



Upland hay meadow, Wensleydale

23. Upland hay meadow

Climate Change Sensitivity: **Medium**

Introduction

Many species that make up Upland Hay meadow are expected to be relatively resilient to projected climate change (Berry et al 2005). However, key species such as wood cranes bill *Geranium sylvaticum* and melancholy thistle *Cirsium heterophyllum* which belong to boreal-montane floristic elements are likely to decline to increased competition from lowland species (Carey 2013). Upland Hay meadows are also highly susceptible to changes in the economics of upland grazing systems, though around 53% is under protective SSSI designation.

Habitat Description

The habitat comprises of *Anthoxanthum odoratum* - *Geranium sylvaticum* grassland²² and is characterised by a dense growth of grasses and herbaceous plants up to 60 - 80 cm high. No single grass species is consistently dominant and the most striking feature of the vegetation is generally the variety and abundance of flowering plants, including wood crane's-bill *Geranium sylvaticum*, pignut *Conopodium majus*, great burnet *Sanguisorba officinalis* and lady's mantles *Alchemilla* spp.

Most of the variation within this habitat is attributable to management treatments. The fields are grazed in winter, mainly by sheep, except in the worst weather. In late April to early May the meadows are shut up for hay. Mowing takes place in mid to late July, though in unfavourable seasons it may be delayed to as late as September. The aftermath is then grazed once more until the weather deteriorates. Traditionally, the meadows have been given a light dressing of farmyard manure in the spring, and this, together with occasional liming, may have helped maintain the distinctive floristic composition of these species-rich grasslands.

Upland hay meadows are confined to areas where non-intensive hay-meadow management has been applied in a sub-montane climate. They are most characteristic of brown earth soils on level to moderately sloping sites between 200m and 400m altitude. Stands of *Anthoxanthum* - *Geranium* meadow are typically found in isolated fields or groups of fields, where many are still managed as hay meadows, but they are also recorded on river banks, road verges, and in woodland clearings. Most stands of the habitat are less than 2 ha in extent.

The main concentrations of upland hay meadow are in the northern Pennines of North Yorkshire, Durham and east Cumbria, but there are scattered locations in west Cumbria, Lancashire and Northumberland. The most important centres are Teesdale, Lunedale, Weardale and Baldersdale in Durham, Swaledale and Wharfedale in North Yorkshire, and around Tebay, Orton and Ravenstonedale in Cumbria. Recent estimates indicate that there are less than 1000 ha in northern England.

Potential climate change impacts

Typical species of these grasslands include those that are adapted to cooler climates and may become out competed by species adapted to higher temperatures as the climate becomes warmer. Initially this will come from other species within the present grassland community, but over time more southerly species may well colonise. Alongside any direct impacts, the influence of climate change on the economics of upland grazing systems may also be important, particularly in sites that are not protected.

²² Upland forms of MG8 *Cynosurus cristatus* - *Caltha palustris* grassland are now included in the Priority Habitat definition for upland hay meadow. However, this is dealt with under the lowland meadows account.

Cause	Consequence	Potential impacts
Hotter summers Warmer winters	Longer growing season Fewer frosts	<ul style="list-style-type: none"> ■ Phenology may change significantly, with flowering and seed setting occurring earlier in the season. Earlier warming in spring may give competitive species, especially grasses, an advantage over slower-growing stress tolerant species, leading to detrimental floristic change. ■ Boreal-montane species are likely to be increasingly out-competed by species with more southerly distributions as temperatures increase. ■ Southern species may start to colonise new sites. ■ Key species such as <i>Geranium sylvaticum</i> that require vernalisation may become less competitive and be lost (Rodwell et al., 2007).
Drier summers	Drought	<ul style="list-style-type: none"> ■ An increased frequency of drought would favour stress tolerant and deep-rooted species. It could also potentially favour ruderal species where there are open gaps in the sward. This may lead to the decline of representative plant species such as wood cranes bill and lady's mantle (Carey 2013). It should however be noted that climate projections indicate lower summer rainfall in the north and west where these grasslands are found, though the declines are less than in the south and east. Rainfall is also higher to start with in many upland areas.
Wetter winters	Higher water tables and increased water-logging	<ul style="list-style-type: none"> ■ Wetter conditions could reduce accessibility for management operations, which could lead to an increase in rushes <i>Juncus</i> spp, which may need controlling.
In combination	Changed economics of pastoral systems	<ul style="list-style-type: none"> ■ Climate change could increase pressure for intensification of existing low input grasslands, or reduce their economic viability, leading to under-grazing and possible land abandonment.

Adaptation responses

Adaptation is likely to focus on increasing the resilience of grassland by minimising other sources of harm. Management of sites will need to be flexible, and adjusted to reflect changing conditions and community composition.

Important components of upland hay meadows will inevitably lose climate space, so identifying and protecting potential climate change refugia will be important. Local climatic variations can be large in upland areas and vulnerabilities of sites may vary considerably within the same geographic area. Targeted habitat creation and restoration will also be important to ensuring the resilience of upland ecological networks.

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

- Adopt greater flexibility in the management of sites in response to increasing fluctuations in seasonal growing conditions. This might include, for example, varying the timing of the hay cut or the date of shut-up or closure for growing hay, or changing the timing, duration and extent of aftermath grazing.
- Adjust cutting and grazing dates to align with changes to the flowering date.
- Identify areas that might act as potential refugia to climate change, particularly areas with relatively cool and damp local climates, and ensure that these are properly protected and managed.
- Where possible, expand the area of upland hay meadows by restoring semi-improved grasslands and re-creating hay meadows on improved grassland and arable land. This should be targeted to ensure expansion and linkage of existing sites.
- Increase the structural heterogeneity of meadows in larger sites by varying the type and timing of management interventions.

Hay meadow prior to cutting. Gowk Bank NNR, Cumbria



Relevant Environmental Stewardship options

Maintenance of species-rich, semi-natural grassland (HK06)

This option is targeted at the maintenance and protection of areas of species-rich grassland.

Restoration of species-rich, semi-natural grassland (HK07)

This option is targeted at grasslands that are potentially rich in plant and associated animal life. They are often on difficult ground and may have suffered from management neglect or been selected for agricultural improvement. The botanical diversity of such grassland may be enhanced by simply amending existing management practices. However, on many sites, pro-active restoration management will be required, involving the introduction of seeds and the creation of gaps for their establishment. Substantial changes of livestock type, timing of grazing or control of dominant species may also be required. The option can also contribute to protecting valued landscapes and archaeology, and the promotion of good soil conditions.

Creation of species-rich, semi natural grassland (HK08)

This option is aimed at creating species-rich grassland on former arable land, ley grassland or set-aside.

Supplementary options

Haymaking (HK18)

This option aims to ensure the continuation or re-introduction of hay-making on sites where the ready availability of livestock and/or the climatic difficulty of haymaking means they would otherwise be grazed and not cut. Sites will have high existing or potential value as meadow land. It will also help ensure hay-making techniques and traditions are not lost to future generations.

Further information and advice

JNCC (2008) UK BAP habitat description [Upland Hay Meadows](#).

[The European context of British Lowland Grasslands](#). Rodwell JS, Morgan V, Jefferson RG & Moss D. (2007). JNCC Report, No. 394.

Monitoring the condition of lowland grassland SSSIs: [Pt 1 English Nature's rapid assessment method \(ENRR315\)](#).

[Plantlife](#) Information about grassland habitats and their management.

Relevant case study

Hay Time

The Hay Time project was set up to co-ordinate restoration schemes using locally-harvested meadow seed in the Yorkshire Dales. The project aimed to restore at least 200 ha of upland and lowland meadows within and close to the Yorkshire Dales National Park.

Key evidence documents

Berry PM, Harrison PA, Dawson TP & Walmsley CA. (2005) *Monarch 2: modelling natural resource responses to climate change*. UK Climate Change Impacts Programme, Oxford.

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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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Lawton, J.H., Brotherton, P.N.M., Brown, V.K., Elphick, C., Fitter, A.H., Forshaw, J., Haddow, R.W., Hilborne, S., Leafe, R.N., Mace, G.M., Southgate, M.P., Sutherland, W.J., Tew, T.E., Varley, J. & Wynne, G.R. 2010 *Making space for nature: a review of England's wildlife sites and ecological network*. Defra, London.

Pinches, C.E., Gowing, D.J.G., Stevens, C.J., Fagan, K. & Brotherton, P.N.M. 2013.

Natural England review of upland evidence - Upland Hay Meadows: what management regimes maintain the diversity of meadow flora and populations of breeding birds? Natural England Evidence Review, Number 005.

Rodwell, J. S. ed. 1992. *British Plant Communities. Volume 3, Grasslands and Montane Communities*. Cambridge, UK: Cambridge University Press.

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