Blanket bog on Fleetwith Pike, Cumbria

16. Blanket bog

Climate Change Sensitivity: **Medium**

Introduction

Blanket bog is an upland habitat that forms in situations with high rainfall, low evapotranspiration and flat or gently sloping land. Healthy blanket bog, with actively growing mire species, particularly Sphagnum mosses accumulates peat, but large areas of blanket bog in England are in a degraded condition because of a combination of drainage, burning, overgrazing and atmospheric deposition.

Changes to seasonal rainfall patterns and/or an increased frequency of summer droughts may destabilise blanket bog systems. Climate envelope modelling suggests that a large proportion of British peat bogs are on the edge of their climatic limits (Clark *et al* 2010, Gallego-Sala *et al* 2010, House *et al* 2010). However these models do not take account of the biological processes that take place within blanket peat. Analysis of the pollen archive within blanket peat shows that over the course of the life of blanket bog to date, the plant species that have been dominant at any given time has varied (eg Tallis, 1964a, 1964b). This variation is likely to reflect human activity, the different environmental conditions that have occurred over the last 3,000 - 5,000 years, and the more recent changes in atmospheric deposition associated with industrialisation. There is therefore potentially a degree of resilience to climate change at least in the short – medium term. A possible scenario is that bryophyte species currently found on blanket bogs that have a tolerance or preference for drier conditions will come to dominate the vegetation.

Blanket bogs receive their water from rainfall, although it is the number of rain-days that is important rather than just the volume of rain, together with the low rates of evapotranspiration associated with high cloud cover. Changes in the chemistry of rain, for example increases in nitrogen, allied with changes in climate, may lead to changes in the plant species present or the way in which they grow (Caporn and Emmett, 2009).

The interaction of climate change and land management is important, as damage or changes to vegetation cover can have significant implications for the long-term stability of the ecosystem. Many areas of blanket bog display features that are the legacy of past and current management (including drainage and burning), atmospheric deposition and visitor pressure, and are therefore degraded (Worrall *et al*. 2010). This increases their vulnerability to climate change.

Habitat Description

English blanket bogs occur at relatively high altitude, with a minimum of 160 days of rain per year and an annual rainfall of at least 1200mm (Rodwell, 1991). By contrast, the low-lying blanket peats of Ireland and western Scotland have a requirement for a similar minimum rainfall but around 200 rain days per annum (O'Connell, 1990). It is the waterlogged, acidic conditions that result from this environment that leads to the formation of peat, through the partial decomposition of Sphagnum mosses and associated plants. The formation of peat occurs across the landscape, and from this is derived the term 'blanket bog'.

Typical blanket bog species include cross-leaved heath *Erica tetralix*, deer grass *Trichophorum cespitosum*, cotton grass *Eriophorum* species, and bog-moss *Sphagnum* species. The relative proportion of these species varies between geographic areas and reflects past and current land use and management (burning, grazing and drainage) and historic atmospheric deposition. Damaged and degraded bogs may be dominated by heather *Calluna vulgaris* or purple moor grass *Molinia caerulea*, and in these situations, typical bog species may be infrequent or absent.

Blanket bog is an important nesting or feeding habitat for upland bird species, including hen harrier

Circus cyaneus, merlin *Falco columbarius*, golden plover *Pluvialis apricaria*, dunlin *Calidris alpina schinzii* and short-eared owl *Asio flammeus*. It is also important for a small number of specialist species with localised or very restricted distributions (Webb et al 2010).

Blanket bog is one of the most extensive semi-natural habitats in the UK. It is found from Devon in the south-west of England to Shetland in the north of Scotland. The largest areas of blanket bog in England are found in the Peak District and the North Pennines. The Bowland Fells also contain significant areas, as does Northumberland. Smaller areas are located in the Lake District and the North York Moors. The total area of blanket bog in England is estimated to be 244,536 ha.

Potential climate change impacts

Cause	Consequence	Potential Impacts
Increased mean temperatures	Longer growing season	■ Mire vegetation may become less dominant, but this is likely to be determined by the hydrological conditions on any given site and the pattern of rainfall. ■ Bracken may become invasive in areas of degraded peat, and at higher altitudes (Carey 2013). ■ Warming may interact with increased nitrogen deposition leading to changes in plant species and communities.
Hotter summers	Increased evapotranspiration	■ A reduced water table could lead to changes in species composition and an increase in the release of particulate and dissolved organic carbon during autumn and winter rainfall, leading to reduced water quality.
Drier summers	Drought Drier ground conditions	■ More frequent droughts could affect vegetation community composition, with a possible shift in the dominance of specialist species, and hummock species becoming dominant over hollow species. ■ Increased oxidation rates and wind-blow of existing bare peat. ■ Increased fire risk, especially where degraded blanket bog is dominated by heather or grasses such as purple moor-grass Molinia. ■ Peat will become more susceptible to damage under wildfire or managed burns. ■ Improved accessibility for visitors could lead to increased erosion and risk of wildfires. ■ Areas of peat on moorland edges will become suitable for higher stocking levels.
Wetter winters	Increased surface water run-off	■ Areas of blanket peat may become less stable, especially where subjected to stress from track construction, excavation or burning, increasing the risk of peat slides, bog bursts and erosion.
Storm events	Increased rainfall intensity	■ Heavy rainfall and more surface water will increase problems of gullying where erosion features already exist.
Combined	Potential changes to the economics of upland grazing and shooting systems	■ An increase in the intensity of livestock grazing could lead to problems of over grazing. ■ Changes in red grouse populations or burning regimes could affect blanket bogs.

Adaptation responses

A large proportion of blanket bogs are already degraded as a result of draining, burning (managed burning and wildfire), over grazing and atmospheric pollution. Many blanket bogs are now relatively dry and may already have lost the peat forming species such as *Sphagnum* mosses, which may have been replaced by other species such as heather and moor grass. In these cases, active restoration, including by grip-blocking and re-vegetation of bare peat, and will be the most important adaptation measure. This is especially important as the resilience of bogs to environmental change has been shown to increase if *Sphagnum* cover can be maintained (Gallego-Sala & Prentice 2012).

Bogs are dependent on a reliable high water table, and in the longer term, as climate change progresses, actions that improve both the quantity and quality of water held on sites will become increasingly important.

The restoration of blanket bogs has multiple benefits. It increases the resilience of the habitat to climate change and improves the range of other ecosystem services such as carbon sequestration and drinking water provision. These systems therefore represent an ideal opportunity to involve stakeholders in planning work at a catchment scale.

In the longer term, it may become increasingly difficult to maintain active blanket bog in more climatically marginal areas. Habitat restoration and appropriate management to increase resilience remain a priority for designated sites, but may need to be reviewed in future.

Some of the potential adaptation options for this habitat are outlined below.

- Adapt land management regimes, for example by avoiding burning and introducing appropriate livestock and stocking regimes, to prevent further habitat degradation and encourage the restoration of 'active' blanket bog with peat forming processes.
- Re-vegetate areas of bare peat, using best practice restoration techniques and appropriate plant species mixes. Initially, this should help to prevent or reduce further peat loss, but in the longer term will help to restore 'active' blanket bog.
- Restore natural hydrological regimes through drain and gully blocking and re-profiling, using best practice techniques.
- Encourage structural diversity within areas of blanket bog by, for example, adjusting grazing levels and using a range of species, breeds, ages and sizes of animal.
- In regions where climate change may reduce the area of blanket bog, such as the Peak District and the Yorkshire Moors, identify areas likely to retain the hydrological regime required for bog development and ensure these are protected and are under optimal management.
- Identify areas where the hydrological regime is currently, or in the future may be, sufficiently impaired to prevent bog development, and determine the most appropriate alternative objectives. This might involve retaining a high water table for as long as possible to maintain ecosystem services such as carbon storage and water management.
- Evidence of any relationship between climate change and increased visitor numbers should be investigated through monitoring, and visitor management plans developed to reduce the risk of erosion and wildfire on sensitive sites.

Hare's-tail cottongrass, an important plant of peat bogs.

Relevant Environmental Stewardship options

HL9 Maintenance of moorland

This option aims to maintain areas of moorland habitats that are currently in good condition, to benefit upland wildlife, retain historic features and strengthen landscape character. The option can also promote good soil management, which will reduce diffuse pollution.

HL10 Restoration of moorland

This option is aimed at restoring moorland where not all habitat is in good condition, to benefit upland wildlife, retain historic features and strengthen landscape character. This option can also promote good soil management, which will reduce diffuse pollution.

Both options include prescriptions, programmes and plans that include stocking regimes, burning (or not burning), cutting and scrub and bracken management, which enable management to be tailored to habitats including blanket bog.

Further information and advice

Peak District National Park (2011) Information brochure **Blanket Bog**.

Cumbria Biodiversity partnership information brochure **Blanket Bog**.

Climate change and upland peat loss: implications for policy – An information note produced by Bristol and Bangor universities.

Climate Change and the British Uplands Climate Research - Vol. 45 (2010).This Climate Research special edition on climate change and the British uplands presents a synthesis of current knowledge to help inform policy decisions about safeguarding ecosystem service provision. Topics covered include changing upland climates, mapping blanket peat vulnerability to climate change, measuring and modelling change in peatland carbon stocks, and managing upland ecosystem services under a changing climate.

Natural England (2013) **Restoration of degraded peat bog** NEER003.

IUCN UK Committee 2011, **Commission of inquiry on peatlands**. The Commission of Inquiry on Peatlands, part of the **IUCN peatland programme**, brought together experts in science, policy and practice to carry out a thorough review of peatland issues and a deliver clear scientific consensus about peatland restoration, particularly in relation to climate change, biodiversity and ecosystem services.

Defra **Compendium of UK peat restoration and management projects in uplands and lowlands** Study undertaken for Defra in 2007/8.

JNCC (2008) UK BAP habitat description **Blanket Bog**.

Key evidence documents

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Natural England 2013, **Review of upland evidence**. Series of evidence review papers covering a range of upland habitats and issues.

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Rodwell, J S (Ed) 1991 *British Plant Communities Vol. 2: Mires and heaths*. CUP, Cambridge
Tallis, J.H. 1964a. Studies on Southern Pennine Peats. I. The General Pollen Record. *Journal of Ecology*, 52, 323 - 331.

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Walking-the-Talk (2011). Paths and climate change - an investigation into the potential impacts of climate change on the planning, design, construction and management of paths in Scotland. Scottish Natural Heritage Commissioned Report No. 436.

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