Bog at Wythburn Head, Cumbria

14. Upland flushes, fens and swamps

Climate Change Sensitivity: **Medium**

Introduction

Upland flushes, fens and swamps are sensitive to changes in the quality and quantity of water supply and its seasonal availability, all of which are likely to alter significantly under climate change. Upland flushes, fens and swamps are likely to be less sensitive to changes in temperature as long as precipitation is sufficient to prevent drying out in rain-fed areas and/or periods of summer drought are not too severe (Carey 2013).

The combination of the direct impact of changes to precipitation and temperature, and the indirect impacts of changes in water management and drainage could pose a threat to these habitats.

Habitat Description

Upland flushes, fens and swamps are peat or mineral-based terrestrial wetlands in upland situations, which receive water and nutrients from surface and/or groundwater sources as well as rainfall. The soil, which may be peaty or mineral, is waterlogged, with the water table close to or above the surface for most of the year. The habitat includes both soligenous[6] mires (springs, flushes, valley fens) and topogenous[7] mires (basin, open-water transition and flood-plain fens), as well as certain moor grass *Molinia grasslands* and rush pastures, but excludes ombrotrophic (rain fed) bogs and associated bog pools and seepages (blanket bog priority habitat).

These wetlands tend to occur within more natural habitat settings than in the lowlands, and the transitions between the various habitat components, such as water courses, mires and drier habitats are more in evidence, and external pressures are in general far less pervasive. This provides a greater degree of resilience to these habitats than their lowland equivalents, as well as retaining transitions and many species of lower nutrient systems which have been lost from the lowlands. Some of the component features (e.g. alkaline fens) tend to be small in extent, but most upland areas support fairly extensive valley mire systems that run from hill tops down to limits of enclosure and sometimes beyond. Although they may not be as extensive as other upland habitats, their contribution to the overall biodiversity of the uplands is great, as they tend to be far more species-rich than the habitats they occur within and also provide essential resources to the fauna associated with these surrounding habitats. Usually these are grazed by deer, sheep, or sometimes cattle, in conjunction with surrounding grassland and heath.

These features are often associated with the headwaters of streams and rivers, and in many cases develop around the initial outflows of watercourses. Their maintenance or restoration, where drained or otherwise damaged, plays a key role in supporting the quality and nature of river flow. The potential to restore natural hydrological function in the headwaters of streams, and the benefits this can bring, is great, but is largely unrecognised and unexploited.

Upland flushes, fens and swamps vary, but are typically dominated by sedges and their allies, rushes, grasses (e.g. *Molinia*, and very often a carpet of bryophytes e.g. *Sphagnum spp.*, *Cratoneuron spp.*, and a diversity of wetland herbs including marsh valerian *Valeriana dioica*, bog asphodel *Narthecium ossifragum*, marsh violet *Viola palustris*, and grass-of-Parnassus *Parnassia palustris*. Vegetation is generally short (less than 1m and often less than 30cm) but can sometimes be taller in swamps.

6 Water movement is predominantly lateral through the soil or discharging from the rock.
7 Water movement is predominantly vertical and overland, resulting in water ponding in depressions.

The habitat frequently supports a rich flora of vascular plants with many rare species e.g. sheathed sedge *Carex vaginata*, alpine rush *Juncus alpinoarticulatus*, false sedge *Kobresia simpliciuscula*, yellow marsh saxifrage *Saxifraga hirculus* and Scottish asphodel *Tofieldia pusilla*. It is also exceptionally important for bryophytes with notable species including, flat-leaved bog-moss *Sphagnum platyphyllum*, slender green feather-moss *Hamatocaulis vernicosus*, and silky swan-neck moss *Campylopus setifolius*. It is also important as nesting habitat for wetland birds, such as curlew, snipe and grasshopper warbler and supports a rich and diverse invertebrate fauna, which in turn provide an important food source for upland breeding birds at critical times of year.

The habitat is widespread but local throughout the English uplands, although certain types are much more geographically limited. For example, alkaline fens are restricted to areas with an outflow of base-rich water, including the Craven area of Yorkshire, the North York Moors, the southern Lake District, the Shropshire Hills, and Upper Teesdale. Most upland areas support predominantly acidic valley mire systems, such as Dartmoor and Bodmin Moor. In general, this habitat has been poorly surveyed and the full extent of its interest and value is not well known. However, recent work is revealing the scale and richness of the habitat in areas where it has not previously been appreciated, e.g. Callaghan 2012; Tratt, Eades & Shaw 2012; Jerram 2015. The extent of this habitat is difficult to assess because the habitat has not been comprehensively surveyed in many areas, tends to occur in small, sometimes numerous stands and often it merges seamlessly into other upland semi-natural habitats such as heath and bog.

Potential climate change impacts

Cause	Consequence	Potential impacts
Higher mean temperatures	Reduced water quality due to increased nutrient concentration from faster decomposition	■ Higher temperatures will shift the balance of competition towards relatively more southerly species with the potential loss of montane and northern species. ■ Increased nutrient loading could lead to eutrophication and the increased dominance of ruderal plant species.
Altered seasonal rainfall patterns	Increased seasonal variation in water table levels	■ Loss of wetland specialists requiring consistently wet conditions.
Drier summers	Drought	■ Reduced water table, leading to changes in species competition and decreased water quality through the increased release of particulate and dissolved organic carbon during autumn/winter rainfall. ■ Drying out of habitats in summer could lead to the loss of individual species and a shift in community composition. ■ Drying and oxidation of peat, followed by a release of nutrients, will lead to further shifts in community composition. Competition by species more suitable to lower water tables and drier conditions may lead to colonisation by scrub (Holland *et al* 2010). ■ Areas with good water supply may come under increased pressure from livestock, leading to poaching and grazing.
More extreme weather events	Heavy rain	■ Heavy rainfall could lead to increased scour and landslips in and around upland springs.
Global impacts	The policy and economic environment for upland livestock farming, renewable energy and carbon management could change	■ Upland flushes, fens and swamp habitats are often found on land under extensive livestock farming or grouse moor management. Changes of management approach within these systems, which may be climate driven, and could include changes to subsidy payments, may have a greater impact on this habitat than climate change, as they are especially sensitive to grazing and trampling (Holland *et al* 2010).

Adaptation responses

The small size of many sites, sitting within a matrix of other habitats, means that minimising adverse impacts from the management of adjacent habitats will often be the most important adaptation response.

The majority of the high quality examples of the habitat occur in sites of relatively high naturalness, and are part of extensive areas of natural and semi-natural habitats.

The fragmented and isolated nature of these habitats reduces the chances of species moving between habitat patches and increases the risk to small blocks of habitat. Restoration of habitat to increase size and connectivity is therefore a priority.

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

- Remove pressures and encourage restoration of natural hydrological function, e.g. by drain blocking and re-naturalisation of stream and river systems.
- Manage grazing levels and timing to reduce the risk of over grazing, eutrophication and severe poaching.
- Where scrub encroachment becomes a problem, ensure appropriate management to prevent a loss of ground flora.
- The isolated nature of flushes means that the translocation of species from other sites may be a viable adaptation option where natural colonisation is unlikely.

Relevant Countryside Stewardship options

UP3 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 the landscape character. The option can also promote good soil management, which will reduce diffuse pollution.

UP5 Moorland re-wetting supplement

This option will maintain and restore vegetation mosaics, wetland habitats and associated wildlife. If successful there will be improved hydrology of moorland habitats and benefits to upland flora and fauna, e.g. increased sphagnum moss growth will improve breeding habitat for invertebrates, a food source for grouse and wader chicks.

Further information and advice

JNCC (2008) UK BAP habitat description **Upland flushes, fens and swamps**.

Scottish Natural Heritage (2011) **The Fen Management Handbook**
This handbook is produced by Scottish Natural Heritage aims to improve managers' understanding of fens and how they function, to explain why fens need management, and to provide best practice guidance.

Environment Agency **A Wetland Framework for Impact Assessment at Statutory Sites in England and Wales**.
Wetland scientists at the University of Sheffield have developed a way of classifying wetlands based on an understanding of where their water supply comes from and the environmental and landscape conditions in which the wetland has developed. Understanding how a wetland 'works' means that important habitats can be protected, as we can assess where, when and how changes in certain aspects such as groundwater supply and water quality may affect the wetland.

Environment Agency (2010) **Ecohydrological Guidelines for lowland wetland plant communities, 2004,** and Fens and Mires update, 2010. A simplified approach to the methods described above.

Mainstone, C., Hall, R., & Diack, I. (2016). **A narrative for conserving freshwater and wetland habitats in England**. Natural England Research Reports No 064.

Key evidence documents

Carey, P.D. (2013). 5. Impacts of Climate Change on Terrestrial Habitats and Vegetation Communities of the UK in the 21st Century. Terrestrial Biodiversity climate change report card technical paper.

Holland, J.P., Pollock, M., Waterhouse, T., Morgan-Davies, C., Bibby, H., Stewart, S. & Armstrong, H.M. (2010). Developing guidance for managing extensive upland grazing where habitats have differing requirements. Scottish Natural Heritage Commissioned Report No.402.

Mitchell, R.J., *et al*, (2007) England biodiversity strategy – towards adaptation to climate change. Final Report to Defra for contract CRO327.

UK Biodiversity Action Plan; Priority Habitat Descriptions. BRIG (ed. Ant Maddock) 2008.

Tratt, R., Eades, P., & Shaw, S.C. (2012). Alkaline Fen & Transition Mire Survey of the North York Moors National Park & Bishop Monkton Ings. Report to Natural England, Telford.

Callaghan, D., (2012). A Survey of flushes on the Long Mynd, Shropshire. Report to Natural England, Telford.

Jerram, R. (2015). Survey of Alkaline Fens in the western Lake District. Report to Natural England, Telford.