the toolkit in a wide range of habitats for generating scientifically robust data to support local conservation, but also informed the development of TESSA v.2:

1. Shirvapuri-Nagarjun National Park, Nepal [**3.2**] – elucidated the synergies between biodiversity conservation and ecosystem services provision and highlighted the importance of including cultural ecosystem services in TESSA v.2 for an integrated ES assessment.

2. Phulchoki mountain forest, Nepal [**3.3**] – the outcomes of community forestry were favourable to most stakeholders; this study contributed to the development of a guidance on stakeholder analysis for TESSA v.2.

3. Centre Hill, Montserrat [**3.4**] – demonstrated that the eradication of invasive species could improve ecosystem services provision and helped to improve the valuation methods for the climate regulation services, harvested wild goods and nature-based recreation.

4. Wicken Fen, UK [**3.5**] – showed that wetland restoration provided more ES benefits than arable land and helped to standardise TESSA v.2 approach to benefit-cost analysis.

3. References to the research

3.1 Peh KSH et al. (2017). *Toolkit for Ecosystem Service Site-based Assessment (TESSA) Version 2.0*. TESSA, UK. https://eprints.soton.ac.uk/416976/

3.2 Peh KSH et al. (2016). Synergies between biodiversity conservation and ecosystem service provision: lessons on integrated ecosystem service valuation from a Himalayan protected area, Nepal. *Ecosystem Services*, *22*(Part B), 359-369. https://doi.org/10.1016/j.ecoser.2016.05.003

3.3 Birch JC, **Peh KSH** et al. (2014). What benefits do community forests provide, and to whom? A rapid assessment of ecosystem services from a Himalayan forest, Nepal. *Ecosystem Services*, *8*, 118-127. https://doi.org/10.1016/j.ecoser.2014.03.005

3.4 Peh KSH et al. (2015). Potential impact of invasive alien species on ecosystem services provided by a tropical forested ecosystem: a case study from Montserrat. *Biological Invasions*, *17*(1), 461-475. https://doi.org/10.1007/s10530-014-0743-9

3.5 Peh KSH et al. (2014). Benefits and costs of ecological restoration: rapid assessment of changing ecosystem service values at a U.K. wetland. *Ecology and Evolution*, *4*(20), 3875-3886. https://doi.org/10.1002/ece3.1248

4. Details of the impact

Impact on international biodiversity policy

1. The Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services (IPBES) is an international body that provides policymakers and decision makers with objective scientific assessments of the state of ecosystem services and biodiversity, and the tools and methods for measuring and monitoring natural capital (i.e., an equivalent to IPCC for biodiversity). IPBES provides policy-relevant knowledge for governments, the private sector and local communities, as well as policy support (i.e. "*identifying policy-relevant tools and methodologies, facilitating their use, and catalysing their further development*"). Since 2018, TESSA v.2 has been included within the IPBES Policy Support Portal which describes the toolkit as a policy support tool that can inform, assist and enhance development and implementation of policy instruments to better protect nature and promote its sustainable use. IPBES also highlights the toolkit as "*relatively low cost compared with many other tools, and does not require advanced technical skills*" and "*applicable to users from developing and developed countries*". These extracts from IPBES summarise the overall importance of TESSA v.2 in the context of other ES tools and what the toolkit has allowed conservation practitioners to do that was not previously possible. [**5.1**]

2. Bird Conservation Nepal (BCN), a local environmental NGO in Nepal working with BirdLife International, used TESSA v.2 to assemble data on benefits provided by community-managed forests – preserving cultural values; creating employment and incomes; maintaining water supplies; enhancing resilience of ecosystems and economies; conserving traditional medicines; enhancing equality; and empowering women through fairer distribution of more diverse goods and benefits – and the key threats to their sustainability. With the resultant ES knowledge, BCN worked with the Department of Forest and Soil Conservation, and the Federation of Community Forestry Users Group to include community forest management into the country's National Biodiversity Strategy and Action Plan (NBSAP). Utilisation of TESSA v.2 therefore resulted in biodiversity protection being incorporated into the Operational Plans (national policy instruments) of at least 45 community managed forests, to be implemented as priority actions. These community forests are distributed across the five main physiographic regions in Nepal and involved at least 10 of the country's 36 Important Bird and Biodiversity Areas. The Department of Forest and Soil Conservation and BCN are also in the process of publishing an official *Biodiversity Supplement to the Community Forest Operational Planning Guidelines* (currently in press). This highlights the Department's firm policy commitment to rolling out the revised Community Forest Operation Plans to 22,000 community managed forests as part of Nepal's NBSAP, in order to mainstreaming biodiversity conservation and ecosystem services provision into community forestry in Nepal. This would ensure that 17 million hectares of community forests (28% of Nepal's total forest area) are being managed sustainably, with benefits for biodiversity conservation as well as rural livelihoods of 2.24 million households [**5.2**].

3. The International Union for the Conservation of Nature (IUCN) governs the Global Standard for the Identification of Key Biodiversity Areas (KBAs), a set of guidelines for identifying sites that contribute significantly to the global persistence of biodiversity. The Science for Nature and People Partnership (SNAPP) Ecosystem Services and Biodiversity working group was established to integrate existing work on ecosystem services assessment with the IUCN KBA guidelines in order to "*provide a much-needed synthesis of the human well-being benefits associated with protecting globally important biodiversity sites*" [**5.3**]. SNAPP organised a workshop in Myanmar in 2017 (48 participants from academia, NGOs and Myanmar government) to make recommendations on classification schemes and checklists for documenting ecosystem services and human wellbeing benefits of KBAs as part of the information compiled during KBA documentation (through the application of the global KBA standard). Peh presented the TESSA case study of Moeyungyi wetland reserve, Myanmar, in this workshop and tested the beta Global KBA Standard approach for documenting ecosystem services on Moeyungyi wetland using his ES knowledge of the site derived from using TESSA (beta) v.2 in 2015. Peh's feedback through this pilot exercise was used by SNAPP to revise the ecosystem services documentation for KBAs [**5.4**]. Addressing the question on how quantitative ecosystem services assessment for KBAs can further support specific conservation objectives in Myanmar, the workshop's final report stated that it is crucial that the conservation practitioners can "*provide policy recommendations with TESSA analysis of [the] current state, alternative degraded state and alternative restored state [of the site]*" [**5.4**].

<u>Impact on conservation strategies and action planning</u>

1. TESSA v.2 sets out a practical, evidence-based approach to ecosystem service assessment which can be applied at a site of interest in any country for generating information to help with decisions about how land is used. *RESTORE* is a major partnership project between seven organisations across NW Europe, co-financed by the European Union Interreg IVB programme, which applied TESSA (beta) v.2 from 2014 to 2015 – particularly the new methods for assessing cultural ecosystem services – to identify and compare the benefits provided by different rehabilitation strategies at 10 mineral extraction sites in northwest Europe [**5.5**]. Specifically, *RESTORE* used the toolkit at Curfs quarry nature reserve, Netherlands, and found that current active management of the site "*has resulted in higher biodiversity and aesthetic value, and hence enhanced the annual number of visitors who have had enjoyed the landscape by 100% (from 2,690 to 5,390 people annually) when compared to less active management of the habitat; thus providing evidence for supporting the current management of the site as a nature reserve*". Similarly, *RESTORE* used TESSA (beta) v.2 at Wenduine clay pits, Belgium, in 2015 and showed that the current state of the site as a restored wetland, compared with

farmland, "*has a higher experiential use of animals in the landscape (i.e. birdwatching) due to a higher biodiversity; and the overall benefits of the site may worth 17% more in monetary terms along a timeline of 50 years as wetland than as arable farmland*" [**5.5**]. *RESTORE* states that these two ES assessments, together with eight others in the UK and Germany, have led to the development of "*a framework for restoring mineral sites to provide benefits for biodiversity, local people and local economies*"; "*the best practice in quarry restoration*"; and the case studies to "*showcase to EU policy-makers the delivery of environmental benefits in parallel with economic development*" [**5.5**]. RSPB, a key partner of *RESTORE* states, "*TESSA can be one important tool in the decision-making process and can demonstrate that conserving sites for biodiversity conservation has additional benefits for people*" and "*the results from TESSA will be useful in demonstrating the effects of conservation management*", particularly "when such management has been controversial or contested" [**5.6**]. These case studies provide evidence that TESSA v.2 is embedded into restoration policy and practice for better suited decisions.

2. TESSA v.2 aids land use planning, as demonstrated by the collaboration between UoS and the UK Environment Agency (EA) in 2017 to assess options to manage the water level of the River Itchen at its tidal confluence within Riverside Park, Southampton. The flow of the Itchen into the estuary is currently controlled by a sluice gate at Woodmill (a location within the park), which has reached a critical condition and is no longer economically viable to maintain [**5.7**]. The EA applied the TESSA framework to rapidly assess the Cultural Ecosystem Services (CES) of Riverside Park in its current state and under a proposed alternative management option, which centres around the decommissioning of the sluice gate and conserving the significant local cultural, economic and environmental importance of Riverside Park and the River Itchen [**5.7**]. The EA states, "*TESSA v.2 was selected over alternative tools as a low-cost, written step-by-step approach with a dedicated section focussed on CES assessment which was specifically designed for comparing the impact of contrasting scenarios at the site scale. The findings identify changes in the spatial hotspots of CES and highlight the spatially-specific sensitivity of local stakeholders to land-use change, and the current and future importance of local biodiversity, aesthetic qualities and values*" [**5.7**]. The results from TESSA v.2 have proven useful for Environment Agency and Groundwork South, "*to understand the values and perceptions of local people, and directly contributed to the Woodmill Stakeholder Engagement Plan*" [**5.7**].

<u>Impact on capacity of ecosystem service assessment</u>

1. The IUCN World Commission on Protected Areas embedded TESSA v.2 in a recent report as one of nine tools for conducting ecosystem service assessments in protected areas, KBAs and natural World Heritage Sites, recognising it as an important tool in the land use decision-making process. TESSA v.2 was shortlisted "*due to its free availability and applicability in the context of these areas*". This report is available to download from the IUCN website since July 2018 and has been referenced in seven IUCN policy documents and read 154 times on IUCN library system, 218 times on Mendeley and 1,031 times on ResearchGate. IUCN World Heritage Outlook distinguishes TESSA v.2 from other tools as a tool that "*provides accessible guidance and low-cost methods to generate information that can be used to influence decision making [even if the users have no economic data from their sites]*" [**5.8**].

2. The intergovernmental Group on Earth Observation – Biodiversity Observation Network (GEOBON) has developed BON in a Box, an online platform to "*simplify the discovery of state-of-the-art tools for data collection, management, analysis and reporting biodiversity observations*" and their experts selected TESSA v. 2 for inclusion on the BON in a Box platform in June 2017, with an aim "*to increase the capacity for biodiversity observations, data management and analysis through a simple discovery and technology transfer mechanism and promote interoperability through the convergence in use of tools and standards*" [**5.9**]. The World Business Council for Sustainable Development and Natural Capital Coalition has also incorporated TESSA v.2 into their interactive database – the Natural Capital Protocol Toolkit – in July 2017 to facilitate businesses uptake of natural capital measurement and valuation [**5.10**]. Local NGOs have applied the TESSA framework and methods globally in at least 96 protected and unprotected areas in 26 countries to highlight the multiple benefits that people obtained from nature conservation. To date, the toolkit has received over 2,500 download requests from at least 69 countries, of which 26% from NGOs, 12% private sector and 11% government.

Impact on conservation capacity building

1. The Tropical Biology Association (TBA) conducted TESSA (beta v.2) training courses in Kenya twice in 2014. Eleven conservation practitioners from nine African countries attended these TBA training workshops. An immediate outcome of these courses was application of TESSA by the course participants for the first time in Cameroon, Ghana, Kenya, Malawi, Madagascar, Uganda and Zimbabwe. Feedback included "*I am already seeing the possibility of immediate application of the tools to generate answers to policy questions*" [**5.11**]. A workshop participant has used TESSA to raise awareness and interest in the conservation of COPAL community forest (4,800 ha; 5,000 inhabitants) in Cameroon. TBA states, "*A long-term [sic] impact of TESSA's application in Cameroon is that the local communities decided to keep their natural forest intact because they recognised the benefits the forest was bringing them. Further, the manager that TBA trained was also employed by the Cameroon forest department because of the expertise he had gained through the training and subsequent application of TESSA*" [**5.11**]

2. The UN Environment TEEB programme also requested the training course, which was run by Tropical Biology Association and Liberia's Environmental Protection Agency in June 2017 to build the capacity of 26 Liberian conservation managers and practitioners to enable better management of their natural resources. Feedback that reflected personal change among the participants included: "*TESSA has given me a new direction*" and "*I can see how communities can benefit from services around them and how I can communicate this*" [**5.11**].

5. Sources to corroborate the impact

5.1 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) website. Policy support tools and methodologies. https://ipbes.net/policy-support/tools-instruments/toolkit-ecosystem-service-site-based-assessment-tessa-v20 (corroborates TESSA as a policy support tool for assembling data and knowledge).

5.2 Letter from Bird Conservation Nepal to corroborate TESSA's contribution to the revision of Nepal's community forest operational plans; dated 13 July 2020.

5.3 SNAPP website https://snappartnership.net

5.4 Science for Nature and People. Workshop Report: Key Biodiversity Areas: Supporting Sustainable Development in Myanmar. Naypyidaw, Myanmar 28-30 March 2017 (TESSA and the case study at Moeyingyi wetland are referenced in the document).

5.5 Letter from RESTORE project to corroborate that TESSA was used in their economic analysis of ecosystem service benefits through quarry restoration; dated 16 September 2020.

5.6 Michael MacDonald, a senior conservation scientist at the RSPB's Centre for Conservation Science explained how TESSA was used in the major EU-funded project RESTORE in Ecosystem News (2015), Issue 11, 9-12.

5.7 Letter from Environment Agency to corroborate the application of TESSA in the land use planning; dated 19 August 2019.

5.8 Neugarten R.A. et al. 2018. Tools for measuring, modelling, valuing ecosystem services: Guidance for Key Biodiversity Areas, natural World Heritage Sites, and protected areas. Gland, Switzerland. IUCN. 70 pp. https://portals.iucn.org/library/node/47778; and IUCN World Heritage Outlook website https://www.worldheritageoutlook.iucn.org/benefits/decision-tree/4-economic-valuation-ecosystem-services (both corroborate TESSA v.2 as one of the main ES assessment tools).

5.9 Email from Vice-Chair of GEO BON to corroborate the inclusion of TESSA on the BON in a Box platform (https://boninabox.geobon.org/); dated 10 May 2017.

5.10 Natural Capital Protocol Toolkit developed by World Business Council for Sustainable Development and Natural Capital Coalition. https://www.naturalcapitaltoolkit.org/search?keywords=TESSA&sortBy=name&category= (incorporates TESSA v.2 into an interactive database to help businesses to measure natural capital).

5.11 Letter from Tropical Biology Association to corroborate the use of TESSA in building the capacity of conservation practitioners from Africa for better managing their natural resources, and an impact of TESSA's application in Cameroon; dated 19 August 2019.