Institution: Bournemouth University
Unit of Assessment: UOA17
Title of case study: Informing global ecological regeneration policy, planning and implementation.
1. Summary of the impact (indicative maximum 100 words)

Bournemouth University's (BU) pioneering analytical method of mapping ecosystem services and their associated values has led to significant impacts on environmental policy, planning and implementation at a global scale. Research informed the Convention of Biodiversity's (CBD) strategic plan for 2011–20 and its target to restore 15% of degraded ecosystems. Planned delivery of this target employs the use of Forest Landscape Restoration (FLR); an approach developed, tested and refined though BU research. Delivery using this method is already underway, with 50 million hectares committed by individual countries. Such restoration efforts have wide-reaching benefits to people and the environment, including carbon storage and increased biodiversity.

2. Underpinning research (indicative maximum 500 words)

The occurrence of widespread environmental degradation has led to extensive ecological restoration efforts to recover degraded land. Initiatives attract billions of US dollars annually, significantly contributing to sustainable development and adaptation to climate change. Ecological restoration is the focus of international policy, with major initiatives underway to restore degraded ecosystems. However, few attempts have been made to evaluate the cost-effectiveness of such initiatives.

BU's pioneering research has developed and applied a new analytical method, involving the mapping of ecosystem services, their associated values and the comparison of different land use scenarios. This provides a robust method for analysing the cost-effectiveness of a policy intervention. The research is primarily led by Newton (BU 2003 to present), with contributions from BU colleagues including Hodder (BU 2007 to present) and Diaz (BU 1998 to present).

Newton designed and co-ordinated The European Commission funded project: Restoration of Forest Landscapes for Biodiversity Conservation and Rural Development project (ReForLan). ReForLan set out to determine whether ecological restoration is cost effective. Using meta-analysis of 89 restoration assessments across the globe, the team showed biodiversity increases by 44% and ecosystem services by 25%. Although these figures are lower than non-degraded ecosystems, they demonstrated for this first time how effective restoration is a finding that has major implications for policy and practice on a global scale (P1).

Subsequent research examined whether restoration was cost-effective when the value of different ecosystem services was taken into account (P2). Using GIS technologies, Newton analysed the spatial dynamics of ecosystem service provision in seven different dry land areas of Latin America during 2006-9 (P2). Results showed that restoration can be cost-effective, if relatively low-cost, passive restoration approaches are adopted. This research provides one of the first systematic assessments of the cost-effectiveness of ecological restoration actions, and therefore has major policy implications.

Through the project Newton developed the principles and practice for FLR, which featured strongly in future policy making. Newton identified the five core principles of FLR and examined how these principles may be implemented in practice. This included an evaluation of the cost effectiveness of this approach and its impact on human communities.

The outputs of this research were disseminated through a freely downloadable book published by International Union for Conservation of Nature IUCN (R3), which coordinates the Global

Partnership in Forest Landscape Restoration (GPFLR) – one of the key partners identified in support of the 2020 restoration targets. They were also disseminated via the GPFLR website. The principles and practice of FLR were published in an open access journal publication (P4) designed to disseminate a summary of the research and increase its impact.

The BU team also applied this analytical approach to the Frome catchment in the UK (P6), to examine the cost-effectiveness of ecological restoration initiatives proposed by the UK Government. Known as TESS (Transactional Environmental Support System), this multi-disciplinary project involved 14 European partners (G2). The objective was to design a system linking central policy planning to local livelihoods, helping policy makers make an informed decision, while encouraging local people to maintain and restore ecosystem services. This showed ecological networks are unlikely to deliver net economic benefits, at least in intensively used landscapes such as those typical of lowland England. This was contrary to the scientific advice on which the policy was based.

3. References to the research (indicative maximum of six references)

P1. Rey Benayas, J.M., Newton, A.C., Diaz, A. and Bullock, J.M. (2009) A meta-analysis demonstrating enhancement of both ecosystem services and biodiversity by ecological restoration. *Science*, 325(5944), 1121–1124. DOI: 10.1126/science.1172460.

P2. Birch, J., Newton, A.C., Alvarez Aquino, C., Cantarello, E., Echeverría, C., Kitzberger, T., Schiappacasse, I. and Tejedor Garavito, N. (2010) Cost-effectiveness of dryland forest restoration evaluated by spatial analysis of ecosystem services. *Proceedings of the National Academy of Sciences USA* 107(50), 21925–21930. DOI: 10.1073/pnas.1003369107.

P3. Newton, A.C., Cayuela, L., Echeverría, C., Armesto, J.J., Del Castillo, R.F., Golicher, D., Geneletti, D., Gonzalez-Espinosa, M., Huth, A., López-Barrera, F., Malizia, L., Manson, R., Premoli, A., Ramírez-Marcial, N., Rey Benayas, J., Rüger, N., Smith-Ramírez, C. and Williams-Linera, G. (2009) Toward integrated analysis of human impacts on forest biodiversity: Lessons from Latin America. *Ecology and Society* 14(2), 2 [online]. URL: http://www.ecologyandsociety.org/vol14/iss2/art2/.

P4. Newton, A.C., del Castillo, R.F., Echeverría, C., Geneletti, D., González-Espinosa, M., Malizia, L., Premoli, A.C., Rey Benayas, J.M., Smith-Ramírez, C. and Williams-Linera, G. (2012) Forest landscape restoration in the drylands of Latin America. *Ecology and Society* 17 (1): 21 [online]. URL: http://www.ecologyandsociety.org/vol17/iss1/art21/.

P5. Bullock, J.M., Aronson, J., Newton, A.C., Pywell, R.F., Rey-Benayas, J.M. (2011) Restoration of ecosystem services and biodiversity: conflicts and opportunities. *Trends in Ecology and Evolution* 26(10), 541–549. DOI: 10.1016/j.tree.2011.06.011.

P6. Newton, A.C., Hodder, K., Cantarello, E., Perrella, L., Birch, J.C., Robins, J., Douglas, S., Moody, C. and Cordingley, J. (2012) Cost-benefit analysis of ecological networks assessed through spatial analysis of ecosystem services. *Journal of Applied Ecology* 49(3), 571–580. DOI: 10.1111/j.1365-2664.2012.02140.x.

P7. Rey Benayas, J.M., Bullock, J.M. and Newton, A.C. (2008) Creating woodland islets to reconcile ecological restoration, conservation, and agricultural land use. *Frontiers in Ecology and the Environment*, 6(6), 329–336. DOI: 10.1890/070057.

Grants:

G1. 2006-2009: EC Framework 6, INCO programme, €1.7m. A European Commission funded international initiative involving researchers from six countries.

G2. 2008-2011: *Transactional Environmental Support System*, EC Framework 7, €1.7 million. This was a multi-disciplinary project involving 14 European partners, which focused on design of a transactional environmental decision support system, linking central policy planning and assessment of ecosystem services to local livelihoods.

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

The ecological restoration research by Newton and his BU colleagues has led to significant impacts on regeneration policy, planning and implementation on a global scale. Research fed into the Convention of Biodiversity's (CBD) strategic plan for 2011-20 and the target to restore 15% of degraded ecosystems. Planned delivery of this target employs the use of FLR; an approach that was developed, tested and refined through BU research. Delivery using this method is already underway, with 50 million hectares now been committed by individual countries. Such restoration efforts have wide reaching benefits to people and the environment, including food provision and increased biodiversity.

The meta-analysis of ecological restoration impacts (P1) influenced global policy discourse relating to the environment. The publication formed a significant part of the United Nations Environment Programme (UNEP) report "*Dead Planet, Living Planet*" (R4), which formed the basis of the UN's campaign on World Environment Day in 2010. It also featured in the Global Biodiversity Outlook 3 (R7); a global environmental assessment produced by the CBD to inform policy development and implementation. It was featured in the TEEB (R8), a major international study launched by Germany and the European Commission in response to a proposal by the G8+5 Environment Ministers in Potsdam, Germany in 2007, to develop a global study on the economics of biodiversity loss. The research was profiled in an Information Note submitted to the CBD as part of Conference of the Parties (COP) 9 (R9), prepared by the Society for Ecological Restoration.

Most significantly the research has fed into Target 15 of the Convention of Biodiversity's 2020 global targets for ecological restoration. Specifically, the cost-effectiveness research (P2) was featured in Information Note XI/2 in the Convention's COP11 in October 2012 (R12). This in turn fed into the Aichi Biodiversity Targets. Target 15 specifically commits signatory countries to restore at least 15% of degraded ecosystems worldwide, thereby contributing to climate change mitigation and adaptation to combating desertification. BU research provided part of the scientific evidence base on which this new global policy target was agreed. Evidence for this is provided by detailed reference to the research in the CBD papers (Information Notes) on which the policy decisions were based.

In addition the research is supporting the implementation of this policy objective. Publication P1 is specifically referred to as an example of ways and means to support ecosystem restoration (R11). This document in turn directly informed Decision XI/16 of the CBD COP11 in 2012, which endorsed the implementation of Target 15 (R12) to regenerate 15% of degraded ecosystems. One of the approaches specifically endorsed by this intergovernmental policy decision was the use of FLR, the principles of which were developed by Newton through the ReForLan project. The project also examined how these principles may be implemented in practice, and evaluated the cost effectiveness of this approach and its impact on human communities.

Specifically the work led to impacts on both policy and practice in the countries of Mexico, Chile and Argentina. In each country, policy recommendations and guidelines for forest restoration were produced, which are now being implemented (R3).

As part of the delivery of Target 15, FLR is being employed as the principal approach for a global movement to restore 150 million hectares of degraded and deforested land by 2020, known as the "Bonn Challenge". This was launched in September 2011 in Germany by the GPFLR, and gained further momentum at the UN Climate Talks in Doha in 2012. Some 50 million hectares have now been committed by individual countries, representing one third of the target, amid broad acknowledgement that the largest restoration initiative in history is underway. This initiative directly employs the FLR approach developed, tested and refined through this research. It is anticipated

this will deliver "a host of major benefits to humanity and the planet, such as improving food security, protecting biodiversity and benefiting people's livelihoods" (R2). This is a significant step towards achieving the policy goals.

Such wide reaching benefits to people and the environment are the motivation behind restoration efforts. BU's pioneering analytical method of mapping ecosystem services and their associated values has made significant contributions to these regeneration policies, planning and implementation, in a bid to realise this goal.

5. Sources to corroborate the impact (indicative maximum of 10 references)

R1. Bullock, J.M., Aronson, J., Newton, A.C., Pywell, R.F. and Rey-Benayas, J.M. (2011) Restoration of ecosystem services and biodiversity: conflicts and opportunities. *Trends in Ecology and Evolution* 26(10), 541–549.

R2. IUCN (2012). Landscape restoration movement approaches 50 million hectares with El Salvador and Costa Rica commitments. http://www.iucn.org/news_homepage/?11607/Landscape-restoration-movement-approaches-50-million-hectares-with-El-Salvador-and-Costa-Rica-commitments.

R3. Newton, A.C. and Tejedor, N. (eds.) (2011) *Principles and practice of forest landscape restoration: case studies from the drylands of Latin America*. IUCN, Gland, Switzerland. http://www.iucn.org/knowledge/publications_doc/publications/?7698/Principles-and-practice-of-forest-landscape-restoration--case-studies-from-the-drylands-of-Latin-America.

R4. Nellemann, C. and Corcoran, E. (eds.) (2010) *Dead planet, living planet - biodiversity and ecosystem restoration for sustainable development*. United Nations Environment Programme, Arendal, Norway. http://www.grida.no/publications/rr/dead-planet/.

R5. Newton, A.C., Hodder, K., Cantarello, E., Perrella, L., Birch, J.C., Robins, J., Douglas, S., Moody, C. and Cordingley, J. (2012) Cost-benefit analysis of ecological networks assessed through spatial analysis of ecosystem services. *Journal of Applied Ecology* 49(3), 571–580. DOI: 10.1111/j.1365-2664.2012.02140.x.

R6. Newton, A.C., del Castillo, R.F., Echeverría, C., Geneletti, D., González-Espinosa, M., Malizia, L., Premoli, A.C., Rey Benayas, J.M., Smith-Ramírez, C. and Williams-Linera, G. (2012) Forest landscape restoration in the drylands of Latin America. *Ecology and Society* 17(1), 21. [online] http://www.ecologyandsociety.org/vol17/iss1/art21/.

R7. Secretariat of the Convention on Biological Diversity (2010) *Global Biodiversity Outlook 3*. Montréal, 94 pages. http://www.cbd.int/gbo3/.

R8. TEEB – The Economics of Ecosystems and Biodiversity for National and International Policy Makers (2009). UNEP, Geneva. www.teebweb.org.

R9. UNEP/CBD/SBSTTA/14/INF/15 (2010). http://www.cbd.int/doc/meetings/sbstta/sbstta-14/information/sbstta-14-inf-15-en.pdf.

R10. UNEP/CBD/COP/11/INF/18 (2012). http://www.cbd.int/doc/meetings/cop/cop-11/information/cop-11-inf-18-en.pdf.

R11. UNEP/CBD/SBSTTA/15/4 (2011). http://www.cbd.int/doc/meetings/sbstta/sbstta-15/official/sbstta-15-04-en.pdf

R12. UNEP/CBD/COP/11/35 (2012). http://www.cbd.int/doc/decisions/cop-11/full/cop-11-dec-en.pdf