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## MONITORING LANDSCAPE-SCALE RESTORATION OF PEATLAND HABITATS IN THE SOUTH PENNINES, UK, BY THE MOORS FOR THE FUTURE PARTNERSHIP

Rachael Maskill, Moors for the Future Partnership, The Moorland Centre, Edale, Derbyshire S33 7ZA (+44) 1629 816579; [Rachael.maskill@peakdistrict.gov.uk](mailto:Rachael.maskill@peakdistrict.gov.uk).

Dr. Jonathan Walker, Moors for the Future Partnership

Dr. Tim Allott, University of Manchester

Professor Martin Evans, University of Manchester

### INTRODUCTION

The uplands of the Peak District and South Pennines are the most degraded in the UK. 150 years of pollution from the industrial heartlands of Lancashire, West and South Yorkshire have resulted in high levels of heavy metals within the peat (up to 1647 mg kg<sup>-1</sup> of lead in some places, MFF 2005) and intense acidification – one site tested prior to conservation works had a pH of 2.98 (pers comms). This, together with the pressures of overgrazing, recreational use, and the devastating effects of wild fires have caused deep erosion gullies, extensive areas of bare peat and loss of biodiversity.

The Moors for the Future Partnership is a public/private partnership that works to restore some of the most severely degraded blanket bog in the UK. Based in Edale, Derbyshire, our projects stretch 80km north along the Pennines. Since 2003 we have utilised the techniques of heather brushing, geo-textiles and lime, seed and fertiliser applications to stabilise bare peat. Gully blocking with stone and timber is used to reduce the speed of water flowing down the slopes, and to trap sediment and speed up the rate of re-vegetation of gully bottoms. Sphagnum delivery helps to enhance the biodiversity of the blanket bog, and also helps increase surface roughness, and therefore also plays a part in slowing the velocity of surface run-off (Holden *et al.* 2008).

This is the largest blanket bog restoration programme in the UK and is currently working over 800 hectares of the Peak District National Park and South Pennines Special Area of Conservation.

Our major restoration projects are supported by extensive monitoring programmes that focus on a range of ecosystem services including biodiversity, water quality, flood-risk management and carbon storage. We have integrated these programmes in terms of shared reference sites and methodologies to enable us to investigate the impacts of restoration at greater spatial scales than previously investigated while affording considerable added value.

In this paper we will discuss the establishment of a landscape-scale integrated monitoring programme and present preliminary results on the impacts of restoration works on blanket bog ecosystem services.

## OUR KEY PROJECTS

### **Biodiversity: MoorLIFE**

We have set up over 200 quadrats as part of the EU funded MoorLIFE Project and will monitor the germination of the seeded nurse crop and its succession to more typical moorland species. This will build on our data set gathered since 2004 from over 500 quadrats across our late-stage restoration sites.

### **Flood-risk Management: Making Space for Water**

University of Manchester were commissioned to carry out a study of the impacts of restoration works on 89 hectares of heavily gullied blanket bog on Kinder Scout. For over a year we have been intensively monitoring 3 sub-catchments: one control (unrestored) catchment, one revegetated catchment, and one revegetated and gully blocked catchment. Data has been collected continuously on rainfall, water table, flow through gullies and run-off adjacent to gullies to start to unpick the mechanisms surrounding rain-fall, run-off and water table and to examine the effect the conservation works have on hydrographs. With over a year's worth of data prior to restoration works, this will be a unique data set – the early results of which will be presented in June.

This study has just been extended for another 3 years until 2015 and will allow for a longer-term monitoring of the effects of restoration on hydrographs. In addition, data will be used to calibrate the Durham 'Flowmap' model, which will be used in a catchment modelling exercise to evaluate the effects of conservation works on flood risk downstream.

### **Water Quality: Kinder Catchment Project**

The National Trust's Kinder Catchment Project is currently underway to restore 188 hectares of the Kinder Scout Plateau. The Moors for the Future Partnership, in collaboration with the University of Manchester are monitoring the restoration works. Similarly to MSW, V-notch weirs are used to determine the effect of gully blocking and revegetation on discharge of gullies. Water samples are being collected regularly and analysed for DOC, POC and colour during the extensive gully blocking works.

## DISCUSSION

With further funding, we are continuing to build on these existing monitoring programmes for water flow and water quality to study the effect of gully blocking on the northern slopes of Bleaklow. Again, discharge and water quality will be monitored before and after gully blocking and revegetation work.

By linking the methodologies to those being employed on the Making Space of Water Project, we are able to bring considerable added value to both projects.

The strength of the Moors for the Future Partnership is our ability to bring together different funding streams and sites by our use of common methodologies and shared reference sites. We are monitoring over 700 vegetation quadrats, over 500 dipwells (water table), 10 weirs/flumes (discharge) and 20 water quality sampling points for six different restoration projects. This is allowing development of a long-term, landscape-scale monitoring programme of the ecosystem services that our upland blanket bogs provide, the preliminary results of which will be presented in this paper.

## REFERENCES

Holden, J., Kirkby, M.J., Lane, S.N., Milledge, D.G., Brookes, C.J., Holden, V. and McDonald, A.T. (2008). Overland flow velocity and roughness properties in peatlands. *Water resources research*, **44**, W06415

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