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Chalk downland with common spotted orchid and rough hawkbit, Hampshire.

20. Lowland calcareous grassland

Climate Change Sensitivity: **Low**

Introduction

Unimproved calcareous grassland has been shown to be relatively resistant to climate change (Duckworth, Bunce & Malloch 2000; Grime et al 2008), and older grasslands are more resilient than those in earlier stages of succession (Grime et al 2000, Carey 2013). Climate envelope modelling indicates that there could be a potential increase in the climate space of many calcareous grassland species in the UK, although their spread would be limited by the suitability of suitable substrate (Harrison et al 2006).

Changes in the management of calcareous grassland will probably continue to have a greater impact on lowland calcareous grassland than the direct impacts of climate change.

Habitat Description

Lowland calcareous grassland is found on shallow, well-drained soils which are rich in bases (principally calcium carbonate) formed by the weathering of chalk and other types of limestone or base-rich rock or drift, and is characterised by vegetation dominated by grasses and herbs. Lowland is defined as below the level of agricultural enclosure. The altitude at which this occurs varies across the UK, but typically becomes higher towards the south.

Lowland calcareous grasslands support a very rich flora, including many nationally rare and scarce species such as monkey orchid *Orchis simia*, hoary rockrose *Helianthemum canum*, and pasque flower *Pulsatilla vulgaris*. The invertebrate fauna is also diverse and includes scarce species like the adonis blue butterfly *Lysandra bellargus*, the silver-spotted skipper *Hesperia comma*, the Duke of Burgundy fritillary *Hamaeris lucina*, and the wart-biter cricket *Decticus verrucivorus*. These grasslands also provide feeding or breeding habitat for a number of scarce or declining birds, including stone curlew *Burhinus oedicnemus* and skylark *Alauda arvensis*.

Lowland calcareous grasslands are characterised by lime-loving plants and are found largely in the south and east of the UK, but also in the Derbyshire White Peak, Yorkshire Wolds, Morecambe Bay and eastern County Durham, where they occur on shallow, calcareous soils generally overlying limestone rocks and drift, including chalk. These grasslands are now found largely on distinct topographic features such as escarpments or dry valley slopes that have not been improved for agriculture, but occasionally remnants survive on flatter topography such as on Salisbury Plain or in Breckland. The total area of lowland calcareous grassland in England is 38,687 ha.

Potential climate change impacts

Cause	Consequence	Potential impacts
Drier summers	Drought Wildfire	■ Changed community composition due to: ■ losses of perennials due to die back, especially in drought prone areas of the south-east (Rodwell et al 2007); ■ expansion of drought tolerant ephemerals and re-colonization by annuals with a persistent seed bank (Rodwell et al 2007); ■ reduced growth of upright brome Bromopsis erecta; ■ increasing dominance and possible range expansion of heath false brome Brachypodium pinnatum. ■ Plants with underground storage organs may have a greater ability to survive droughts, as may deep rooted species. Shallow rooted species will be disadvantaged (Sternberg et al. 1999). ■ A decline in the abundance and diversity of associated fungi communities and specialist mosses. ■ Damage to lower plant assemblages.
Wetter winters		■ Wetter conditions could lead to an increased dominance of grasses in the sward, due to increased competition, and a reduction in broad-leaved herbaceous species that characterise calcareous grasslands.
In combination		■ Changes to farm economics driven by climate change could put existing grazing regimes at risk. ■ Possible loss or reduction in populations of species of more northern upland floristic elements (boreal montane, boreo-temperate) from northern limestone formations – eg limestone bedstraw Galium sterneri, dark red helleborine Epipactis atrorubens and the moss Tortella tortuosa'. ■ A combination of increased temperature and increased nutrients from nitrogen deposition could result in a higher proportion of grasses and fewer broadleaved species, especially where drought is not expected (Carey 2013).

Adaptation responses

Lowland calcareous grassland has been shown to be relatively robust to the direct threats posed by climate change, at least in the short term, with other non-climate change drivers such as fragmentation, under or over-grazing and nutrient enrichment from atmospheric nitrogen deposition representing greater threats. In the medium term, climate change could alter the economics of grazing in relation to other land use. This may lead to a decline in the availability of grazing, an intensification of grazing systems, or pressure to convert land to arable production.

Adaptation should therefore focus on ensuring other sources of harm are reduced, to increase resilience. Priority should be given to measures to increase the size, heterogeneity and connectivity of existing patches of calcareous grassland, and these changes should be factored into long-term site management objectives.

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

- Ensure best practice management of existing stands through suitable grazing regimes and avoiding over or under grazing, and avoiding agrochemical and fertiliser inputs.
- Increase the area of existing habitat through targeted re-creation and restoration effort around existing patches. Consideration should be given to increasing topographic, soil and hydrological heterogeneity when identifying potential sites.

- Manage the grazing of sites flexibly in response to seasonal variations in vegetation growth.
- Accept changes to community composition where we can be sure that these are driven by climate change. For example, allow the transition from upright brome Bromposis erecta to heath false brome Brachypodium pinnatum on sites where this species appears to be increasing due to climatic factors.
- A certain level of scrub can be beneficial, especially on sites that are prone to heat stress or drought, due to its shading effect potentially providing micro-refugia for a suite of invertebrates.
- Within sites, identify areas that might act as potential refugia from climate change, such as areas with north facing slopes, complex micro-topography, low nitrogen levels, and high species diversity, and ensure that these are under optimal management.

Adonis blue Lysandra bellargus

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.

Further information and advice

JNCC (2008) UK BAP habitat description **Lowland Calcareous Grassland**.

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

Natural England (2008) **State of the Natural Environment**. This provides an overview of the state of England's grasslands – their extent, trends, key drivers of change, and actions to achieve favourable condition of the resource.

Relevant case study examples

Climate Change Adaptation and Biodiversity in the Isle of Wight (2009)
This report is a good example of a local climate change risk assessment and adaptation plan. It presents the key findings and recommendations from an extensive literature review, that have particular relevance to the landscape, ecosystems, habitats and species of the Isle of Wight, including lowland calcareous grassland, and uses the EBS principles to identify appropriate adaptation responses.

Wiltshire Chalk Country
The Wiltshire Chalk Country project aims to re-create the largest network of chalk grassland sites in north-west Europe, connecting Salisbury Plain, Porton Down and the Stonehenge World Heritage Site, redressing historic losses and re-establishing links between remnant fragments. The RSPB is working with farmers and landowners to create new chalk grassland under Natural England's Environmental Stewardship scheme.

Key evidence documents

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Sternberg M., Brown VK, Masters GJ & Clarke IP.(1999) Plant community dynamics in a calcareous grassland under climate change manipulations. *Plant Ecology* 29-37.