PhD-Project Title: Determining the Role of the Peatland Margin Facies in the Resilience of Blanket Peatland to Extreme Climate Events.

Summary
Current large-scale and fast-paced peatland restoration interventions across the UK will only lead to successful outcomes if they increase the capacity of degraded blanket bogs to withstand and adapt to threats such as climate change, invasive species, wildfires or pollution. This resilience depends on natural thresholds that relate to landscape position and re-establishment of feedbacks between production, decomposition, hydrodynamics, and eco-hydrology, which remain poorly characterised for blanket bog at large scale.

Project Background
Peatlands are the Earth’s most efficient terrestrial carbon store, regulating hydrology and climate and supporting biodiversity with the wet, cool climate of the UK supporting large areas of globally rare blanket peatland. However, a legacy of historic conversion and drainage of UK peatlands threatens the delivery of these benefits, and risks destabilisation of a previously resilient carbon store. Consequently, peatlands have recently attracted significant investment in order to mitigate across the UK (and Scotland particularly). However, there are still considerable uncertainties regarding current and future restoration trajectories and in particular the impact of climate induced increases in extreme event prevalence.

In many peatlands, restoration efforts are targeted towards the conditions typical of blanket peatland centres, namely Sphagnum dominated, high water table, low density peats. However, there are many areas where due to topography, natural drainage, fragmentation due to land use and erosion and hydrology, central conditions would be difficult to achieve and may actually result in increased peat instability. This drier, denser marginal peat ‘facies’ is a component of all ‘near natural’ peatlands and represents the interface between peat and non-peat soils. This makes it an important location in the hydro regulation of blanket peatland and an area of opportunity during climatic conditions favourable for peat expansion. However, with this comes vulnerability. For example, burn depth in peatland margins has been observed to be 8 times that of adjacent peatland centres (Hokanson et al., 2016) and many peatland margins in the UK are lost or modified due to drainage. This vulnerability is poorly characterised in blanket peatland as is the role of peatland margins in the overall resilience of blanket peatland to climate change.

This project will aim to define the key characteristics of the peatland margin facies and examine how these characteristics have changed over time. The project will then use a variety
of extreme climate events (e.g. 2017 ‘Beast from the east’, 2018 European Drought Event, 2019 Flow Country Fire) to examine the hydrodynamic response of the peat surface to hydrological stress to understand how the peatland margin facies influences overall blanket peatland resilience across multiple sites across the Flow Country.

**Research Questions**

1) What are the ecological, hydrological, mechanical, and morphological characteristics of the blanket peatland margin facies with differing climate, management, and landscape position?

2) How does the peatland margin facies evolve over time and what is its relationship to adjacent peatland facies morphology and character?

3) How do peatland margin characteristics impact the overall resilience of blanket peatland to extreme rainfall, drought, and fire events?

**Methodology**

The PhD will take advantage of the climatic gradient across the Flow Country with long-term annual rainfall averages ranging from 3000mm/yr in the west to <800mm/yr in the east to define and characterise the ecological, hydrological, mechanical, morphological and stratigraphic characteristics of the peatland margin facies in different settings. The project will do this by undertaking an extensive field campaign including drone surveys, hydrological measurements, vegetation surveys, peat coring and stratigraphic logging of peat sections. This will be supported by remote sensing techniques such as historic aerial photography, satellite InSAR and multispectral satellite imagery. It could also involve the development of low-cost logging equipment.

A key aspect to understanding the resilience of the peatland margin facies is to examine how the peatland margin facies has evolved over time. This will be achieved over selected areas using peat coring and basal age dating across transects from peatland centre to margin to examine whether marginal characteristics can firstly be identified in core and secondly understand the conditions under which margins can expand and contract over time. Supporting this will be morphological assessments of the relationship between peatland centres and margins in different states using drone and aerial imagery.

Finally, the project will use hydrodynamic data derived from satellite interferometric radar and visual remote sensing (historical and satellite based) to examine the peat surface response to recent hydrological stress such as cold periods (2017 Beast from the East), drought (2018
European Drought Event), Fire (2019 Flow Country Fire) and intense precipitation events over the past 5 years. We will compare pre and post event characteristics at sites in different condition and relate the immediate effect, area of influence and long-term legacy to determine the resilience of the blanket peatland system to extreme climate events.

Training

A comprehensive programme will be provided comprising both specialist training and generic transferable and professional skills. The student will have access to a range of training opportunities within each of the project partner organisations, but also through SAGES (www.sages.ac.uk).

The student will form a core part of the Leverhulme Leadership Award “Blanket Bog Resilience” team and the ERI’s “Carbon, Water & Climate” theme, attending regular meeting with the relevant postdocs, PhD students and collaborators. In addition, the student will join the “Flow Country Research Hub”, a network of >60 organisations involved in peatland research in the north of Scotland, which will give further opportunities for training and non-academic skills development.

All essential and medical training (e.g. first aid training) relating to fieldwork will be provided. Fieldwork in the north of Scotland can be challenging, involving carrying kit over difficult terrain in sometimes cold and wet conditions, and often with the company of midges. We would expect the student to have some outdoor experience and enjoy spending time in remote, isolated areas.

Academic qualifications:

We expect an undergraduate degree (minimum 2:1) in a relevant field (e.g. physical geography, geology, environmental sciences, biological sciences) or equivalent. English language requirement: IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. Full details of the University’s policy are available online.

Essential attributes

- Strong interest in peatland research
- Experience of field-based research
- Experience of remote sensing methods, and interpretation (e.g. experience with GIS)
- Good written and oral communication skills
- Full clean driving license
• Due to the field work requirements associated with this PhD, it will be necessary for the candidate to be based in Thurso, Scotland for the duration of the PhD.

Desirable attributes

• Hydrology and Stratigraphy Experience and interest
• Laboratory experience
• Interest in developing bespoke logging equipment

Supervisory team:
Dr Chris Marshall – lead supervisor (University of the Highlands and Islands)
Dr Roxane Andersen (University of the Highlands and Islands)
Dr David Large (University of Nottingham)
Dr Ben Clutterbuck (Nottingham Trent University)

Key references:


Additional information:

Eligibility: To be eligible applicants must have no restrictions on how long they can stay in the UK (with some further constraint regarding residence for education).

Note: EU, EEA and Swiss citizens who are entering the UK on or after 1 January 2021 will need a Tier-4 visa in order to work, live and study in the UK. All those who are living in the UK before 31 December 2020 must apply for either pre-settled or settled status in order to remain living in the UK after 30 June 2021. Any EU/EEA/Swiss national who commences study in 2020/21 will need to apply for pre-settled status at the latest by the end of this calendar year.

Funding: This project is funded through a Leverhulme Leadership Award to Dr Andersen and will include stipend and fees at RCUK rates for 42 months. UK fees will apply to EU students registered in the academic year 2020/21 for the duration of the programme. The funding does not cover international fees. We advise international student to get in touch with the lead supervisor before submitting their application process. The successful candidate will start between April and September 2021 (to be agreed with student).

Deadline for application: 25/01/2021

Shortlisted candidates will be interviewed in the week of the 08/02/2021

For further information, please contact roxane.andersen@uhi.ac.uk or chris.marshall@uhi.ac.uk