Upland Oak. Johnny Wood SSSI, Borrowdale

3. Upland oak woodland

Climate change sensitivity: **Medium**

Introduction

The trees in upland oak woods are likely to be relatively resilient to the projected changes in climate over the short to medium term, with little change in the distribution of the main species (Berry *et al* 2001, 2003). However, the high abundance and diversity of ferns, bryophytes and lichens in upland oak woods is associated with a cool, wet climate, and a transition to warmer, drier summer conditions could result in a significant change in their character. Changes to the phenology and vigour of the canopy trees may have impacts on ground flora.

Upland oak woods may come under increasing pressure from both native and non-native invasive species, and from the spread of potentially injurious pathogens.

Habitat Description

Upland oak woods are characterised by a predominance of oak (mostly sessile *Quercus petraea*, but locally pedunculate *Quercus robur*) and birch *Betula spp* in the canopy, with varying amounts of holly *Ilex aquifolium*, rowan *Sorbus aucuparia* and hazel *Corylus avellana* as the main understorey species.

The range of plants found in the ground layer varies according to the underlying soil type and degree of grazing, and ranges from bluebell-bramble-fern communities through grass and bracken dominated ones to moss-dominated areas. Most oak woods contain areas of more alkaline soils, often along streams or towards the base of slopes, where much richer communities occur, with ash and elm in the canopy, more hazel in the understorey and ground flora such as dog's mercury *Mercurialis perennis*, false brome *Brachypodium sylvaticum*, Ramsons *Allium ursinum*, enchanter`s nightshade *Circaea lutetiana*, and tufted hair grass *Deschampsia cespitosa*.

Elsewhere, small alder stands may occur, or peaty hollows covered by bog mosses *Sphagnum spp*. These elements are an important part of the upland oak wood system. The ferns, mosses and liverworts found in the most oceanic of these woods are particularly rich. Many also hold very diverse lichen communities and the woods have a distinctive breeding bird assemblage, with redstarts *Phoenicurus phoenicurus*, wood warblers *Phylloscopus sibilatrix*, and pied flycatchers *Ficedula hypoleuca* being associated with them throughout much of their range. In the south west of England, the rare blue ground-beetle *Carabus intricatus* is associated with this habitat.

Upland oak woods are found throughout the north and west of England, with major concentrations in Cumbria, Devon and Cornwall. Related woodland does occur on the continent, particularly in the more oceanic areas, but the British and Irish examples are recognised internationally as important because of their extent and their distinctive plant and animal communities. For some of these species, Britain and Ireland hold a substantial part of the world/European population.

Many upland oak woods were intensively managed for charcoal until the late 1800s and many were felled in the two World Wars. Between 1930 and 1985 about 30% of the area was replanted with conifers, but many of these areas are now being restored. Some areas were cleared to create pasture, but elsewhere there has been some natural expansion. There is an estimated 30-40,000 ha of upland oak woodland across England.

Potential climate change impacts

Cause	Consequence	Potential impacts
Increased mean temperature	Longer growing season and altered phenology	■ Decline of boreal and sub-boreal bryophyte and moss species at their range margins in the UK, especially in southern-most sites (Ellis 2012). ■ Potential breakdown in synchrony between species due to changes in the time of flushing, for example within food webs (Broadmeadow & Ray 2005, Ray, Morison & Broadmeadow 2010) and food availability (Masters *et al* 2005, Read *et al* 2009). ■ Increased shading due to increased and earlier canopy cover leading to changes in ground flora composition and regeneration (Masters *et al* 2005). ■ Increased threat from of the two spotted oak buprestid *Agrilus pannonicus* (Broadmeadow & Ray 2005), a wood-boring beetle associated with acute/sudden oak decline (Denman & Brown 2011).
Warmer winters		■ Potential expansion of *Phytophthora cinnamomi* (Forestry Commission 1999, Bergot *et al* 2004) and potentially P. ramorum (Broadmeadow & Ray 2005), soil borne fungal pathogens responsible for oak dieback. ■ Improved winter survival of mammal pests such as deer species and grey squirrel *Sciurus carolinensis* could lead to reduced regeneration and loss of ground flora.
Drier summers	Reduced soil moisture and drought Increased risk of wildfire	■ Decline and potential loss of sensitive ground flora and epiphytes, particularly ferns, bryophytes and lichens with oceanic distribution patterns (Ray, Morison & Broadmeadow 2010; Ellis 2012). ■ Increased tree stress, leading to greater susceptibility of trees to pests and diseases (Broadmeadow & Ray 2005). ■ Broadleaved trees including oak are relatively resistant to fire, but fires could result in localised changes in ground flora and understorey composition (Ray, Morison & Broadmeadow 2010), and could lead to localised loss of seedling regeneration and established saplings (Ray, Morison & Broadmeadow 2010).
Increased extreme events	Increased frequency of winter gales	■ Rowan and birch could become more dominant in areas affected by wind-blow of oak (Ray, Morison & Broadmeadow 2010).
In combination		■ Increased encroachment from non-native species such as rhododendron, and native species such as beech which are currently more typical of lowland and southern locations (Ray, Morison & Broadmeadow 2010).

Adaptation responses

Actions that reduce the negative impacts of existing pressures such as pollution, over-grazing and neglect are likely to be the main adaptive response for most oak woodlands. The management of invasive species and monitoring and developing suitable management responses to pests and diseases will also be important for certain sites.

In areas likely to suffer from drought, there may be opportunities to identify potential refugia with consistent water supplies, such as at spring lines. Where these are found within existing woodland, they can be protected and managed. There may also be opportunities to plant new woodland in such areas where that is consistent with wider objectives.

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

- Where possible, reduce the impacts of other pressures, such as pests and diseases, pollutants and development pressures.

- Ensure sites are not overgrazed by livestock or deer, with grazing managed to ensure adequate woodland regeneration.
- Implement management such as rotational coppicing, where appropriate, to diversify the age structure and reduce shading. Reducing shading will help encourage natural regeneration. However, in drought-prone sites, maintaining greater canopy cover may be appropriate to reduce water loss and the impacts of drought on ground flora.
- Potential refugia, where the direct impacts of climate change may be less than in the surrounding area, can be identified. These could include north facing or more sheltered slopes and areas with more secure water supply, for example along spring lines or in low lying areas closer to the water table. Patterns of rainfall can also vary significantly in the uplands.
- In the southern and eastern parts of its range, and in locations prone to drought, new planting can be targeted in areas of high landscape heterogeneity, focusing on areas with resilient sources of ground water and on north-facing slopes less prone to drought. A broader mix of native trees within the canopy of 'oak woods', such as beech, rowan and birch, and within the shrub layer, can increase resilience. These potential changes in native tree composition should be reflected in site conservation objectives and guidance.
- Develop contingency plans for outbreaks of pests and diseases, or major new disturbance events such as fires.
- Take positive steps in all woodland situations to increase the proportion and diversity of decaying wood throughout sites so as to ensure both, resilience of dependent species, and the replenishment of woodland soils' organic content and hence capacity for moisture retention and provision of other essential ecological functions needed by trees and other species.

Oak and ferns. Wistman's Wood, Dartmoor.

Relevant Countryside Stewardship options

WD1 Woodland Creation - maintenance payments

This option aims to support the successful establishment of newly created woodland that provides environmental and/or social benefits including:

- Supporting wildlife, particularly where new woodland links habitats or provides a protective buffer.
- Help reduce flood risk, improve water quality and prevent soil erosion.
- To create woodland that is resilient and can adapt to climate change.
- Landscape enhancement.

WD2 Woodland improvement

This option aims to change the woodland structure or management regime to improve biodiversity or enhance resilience to climate change. Dependent on the operation, multi-annual agreements will show a gradual restructuring or improvement in the condition of the woodland.

Further information and advice

Forestry Commission (2003), **The management of semi-natural woodland 5. Upland Oakwoods**.

Cumbria Wildlife Trust **Atlantic Oak Wood**

JNCC (2008) UK BAP habitat description **Upland Oakwood**.

Key evidence documents

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