Institution: Nottingham Trent University (NTU)

Unit of Assessment: C14 - Geography and Environmental Studies

Title of case study: Enhancing the identification, protection and restoration of blanket bog in the UK and Spain

Period when the underpinning research was undertaken: 2005 – 2019

Details of staff conducting the underpinning research from the submitting unit:

Names:	Roles:	Periods employed by submitting HEI:
Dr Ben Clutterbuck	Senior Lecturer	2012 - present
Dr Jillian Labadz	Associate Professor	1999 - 2020
Dr Nicholas Midgley	Senior Lecturer	2004 - present

Period when the claimed impact occurred: 2015 to July 31, 2020

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

1. Summary of the impact

Peatlands are the largest natural terrestrial carbon store, and damaged peatlands are a major source of greenhouse gas emissions. Research at NTU has extended the global peatland inventory, monitored the impacts of restoration and informed national and international peatland monitoring initiatives and management policy designed to preserve biodiversity and mitigate against climate change.

The studies have:

- Identified new areas of geographically significant blanket bog in Spain and provided data used to protect it from development.
- Provided the Spanish provincial governments of Bizkaia and Cantabria with evidence to initiate and extend protection of blanket bog.
- Enabled the National Trust to extend its blanket bog restoration programme.
- Provided evidence that is being used by Natural England and DEFRA to develop policy to protect peatlands in the UK.
- Contributed to the development of a citizen science monitoring network for UK peatlands that has been recognised by the IUCN.

2. Underpinning research

While known peatlands cover less than 3% of the global land surface, these ecosystems contain more than 1.5 times the amount of carbon held in the atmosphere. Damaged peatlands release 5-6% of global greenhouse gases (GHG), and the protection and restoration of these habitats has international significance for how we respond to climate change. The Committee on Climate Change identified restoration of peatlands as a key measure to deliver the UK Government's Net Zero GHG emissions target.

Blanket bogs are rare types of peatland that are internationally recognised for habitat provision and carbon storage. Research over the last 20 years at NTU has sought to develop a better understanding of effective management and restoration strategies for blanket peat. In the mid-2000s, Labadz worked with colleagues from Durham University, Coventry University and University of Huddersfield to investigate the relationship between erosion in upland blanket bogs and water quality **(R1)**. In 2007, Labadz led a review of management and restoration options for blanket bog for DEFRA, making recommendations for how these habitats could be sustainably managed **(R2)**.

This earlier work led to research in 2013 for the National Trust **(G1)**, led by Clutterbuck and Labadz, to monitor the impacts of an erosion gully blocking initiative employed to restore the most intact example of blanket bog in the Peak District (Featherbed Moss). Gully blocking aims to retain water behind dams to raise the water table, restore hydrological function, improve vegetation diversity and reduce erosion. The area is protected by European Union (EU) and national-level

designations, and permission to undertake the restoration intervention was granted by Natural England on the proviso that the National Trust could show it was not having an adverse impact elsewhere. Gully blocking is more common in low-sloping peatlands; the NTU studies not only demonstrated that this approach can be successful on more degraded and steeper peat slopes, but that it reduced total and peak streamflow, improved water quality and did not impact on adjacent features **(R3)**.

Working with colleagues at University of East London, Clutterbuck co-authored a training manual 'Eyes on the Bog' under the International Union for Conservation of Nature (IUCN) Peatland Programme (PP) that is designed to facilitate long-term monitoring of UK peatlands by networks of citizen scientists **(R4)**. As part of this initiative, techniques have been developed using augmented and virtual reality (AR/VR), including 360-degree cameras and 3D photography that record surface morphology and vegetation for archival reference. Baseline survey data are now available to the public and contribute to an ongoing research theme by Clutterbuck since 2005 determining the impact of burning on blanket bog. This research funded by Natural England **(G2)** provides a historical reconstruction (1953 to present) of a long-term experiment (started in 1954) that has been used to assess the impacts of burning on bog vegetation, hydrology and carbon loss. Combined with contemporary ground survey the research demonstrates that pre-experimental conditions have a greater impact than factors manipulated in the experiment and adds key input to the debate over the apparent suggested benefits of burning blanket bog, many of which have been derived from this experiment **(R5)**.

Key areas of peatland are not benefitting from more effective management strategies because the global peatland inventory is incomplete, leaving unmapped areas exposed to heightened risk. The majority of blanket bogs in north Spain are recognised in Galicia but a number of currently unmapped, and therefore unprotected, blanket bogs exist in the Cantabrian Mountains (Cordillera Cantabrica). Clutterbuck, Labadz and Midgley identified and classified 14 new areas of blanket bog on the regional boundaries of Cantabria and Castilla y Leon **(R6)**. This research also developed a technique to quantify millimetre-resolution surface change and demonstrated that unprotected areas are eroding at significantly higher rates than protected areas, predominantly as a result of trampling by livestock.

3. References to the research

The high quality of the underpinning research is indicated by the wide range of funding organisations continuing to invest in the research and its dissemination.

R1 Yeloff, D.E., Labadz, J.C., Hunt, C.O., Higgitt, D.L. & Foster, I.D.L. (2005). Blanket peat erosion and sediment yield in a southern Pennine upland reservoir catchment. *Earth Surface Processes and Landforms* vol 30 pp 717-733. *This paper was cited in a major report by Lindsay (2010) on peat bogs and carbon for RSPB and by Scottish Natural Heritage (2011) in a report on peat erosion and the management of peatland habitats.*
R2 O'Brien, H., Labadz, J.C. & Butcher, D.P. (2007). *Review of Management and Restoration Options for Blanket Bog (DEFRA project BD1241)*. Nottingham Trent University. *This research resulted from a competitive tender process by DEFRA and included literature review but also significant original interview-based stakeholder research. It has been cited in numerous reports including the National Trust (2012).*
R3 Clutterbuck, B., Labadz J., Butcher, D.P. & Hart, R. (2019) Featherbed Moss Monitoring Programme – Phase I: Final Report to National Trust, July 2019.
R4 Lindsay, R., Clough, J., Clutterbuck, B., Bain, C. & Goodyer, E. (2019) Eyes on the Bog: Long-term monitoring network for UK peatlands. IUCN UK Committee Peatland Programme. Available at:https://www.iucn-uk-peatlandprogramme.org/sites/default/files/header-images/Eyes%20on%20the%20Bog%20Manual.pdf *This training manual was produced following a major process of review and comment building on a report for the RSPB: Lindsay, R. 2010 'Peatbogs and Carbon: a Critical Synthesis'.*

R5 Clutterbuck, B., Lindsay, R., Clough, J. & Chico, G. (2020) The Hard Hill Burn Plots on Moor House – Upper Teesdale National Nature Reserve: A review of the experimental setup. *Natural England Commissioned Report No.321.*
R6 Chico, G., Clutterbuck, B., Clough, J., Lindsay, R., Midgley, N. G. & Labadz, J. (*2020*). Geo-hydromorphological assessment of Europe's southernmost blanket bogs. *Earth Surface Processes and Landforms,* https://doi.org/10.1002/esp.4927.

Key supporting grants

G1 Clutterbuck and Labadz. *Featherbed Moss peatland restoration project: 2013-2018* and *2018-2021*. National Trust. Two grants totalling £52,688.
G2 Clutterbuck. Natural England. 2016-2019. £8,348.
G3 Clutterbuck and Chico Leon. Government of Bizkaia & HAZI. 2018-2020. £30,000.

4. Details of the impact

Impact on peatland restoration policy and practice in Spain – and extending the global peatland inventory

The identification of 14 new areas of blanket bog in northern Spain by NTU has provided the first evidence of the existence of this rare peatland in Cantabria. These areas are equivalent to >10% of the blanket bog currently recognised in Spain. The findings have identified an urgent requirement to protect these areas as the EU Habitats Directive (92/43/EEC) stipulates that the natural range of a listed habitat must be stable or increasing: NTU research showed that these areas are degrading. This has given the regional government of Cantabria and the European Commission the opportunity to designate these sites as protected areas under Natura 2000, under which the Government of Cantabria could seek financial support from the EU to protect and restore these areas. The Government of Cantabria recognise that the work "*has significantly raised the profile of Cantabria highlighting that the region contains a great number and diverse assemblage of blanket bogs"* and *"As a result, we use this information to plan livestock management in parts of the mountain chain where we now know blanket bogs exist."* **(S1)**

The inclusion of these new areas in the global peatland inventory has significantly increased wider understanding of the distribution of blanket bogs globally. The IUCN Peatland Programme recognise that the presence of blanket bogs in this part of Spain "*brings into question some of the more negative predictions about their fate in the UK as a result of climate change*" as the work "*highlights that these habitats are able to persist outside of the current modelled envelope for blanket bog ecosystems*." **(S2)**

Data collected by NTU were used in a case to oppose the installation of a wind farm over one of the unmapped areas in Cantabria in November 2017 **(S3)**. The Government of Bizkaia confirmed that the data "*were instrumental in stopping a windfarm development plan proposed by Cantabria government"* **(S4)**, as without designation and protection there is little in the way of statutory or official procedural process to oppose windfarm installations on blanket bog. The proposed development highlights ongoing conflict between neighbouring authorities as "*The size of the development would irreversibly damage the blanket bog"* **(S4)**

The €2.5m LIFE+ Ordunte Sostensible project (2012-2017), funded by the EU, was undertaken to restore and improve the conservation status of the Ordunte mountain range. This area contains the only Natura 2000 designated blanket bog (Zalama) in the Basque Country region. Zalama is described by the Government of Bizkaia as "*a clear example of one of the rarest and most endangered habitats of Europe*" **(S5)**. The Government of Bizkaia and HAZI Foundation, a rural development agency, reported that the restoration of Zalama under the LIFE+ project had been a success. However, there was little evidence to quantify the success. NTU researchers quantified that as a result of restoration efforts peat erosion was 4-6 times lower than in unrestored areas. The NTU data were presented at the closing workshop for the LIFE+ project in Bilbao in December

2017. This provided clear evidence for the teams to demonstrate success to the EU **(S6)**. As a result, NTU were awarded post LIFE+ monitoring **(G3)** by the Government of Bizkaia (2018-2021).

In addition to monitoring, NTU have developed a protocol for growing *Sphagnum* to reintroduce into Zalama with €7500 of funding from the Government of Bizkaia. Rollout of the protocol by the Government and the first phase of planting due in June 2020, both led by NTU, has been postponed due to Coronavirus. The Government of Bizkaia have also installed additional fencing around Zalama blanket bog upon recommendation from NTU "*as a result we invested a further 4,000 € and extended the fence to cover all the peatland*" **(S4)**.

Impact on National Trust's management and restoration of degraded peatlands

NTU's final report to the National Trust **(R3)** established the viability of extending the programme of gully blocking to other areas of adjacent peatland. Clutterbuck and Labadz presented the key findings at a meeting with Natural England and the National Trust in 2019. The National Trust recognise that "*Academic research has become a fundamental part of understanding how our interventions deliver the outcomes we need*" and reported that the evidence provided by NTU research "*enabled Natural England to provide the National Trust with permission to extend gully blocking activities in the surrounding area of Thomason's Hollow and Salvin's Ridge (around 30 hectares). Further gully blocking has now been undertaken, and as of 31 July 2020, over 550 new gully blocks have been installed by the National Trust in these areas*." **(S7)**

NTU have been contracted to monitor the further restoration programme (2018-2021) and this extension **(G1)** forms part of a €16 million project with Moors for the Future (MoorLIFE 2020) funded by the EU LIFE programme and co-financed by Severn Trent, Yorkshire Water Plc and United Utilities.

Impact on burning on peatlands

Burning of vegetation for field sports is widely recognised as being detrimental to the success of blanket bog restoration projects, and the IUCN position statement on Burning and Peatlands (March 2020) highlights that *"A number of recent studies have presented misleading conclusions resulting in the mistaken interpretation that burning is beneficial for peatland conservation and restoration".* A long-term experiment (started in 1954) has been used to assess the impacts of burning on bog vegetation using a series of reportedly 'comparable' experimental plots. No baseline vegetation survey or topographic assessment of the plots was undertaken at the start of the experiment.

The research by NTU with colleagues from UEL has provided the first assessment of the vegetation at the beginning of the experiment and examined the microtopography and gross morphology of the experimental plots. This has identified that the experimental plots are in fact not comparable and indicates that differences observed in vegetation between experimental plots today arise from pre-experimental conditions and not factors manipulated in the experiment (specifically burning). NTU research highlights significant concerns about the validity of conclusions about the impact and benefits of burning drawn from this experiment. The findings are published as a Natural England Commissioned Report and Natural England is subsequently "…*reviewing the data around this important experiment and the recent work by Dr Clutterbuck on the experimental set up has provided valuable new information which we can use to shape and develop the review*." **(S8)** DEFRA also recognise that "*This study contributes to the weight of evidence used to develop the government's policy on upland peatland management and restoration"* and *"The full weight of evidence, including Dr Clutterbuck's study, is being used to develop policy in this area."* **(S9)**. In November 2020 the Werritty Report by The Scottish Government reported that "*There will also be a statutory ban on burning on peatland, except under licence for strictly limited purposes, such as approved habitat restoration projects*". In January 2021, Defra announced that the government plans to bring forward legislation to prevent the burning of heather and other vegetation on protected blanket bog habitats.

Impact on citizen science programmes via national peatland initiative

The IUCN has proactively promoted our Eyes on the Bog manual as "*a scientifically robust, repeatable, low tech, long-term monitoring initiative*" that enables "*individual peatland sites to be consistently monitored across the UK, creating a network of comparable sites*." **(S10)** The low-cost and straightforward nature of the monitoring techniques, combined with the use of AR/VR technology, has allowed peatland community employees and volunteers to collect useful information on many aspects of peatland conditions, including peat subsidence and carbon loss. Natural Resource Wales have included all seven sites in the £4million EU funded New LIFE for Welsh Raised Bogs Project and already recorded baseline monitoring data. The West Cavan Bog Association have set up two Eyes on the Bog sites in Fartrin and Aughaween (County Cavan, Ireland). The Yorkshire Wildlife Trust have also installed monitoring equipment on their first site and are rolling out further installations to include as many sites as possible.

Summary

This body of work by NTU has led to identification, protection and new management practices for peatland landscapes in both the UK and Spain. It has shaped national and international policy on how these important areas should be monitored and conserved in the future.

5. Sources to corroborate the impact

S1 Letter of support from Government of Cantabria confirming the significance of the identification of the new areas of blanket bog in the region, how this has changed the way they plan livestock management and has prompted them to pause some windfarm developments.
S2 Letter of support from IUCN to corroborate global inventory significance.
S3 The final report for the case against the installation of a wind farm at Ilsos de Zalama, highlighting the crucial role of NTU data: Boletín Oficial de Cantabria (BOC) (2017) Gobierno de Cantabria. Online at: https://boc.cantabria.es/boces/verAnuncioAction.do?idAnuBlob=316715
S4 Letter of support from the Government of Bizkaia confirming the importance of NTU research in developing a protocol for growing *Sphagnum*, facilitating the installation of additional restoration intervention measures at Zalama and opposing a windfarm installation.
S5 Description of the Zalama restoration project on the Bizkaia Government website: https://www.bizkaia.eus/home2/Temas/DetalleTema.asp?Tem_Codigo=7647&idioma=IN&dpto_biz=&codpath_biz=%7C7647
S6 Letter of support from Senior Biodiversity Officer at HAZI Foundation confirming that goals of the LIFE+ Ordunte Sostensible project would not have been achieved without NTU research.
S7 Letter of support from the National Trust confirming the impact of NTU's research contribution on its peatland management and restoration strategies.
S8 Letter of support from Senior Upland Advisor from Natural England confirming that NTU research has formed part of their review of policy on the use of burning on blanket bog.
S9. Letter of support from Senior Policy Advisor from DEFRA confirming that NTU research is being used to develop policy.
S10 IUCN's promotion of the Eyes on the Bog monitoring programme: https://www.iucn-uk-peatlandprogramme.org/sites/default/files/header-images/Eyes%20on%20the%20Bog%20Manual.pdf