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 defined as 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[20] mires (springs, flushes, valley fens) and topogenous[21] 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).

The habitat tends to be small in area and located within other upland habitats. Although small, their contribution to 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, 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 (eg *Molinia*, *Phragmites*), and/or a carpet of bryophytes eg *Sphagnum* spp., *Cratoneuron* spp., and occasionally wetland herbs (eg meadowsweet *Filipendula ulmaria*). Vegetation is generally short (less than 1m and often less than 30cm) but can sometimes be taller in swamps.

The habitat frequently supports a rich flora of vascular plants with many rare species eg scorched alpine-sedge *Carex atrofusca*, bristle sedge *C. microglochin*, sheathed sedge *C. vaginata*, mountain scurvygrass *Cochlearia micacea*, alpine rush *Juncus alpinoarticulatus*, two-flowered rush *J. biglumis*, chestnut rush *J. castaneus*, three-flowered rush *J. triglumis*, false sedge *Kobresia simpliciuscula*, Iceland-purslane *Koenigia islandica*, Yellow Marsh Saxifrage *Saxifraga hirculus* and Scottish asphodel *Tofieldia pusilla*. It is also exceptionally important for bryophytes with notable species including Lindberg's Bog-moss, cleft Bog-moss, slender green feather-moss *Hamatocaulis vernicosus* , Scottish Beard-moss *Bryoerythrophyllum caledonicum* and Silky swan-neck moss *Campylopus setifolius*. It also may also be important as nesting habitat for waders, such as curlew, snipe and redshank and can support a varied 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

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

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. Other areas support more acidic valley mire systems, such as Dartmoor and Bodmin Moor. In general, this habitat is poorly surveyed and the full extent of its interest and value is not well known. The extent of this habitat is difficult to assess because the habitat has not been comprehensively surveyed in many areas and tends to occur in small, sometimes numerous stands.

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 in upland springs. ■ Extreme rainfall events could lead to increased peat slippage.
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.

Maintaining the quality, quantity and temporal variation of water is likely to be the main adaptation challenge. In the short term, this may take the form of managing and impeding drainage networks, but over the longer term will require planning at the catchment level to restore the natural capacity of catchments to hold water and maintain flows under wet and dry conditions.

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.

- Ensure that negative off-site impacts are minimised, through the appropriate management of surrounding habitats to avoid run-off, erosion and drainage.
- Ensure that the hydrological regime of the site is protected and enhanced, for example through drain and gully blocking and re-profiling water courses.
- 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.

Bog pimpernel Anagallis tenella and tormentil Potentilla erecta. Base rich flush on the Long Mynd, Shropshire.

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 the 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 the landscape character. This option can also promote good soil management, which will reduce diffuse pollution. In addition it may, in the right situation, provide an area of flood storage and some benefits to flood risk management.

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 upland flushes, fens and swamps.

Further information and advice

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

Biodiversity Planning Toolkit **Upland flushes, fens and swamps**.

Key evidence documents

Carey PD. (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.

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Mitchell et al, England biodiversity strategy – towards adaptation to climate change.

Final Report to Defra. May 2007.

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