Institution: Anglia Ruskin University

Unit of Assessment: Geography, Environmental Studies and Archaeology

Title of case study:
Restoration of wetlands: best practice guidelines and practical toolkits for policy makers and practitioners

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

Our research on the hydro-ecology of restored wetlands has had impact through i) Changing the practices of conservation Non-Governmental Organisations (NGOs) in wetland habitat restoration and monitoring. This has been achieved by re-framing approaches to restoration as 'open-ended' rather than 'prescriptive'; and by producing a clear and accessible new guideline document on how to monitor open-ended, landscape-scale wetland restoration projects; ii) Building capacity for NGOs in biodiversity monitoring through running 44 workshops for volunteers on species identification; iii) Challenging conventional conservation wisdoms on approaches to habitat restoration through debate with stakeholder groups; iv) Increasing the influence of conservation NGOs and government agencies by providing them with a new toolkit for measuring the ecosystem services of restored wetlands.

2. Underpinning research (indicative maximum 500 words)

Fundamental and applied Research on biophysical processes that underpin the functioning of wetland ecosystems and their provision of ecosystem services, at a landscape-scale, has been carried out within the Animal and Environment Research Group (AERG) since 2007 by Dr. Francine Hughes and Dr. Peter Stroh. The research has taken place at two landscape-scale wetland restoration projects in the fens of East Anglia, UK: The Great Fen Project, owned by the Wildlife Trust (WT) and managed by WT and Natural England (NE); and the Wicken Fen Vision Project, owned and managed by the National Trust (NT).

The research has two main strands:

1. **The study of plant-soil-hydrology interactions in landscape-scale wetland restoration projects**, how these change through time and the uncertainties associated with managing ecosystems using dynamic natural processes. This research has shown that when dynamic natural processes such as natural regeneration, fluctuating hydroperiods and low-intensity naturalistic grazing regimes are used as restoration tools rather than more prescriptive or engineered restoration activities, there are considerable uncertainties in terms of biodiversity outcomes. We have described this dynamic approach as an 'open-ended' approach to restoration in terms of biodiversity outcomes and it maps well with the 'ecosystem approach' to conservation advocated by the Convention on Biological Diversity and the UK's post-2010 Biodiversity Framework (DEFRA, 2010). The research shows that when using dynamic natural processes the previous land use history of restored land acts as a significant filter on restoration outcomes (Stroh et al. 2012a, 2012b, 2013).
2. **The design of monitoring and evaluation systems for landscape-scale wetland restoration projects.** In this applied area of research we have designed (i) A biophysical monitoring approach suitable for landscape-scale wetland restoration projects and contributed to (ii) a toolkit for measuring ecosystems services that can be used at wetland restoration projects. These monitoring systems keep track of both changing landscape dynamics and changing ecosystem service provision over the longer time periods within which landscape-scale restoration projects are framed:
   (i) The biophysical monitoring approach advocates the monitoring of hydrological and habitat change through time, using an 'open-ended' approach, rather than monitoring against prescribed targets. It also introduces the concept of 'landscape-species' for monitoring the development of habitats over the long-term (Hughes et al, 2012).
   (ii) Research on how to design a toolkit for measuring and monitoring ecosystem services draws on the fundamental ecohydrological research in Strand 1, which informed, specifically, the methods designed for measuring water-related ecosystem services. A practical toolkit, the Toolkit for EcoSystem Service Assessment (TESSA), intended for measuring and monitoring ecosystem services at conservation or restoration sites was the research output of this work (Peh et al, 2013). Toolkit development was led by the

University of Cambridge in partnership with Anglia Ruskin University (ARU), Birdlife International (BI), UNEP-World Conservation Monitoring Centre (WCMC) and Royal Society for the Protection of Birds (RSPB). Hughes led the water-related services section of the TESSA toolkit.

The research has been led since 2007 by Dr. Francine Hughes (P/T Reader, employed at ARU since November 2003) with Dr. Peter Stroh (employed at ARU as F/T project scientific officer from April 2007 to October 2012 and P/T PhD student from 2008 to April 2012). The research in Strand 1 was carried out in partnership with NT, WT and NE; the research in Strand 2 also included the partners listed above (BI, UNEP-WCMC and RSPB and University of Cambridge).

3. References to the research (indicative maximum of six references)
Authors in **bold** are currently or have previously been staff members in the Animal and Environment Research Group between 1st January 1993 and 31st December 2013.

1. **Stroh, P.A.,** Mountford, J.O., Araya, Y.N. and **Hughes, F.M.R**. (2013) Quantifying soil hydrology to explain the development of vegetation at an ex-arable wetland restoration site. *Wetlands* 33:311-320. DOI: 10.1007/s13157-013-0385-1 *[included in REF 2]*

2. **Stroh, P.A. Hughes, F.M.R**., Mountford, J.O. (2012a) The potential for endozoochorous dispersal of temperate fen plant species by free-roaming horses. *Applied Vegetation Science* 15:359-368 DOI: 10.1111/j.1654-109X.2011.01172.x *[Included in REF 2]*

3. **Stroh, P. A., Hughes, F.M.R.,** Sparks, T. and Mountford, J.O. (2012b) The influence of time on the soil seed bank and vegetation across a landscape-scale wetland restoration project. *Restoration Ecology* 20:103-112. DOI: 10.1111/j.1526-100X.2010.00740.x*[included in REF 2]*

4. **Hughes, F.M.R., Stroh, P.,** Adams, W.A. Kirby, K. Mountford, J.O., Warrington, S. (2011) Monitoring and evaluating large-scale, open-ended habitat creation projects: a journey rather than a destination. *Journal for Nature Conservation* 19: 245-253. DOI:10.1016/j.jnc.2011.02.003

5. Peh, K. S.-H., Balmford, A., Bradbury, R. B., Brown, C., Butchart, S. H. M., Brown, C., **Hughes, F. M. R.,** Stattersfield, A., Thomas, D. H. L., Walpole, M., Bayliss, J., Gowing, D., Jones, J. P. G., Lewis, S. L., Mulligan, M., Pandeya, B., Stratford, C., Thompson, J. R., Turner, K., Vira, B., Willcock. S. & Birch, J. (2013) TESSA: a toolkit for rapid assessment of ecosystem services at sites of biodiversity conservation importance. *Ecosystem Services 5: 51-57.* http://dx.doi.org/10.1016/j.ecoser.2013.06.003

These publications are in international journals that have a rigorous peer-review process.

Key external research grants that funded the above research and which were competitive and peer-reviewed at the proposal stage:
Research project entitled *'Monitoring and evaluating landscape scale wetland restoration projects: The Wicken Vision Project and Great Fen Project.'* Principal Investigator (PI) was Dr. Francine Hughes (ARU), two grants awarded by the Esmee Fairbairn Foundation and held at ARU. Grant number 06-2151 (2007-2010) value £129,820 and Grant number 09-2739 (2010-2012) value £89,886. These grants funded a full-time post held by Peter Stroh for the period April 2007-Dec 2012 with a bridging grant in 2010 from AERG. Partnership consisted of Anglia Ruskin University, National Trust, WildlifeTrust, Natural England, Environment Agency, NERC-CEH Wallingford. Additional funding (£10,000) was contributed to the project by the Environment Agency (via National Trust) to purchase and install hydrological equipment and funding in kind (approximate value £12,000) to provide personnel to download data loggers in the field, replace loggers when necessary and carry out some data analyses, with responsibilities specified in a contract between the Environment Agency and Anglia Ruskin University.

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

The research on understanding ecohydrological processes at landscape-scale wetland restoration projects and on designing monitoring systems for such projects, has had impact through:

(i) ***Changing the habitat restoration and monitoring practices of conservation NGOs engaged in wetland restoration.*** This impact has been achieved by re-framing approaches to wetland restoration as 'open-ended' rather than 'prescriptive' and by providing a guideline document for wetland monitoring (see Stroh and Hughes, 2010 in section 5). The adoption of an open-ended approach to wetland restoration has led to a change in management and particularly in monitoring practices by the Wildlife Trust and the National Trust at the Great Fen and Wicken Fen Vision projects respectively. For example, at the Wicken Fen Vision project, the research has had a direct impact on the National Trust's vegetation and water level monitoring protocols. Moreover, the open-ended approach and the guideline document have had wider impact, evidence for which includes:

- Francine Hughes invited to give advisory seminars on 'open-ended' management and monitoring at wetland habitat restoration sites to: (i) British Trust for Ornithology (Jan 2012) (ii) NT's regional conservation advisors and Central Conservation Group (5th Oct 2011); (iii) EU-Leonardo da Vinci Partnership Programme of European wetland reserve managers (22nd May 2012)
- Inclusion of Francine Hughes and Peter Stroh on NT's Local Committee at Wicken Fen (a nature conservation advisory committee which meets 4 times per annum; chaired by Francine Hughes 2004-09) and Peter Stroh on advisory committee at Great Fen.
- 542 downloads of guideline document from ARU's website since November 2011
- A request for 140 hard copies of the guideline document by the EA, NE and NGOs
- Favourable review of the guideline document in British Wildlife, 2011 (25,000 readers)

(ii) ***Capacity building to enhance biodiversity practice.*** Between 2008 and 2012, Peter Stroh and Francine Hughes provided training in biodiversity identification and survey methods at the fen wetland restoration sites for over 100 volunteers from the general public and 60 6th form students from Long Road Sixth Form College, Cambridge by organising 44 training workshops and field visits across Great Fen and Wicken Fen. In addition 18 amateur or professional experts engaged in training or monitoring activities associated with this project. Evidence for the impact:

- Annual biodiversity and hydrological monitoring by specialist groups of volunteers (e.g. bird and plant surveys, hydrological data collection) for the NGOs involved in the wetland restoration projects continues to take place at both Wicken Fen and Great Fen following completion of the research.

(iii) ***Challenging conventional wisdoms through debate with stakeholder groups.*** Francine Hughes has addressed and discussed with a wide range of stakeholder audiences how to design, monitor and evaluate landscape-scale wetland restoration projects using an open-ended approach. Audiences have included members of the public, parish councillors, UK local government representatives, conservation NGOs, government agencies, EU conservation practitioners and policy makers. There is scepticism in some parts of the conservation practitioner community and the general public about the relevance of using an open-ended approach to the setting of restoration objectives because of the uncertain biodiversity outcomes. Peter Stroh wrote 8 articles in regularly distributed NGO newsletters to interpret this work for a wider audience (22,000 households receive these newsletters around Wicken Fen). The increasing recognition of the importance of an open-ended approach to biodiversity conservation and restoration is evidenced by:

- Francine Hughes invited to speak at a Natural England workshop on 'landscape-scale habitat restoration' designed to co-ordinate a response to a draft version of a UK White paper 'The Natural Choice: securing the value of nature' (Feb. 2010)
- Policy changes endorsing landscape-scale, process-driven approaches to biodiversity restoration and their importance in underpinning ecosystem services in UK White paper 'The Natural Choice: securing the value of nature' (DEFRA 2011)

(iv) ***Increasing the influence of conservation NGOs and their capacity for advocacy by enabling the measurement of ecosystem services at protected wetland sites threatened with land use change.*** The Toolkit for ecosystem services measurement (TESSA) began in 2010 as a collaboration between academic and practitioner partners in response to a demand by protected area managers for a toolkit that could measure ecosystem services and provide data for use in advocacy where choices about land use had to be made. It enables non-experts to make state-of-the-art assessments of ecosystem services in all habitats, including restored wetlands. TESSA has been tested or is being tested at 32 sites worldwide by numerous national and international NGOs, (e.g. 15 sites across Africa through the Tropical Biological Association; 9 sites owned or managed by the RSPB plus 2 in UK Overseas territories). Its application at the Wicken Fen Vision project led to the discovery that the economic value per hectare of restored wetland is higher than the pre-restoration use of the land for intensive arable agriculture. Evidence for its impact includes:

- The NT is able to defend its conversion of arable land to restored wetland in the Fens at a time when food security is high on the political agenda
- The RSPB can demonstrate the value of landscape-scale wetland restoration projects in the fens where it has converted arable land and former aggregate sites to wetland
- 1500 hard copies of the TESSA introductory document were requested by Birdlife International's partner organizations during 2012
- Over 35 electronic requests for copies of the TESSA toolkit during its testing phase (January 2011-July 2013)

5. Sources to corroborate the impact (indicative maximum of 10 references)
(Individuals listed work as partners in projects that have contributed to research impacts)

Impacts i) ii) and iii) (These three individuals provide evidence of the value of the research to designing wetland monitoring systems and of their influence on wetland habitat management)

- Regional Conservation Consultant, National Trust Eastern Region (*available from ARU*)
- Property Operations Manager, Wicken Fen National Nature Reserve, National Trust, Cambridgeshire (*available from ARU*)
- Senior Reserves Manager, Natural England, based at Woodwalton Fen, Cambridgeshire. (*available from ARU*)

Stroh, P. and **Hughes, F.M.R.** (2010) *Practical Approaches to Wetland Monitoring: guidelines for landscape-scale, long-term projects*. Available at www.anglia.ac.uk/francinehughes. Developed in partnership with the NT, WT, NE and the Environment Agency (EA).

Impact iv) (These two individuals provide evidence of the value of the research in designing the water-related section of the TESSA toolkit for measuring ecosystem services and the impact on their own organisations' work in protected areas or at habitat restoration projects.

- Head of Communities and Livelihoods, Birdlife International (*available from ARU*)
- Head of Environment Research, RSPB (*available from ARU*)

The TESSA toolkit: compiled by Balmford, A., Birch, J., Bradbury, R., Brown, C., Butchart, S., **Hughes, F.M.R**., Peh, K., Stattersfield, A., Thomas, D. and Walpole, M. (2011)) *Measuring and Monitoring ecosystem Services at the Site Scale: A practical Toolkit*. Available at http://www.birdlife.org/datazone/info/estoolkit

Endorsement of the value of results from the testing phase of the TESSA toolkit in Nepalese Important Bird Areas (IBAs), including Koshi Tappu wetland, by the Ministry of Forests and Soil Conservation in Nepal can be seen in the following publication:
BCN and DNPWC (2012) *Conserving biodiversity and delivering ecosystem services at Important Bird Areas in Nepal*. Kathmandu and Cambridge, UK: Bird Conservation Nepal, Department of National Parks and Wildlife Conservation, and BirdLife International.
http://www.birdlife.org/datazone/sowb/sowbpubs#Ecoservices2012