ENGLISH NATURE

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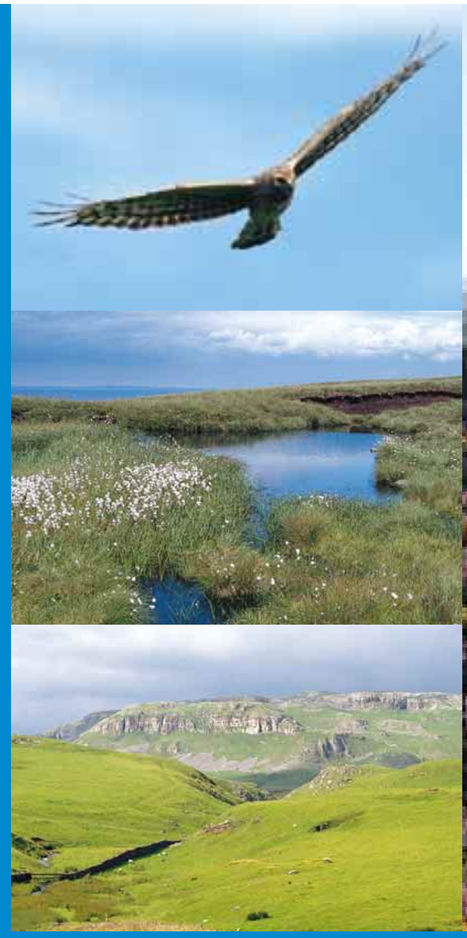
ENGLISH NATURE

State of nature

The upland challenge



working today for nature tomorrow

The Stiperstones NNR, Shropshire. Photograph © Peter Wakely/English Nature.

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Foreword

The conservation of our natural resources is not a luxury. It is not something we can chose to do when it is convenient, or when funds are available or when everybody agrees to a particular course of action. It is of fundamental importance to our future well being and prosperity and is an absolute necessity in a progressive, forward looking and sustainable society.

Nature conservation is about understanding the natural environment, and the benefit that we derive from it, and using that understanding to negotiate the kind of future we want. The challenges are enormous. The natural world is dynamic and dauntingly complicated. The pressures and impacts we place upon it are many, and growing all the time. Our understanding of species ecology and physical, chemical, geological and biological processes is inadequate in so many ways. The benefits we derive from nature need to be explained and valued.

Unfortunately far too many key policy and decision makers neither understand nor value a healthy, thriving natural environment. But millions of people do, and politicians, regulators, planners and businesses ignore it at their peril.

We need to know what is really happening to the natural assets of England, what are the big changes, why are they occurring and most importantly how should we respond? This is English Nature's first attempt to put together such an assessment. In this first year we have focused on the uplands. Next year we will focus on the coastal and marine environment and the year after the lowlands. The report is inadequate in all sorts of ways but I make no apology. It is important that we start somewhere and build up our expertise and knowledge year by year. It is also essential that we expose what we know and what we don't know in order to focus attention on filling the gaps.

This report is not a comprehensive account of all the habitats, species and natural features of the uplands nor is it a glossy coffee table publication. It is intended to be a broad overview, drawing information from a number of sources. It exposes the issues, as we see them, facing the conservation of nature in the uplands and promotes action by all those sectors that can make a difference. It is a call for action to meet the Uplands Challenge.

Professor David Norman
Acting Chairman, English Nature
March 2001

Executive summary

The uplands, although a landscape shaped by centuries of human activity, are the nearest that England has to wilderness. Behind the face of scenic beauty, however, the English uplands are suffering from economic crisis, social change and environmental degradation.

We wish to see a sustainable future for upland wildlife, agriculture, economies and communities. These are interdependent in the uplands. We seek to ensure that changes to the Common Agricultural Policy (CAP), including the new Hill Farm Allowance Scheme, are good for wildlife, but at the same time have benefit for all in the uplands.

The importance of the uplands for wildlife is clear - almost a quarter of the English uplands is designated as Sites of Special Scientific Interest (SSSIs). These sites have many plant and animal communities that are found only in the uplands, and many species are rare and threatened. A high percentage of upland SSSIs are in poor condition, that is they have species or habitats which are declining and which will eventually disappear without some form of management intervention. For example, over 70% of heathland on upland SSSIs is in poor condition.

The main pressures on upland wildlife are heavy livestock grazing, made worse by unco-ordinated management of common land, inappropriate management on some grouse moors, increased access and recreation, climate change and atmospheric pollution. For each of these pressures we have identified the priority actions that are needed to tackle the problems. Effective action will require real commitment and co-ordination from all those whose policies and decisions influence upland areas.

Wildlife in the uplands is intimately linked to livestock farming but is sustained only through sensitive management. CAP subsidies which are based on the number of livestock, encourage more stock than is environmentally sustainable, and, as a result, many hill areas are overgrazed. There is also a crisis in the upland farming industry with many farmers struggling to retain viable businesses. To achieve sustainable land management for the uplands, and maintain viable upland communities, there is a need to:

- **target agri-environment schemes at biodiversity priorities;**
- **reform the sheepmeat and beef regimes;**
- **enforce the overgrazing rules more effectively;**
- **promote the implementation of the Rural Development Programme.**

Tackling unsustainable livestock management on common land is made more difficult because there is currently no legal requirement to co-ordinate management of commons. Management committees, with management plans and registers of activities, could co-ordinate livestock grazing on common land and ensure that it is environmentally sustainable. To tackle this we need:

- **new legislation for common land.**

The other major land use in the uplands of England is the management of grouse moors for shooting. This has had the very real benefit of saving heather moorland from post-war afforestation and agricultural intensification. However, some management practices have negative impacts on wildlife, such as intensive burning, drainage and illegal predator control. To deliver many of the nature conservation targets for upland heathland, there is a need to:

- **promote environmentally sustainable grouse moor management;**
- **enforce the law to end persecution of raptors.**

Increased access to the open land in the uplands, provided for in the new Countryside and Rights of Way Act, must be managed to prevent damage to wildlife features, for example the disturbance of breeding birds. To be effective there is a need for:

- **advice and demonstration of managing land for people and wildlife.**

The wider environmental pressures from climate change and atmospheric pollution, much of which results from human activities away from the uplands, must be tackled at all levels from individual action through to Government policy and international agreements. Critically, there is a need to:

- **provide a landscape which allows wildlife to respond to climate change;**
- **reduce the emissions of diffuse atmospheric pollution.**

We hope to see progress on these vital issues within the next two years and intend to conduct a review of progress in our state of nature report in 2003.

Our vision for the uplands is a mosaic of more diverse habitats supporting characteristic wildlife and at the same time environmentally sustainable agriculture, economies and communities. We hope that this report achieves a wider ownership of the vision for the uplands and the problems facing wildlife there. We share responsibility for securing a sustainable future for the uplands and can achieve this only by working in partnership.

Hence, we urge everyone to work with us to meet the Upland Challenge.

The Upland Challenge

Targeting of agri-environment schemes - Target agri-environment schemes in the uplands at biodiversity priorities, tackling environmentally unsustainable management, to ensure that SSSIs are restored and maintained in favourable condition.

Sheepmeat and beef regimes - Reform the Sheep Annual Premium, Suckler Cow Premium and Beef Special Premium schemes to an integrated area-based scheme, with payments conditional on practical environmental standards, at the next review of the CAP.

Overgrazing rules - Give higher priority to an adequately-resourced implementation of the overgrazing rules, with an effective reporting procedure and a simpler methodology to encompass the full range of overgrazed habitats.

Rural Development Programme - Promote the effective implementation of the England programme as a mechanism to maintain the rural environment and viable rural communities in the Less Favoured Areas.

Common land legislation - Secure new legislation for common land, implementing the proposals in the recent consultation *Greater Protection and Better Management of Common Land in England and Wales*.

Grouse moor management - Promote environmentally sustainable moorland management, including sensitive burning practices.

Raptors - Implement the recommendations of the UK Raptor Working Group, including greater enforcement of existing legislation to prosecute those found disturbing or killing birds of prey.

Access and recreation - Provide advice and demonstrate good practice in managing land for people and wildlife.

Climate change - Provide a landscape which allows wildlife to move in response to climate change.

Diffuse atmospheric pollution - Reduce the impacts of diffuse atmospheric emissions from agriculture and vehicles, basing targets on the protection of sensitive ecosystems backed by regulation.

1. Introduction

The uplands of England are considered to be some of our last remaining wild areas. Their rugged inspirational landscapes give us a sense of naturalness and space. Yet these areas are far from being true wilderness. What we see today is a landscape which, although the product of powerful geological and biological processes, has also been greatly shaped by centuries of human activity.

Behind a face of scenic beauty the uplands of England are suffering from economic crisis, social change and environmental degradation and a loss of traditional land management skills. These changes, combined with inappropriate livestock subsidies, have led to the degradation, mainly from overgrazing, of large areas of upland habitat, even within Sites of Special Scientific Interest.

Geltsdale in winter.
Photograph © Malcolm Stott.

The uplands and their origin

To understand England's upland environment we first need to look back in time. The whole country has been shaped over millions of years by natural forces, the most powerful of which have been the geological processes that have given rise to the varied topography and landscape we see today.

The geological history of England spans more than 600 million years. This vast period has seen the repeated rise and fall of sea levels, the building and destruction of mountain ranges, the fluctuation of the climate from ice ages to tropical conditions, and the evolution and extinction of countless species.

Granite tor on Dartmoor. Photograph © David Townshend / English Nature.

Carboniferous Limestone landscape in North Pennines. Photograph © Peter Wakely / English Nature.

The upland areas of England are characterised by harder rocks more resistant to erosion than surrounding areas. There are sedimentary rocks laid down by ancient rivers and seas, such as the sandstones and limestones of the Pennines, and igneous rocks formed as molten rock solidifies, such as the granite of Dartmoor and the Whin Sill of northern England. Natural features associated with the uplands include tors, limestone pavements and many caves.

Periods of mountain building, caused by the collision of continents and the opening and closing of oceans, have folded, faulted and uplifted these rocks to form upland areas. More recently, during the last two million years, the advance and retreat of ice sheets (the 'ice ages') has eroded and scoured our upland landscape, rounding-off the mountains and forming the corries and U-shaped valleys of the Lake District. Lakes now sit in the valleys and in areas hollowed out by the ice and dammed by glacial deposits.

Ice-scoured Lake District landscape, Glenridding Valley.
Photograph © David Townshend / English Nature.

About 20,000 years ago, at the height of the last ice age, the sea level was as much as 120 metres lower than today, and 'England' was joined to 'Europe'. Following the retreat and melt of the last ice sheet, the sea level rose and flooded this connection, inhibiting the natural colonisation of plants and animals from continental Europe. As a result, England's present day fauna and flora, including upland areas, are less diverse than those of most of continental Europe.

In the most recent ice age, which ended only 11,500 years ago, northern England was covered by a thick sheet of ice. The unglaciated areas immediately to the south of the ice sheet had a cold, dry climate, and tundra-like vegetation with mossy, lichen-rich swards and scattered pockets of willows and dwarf birch, much like northern Scandinavia today. As the climate warmed, and the ice receded, woodland spread across the country, first birch and then species such as hazel and Scots pine. Gradually other broadleaved trees colonized the lowlands, but birch and pine remained dominant in the uplands.

As the climate became wetter *Sphagnum* mosses began to dominate in areas with poor drainage, especially in the west where the rainfall is higher. *Sphagnum* absorbs water and helps to maintain the waterlogged ground, which becomes devoid of oxygen and inhibits plant decomposition. As the *Sphagnum* and other plants die they accumulate over the soil surface as peat. The accumulated peat insulates the surface vegetation from the mineral soils beneath, and the main source of water and nutrients gradually shifts from groundwater to atmospheric fall-out. These peat deposits dominate much of the uplands.

Mineral soils in the uplands are also poor. The high rainfall leaches the soils, making them more acid and less fertile, a process accelerated by the acid litter produced by heather. These soils, called podsols, have a layer near the surface from which almost all the organic matter, lime, iron and other minerals have been leached out. Many of these soils are free draining, but in some areas a lower zone forms where iron has concentrated. This 'iron pan' can be hard and impermeable to roots and water, causing waterlogging and peat formation.

The prevailing wind from the North Atlantic, warmed by the Gulf Stream, is laden with moisture which is deposited as the air rises over the hills and mountain areas. This oceanic influence gives the upland areas of England an unusual climate characterised by high humidity and rainfall, comparatively small seasonal variations in rainfall and temperature, cloud conditions and high winds. The oceanic effects decrease from west to east and the temperature decreases from south to north. This, combined with changes in altitude, topography, geology and land use, accounts for much of the regional variation in the plant and animal communities found in the uplands.

The uplands and people

Whilst geology and climate have determined the basic structure of the upland landscape of England, it has been continually modified by human use.

Stone Age man is thought to have had a nomadic hunting and gathering existence with little effect on the land. In the New Stone Age, man introduced farming and began to clear the forests that covered much of England up to the natural tree line around 600 metres. By about 500 BC much of the forest cover in areas such as the North York Moors, Dartmoor and the Lake District had been removed. As the farming population increased, fire and the grazing of domestic livestock suppressed natural tree regeneration. This created moorlands dominated by grasses and heather.

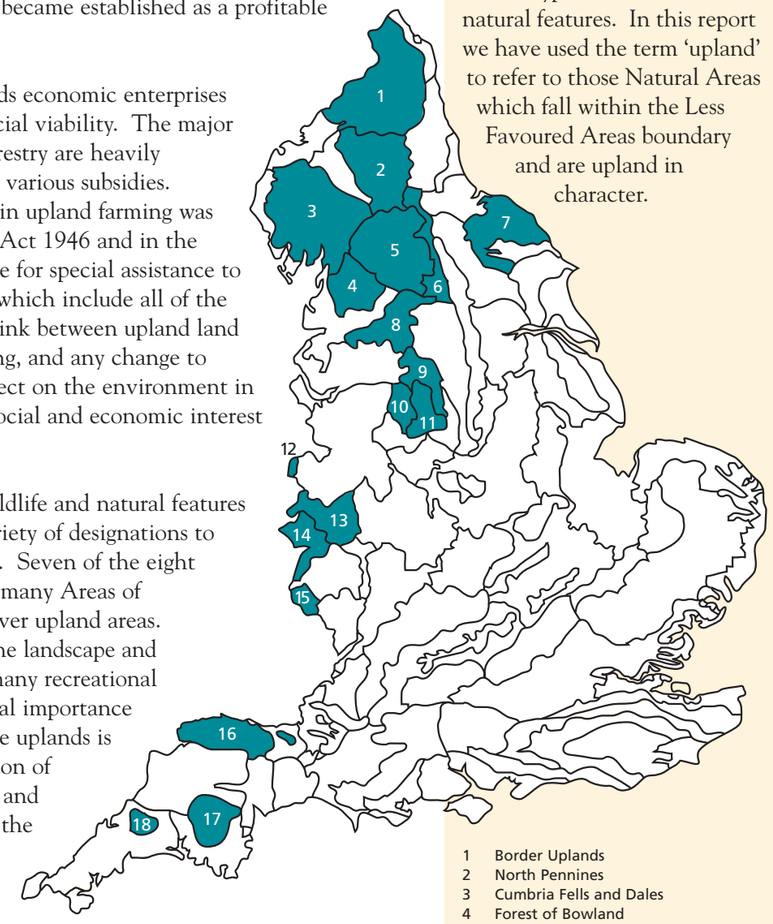
Traditionally heather moorland has been used for free-range grazing by domestic livestock, and for sport. Although cattle grazing has been common in the past, sheep grazing has been the dominant land use throughout the uplands of England. The other main use of heather moorland is for the shooting of red grouse. The red grouse is virtually confined to open moorland, and presumably extended its range as forests were cleared and moorland extended. It was only in the mid nineteenth century that, with increasing wealth and improvements in transport and guns, the sport of shooting became established as a profitable land use.

Throughout much of the uplands economic enterprises operate at the margins of financial viability. The major land uses of hill farming and forestry are heavily influenced by public policy and various subsidies. The need for support to maintain upland farming was recognised in the Hill Farming Act 1946 and in the European Commission Directive for special assistance to Less Favoured Areas (75/268), which include all of the upland areas of England. The link between upland land use, policy and subsidies is strong, and any change to these inevitably has a major effect on the environment in the uplands, as well as on the social and economic interest of upland communities.

The outstanding landscapes, wildlife and natural features of the uplands have led to a variety of designations to protect and manage these areas. Seven of the eight National Parks in England and many Areas of Outstanding Natural Beauty cover upland areas. Together they help to protect the landscape and natural resources, and provide many recreational opportunities. The international importance of the biological resources of the uplands is also recognised by the designation of extensive areas under the Birds and Habitats Directives[15, 16] and also the Ramsar Convention on the conservation of wetlands.[14]

Upland Natural Areas

Natural Areas have been identified by English Nature as parts of the country with similar types of wildlife and natural features. In this report we have used the term 'upland' to refer to those Natural Areas which fall within the Less Favoured Areas boundary and are upland in character.



1 Border Uplands
2 North Pennines
3 Cumbria Fells and Dales
4 Forest of Bowland
5 Yorkshire Dales
6 Pennine Dales Fringe
7 North York Moors and Hills
8 Southern Pennines
9 Dark Peak
10 South West Peak
11 White Peak
12 Oswestry Uplands
13 Shropshire Hills
14 Clun and North West Herefordshire Hills
15 Black Mountains and Golden Valley
16 Exmoor and the Quantocks
17 Dartmoor
18 Bodmin Moor

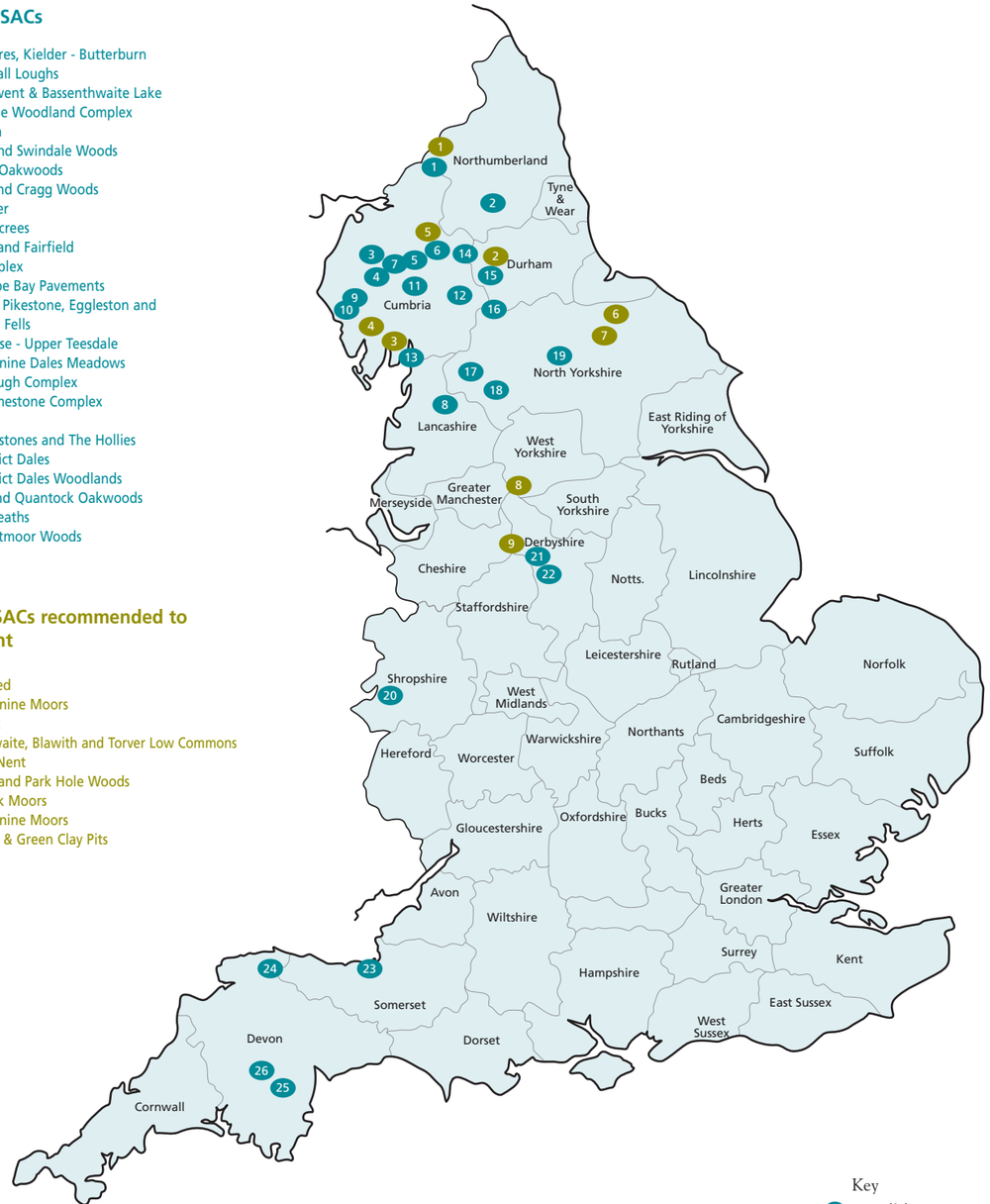
Special Areas of Conservation (SACs) in upland England

Candidate SACs

1 Border Mires, Kielder - Butterburn
2 Roman Wall Loughs
3 River Derwent & Bassenthwaite Lake
4 Borrowdale Woodland Complex
5 River Eden
6 Helbeck and Swindale Woods
7 Ullswater Oakwoods
8 Calf Hill and Cragg Woods
9 Wast Water
10 Wasdale Screes
11 Helvellyn and Fairfield
12 Asby Complex
13 Morecambe Bay Pavements
14 Bollihope, Pikestone, Eggleston and Woodland Fells
15 Moor House - Upper Teesdale
16 North Pennine Dales Meadows
17 Ingleborough Complex
18 Craven Limestone Complex
19 Ox Close
20 The Stiperstones and The Hollies
21 Peak District Dales
22 Peak District Dales Woodlands
23 Exmoor and Quantock Oakwoods
24 Exmoor Heaths
25 South Dartmoor Woods
26 Dartmoor

Proposed SACs recommended to government

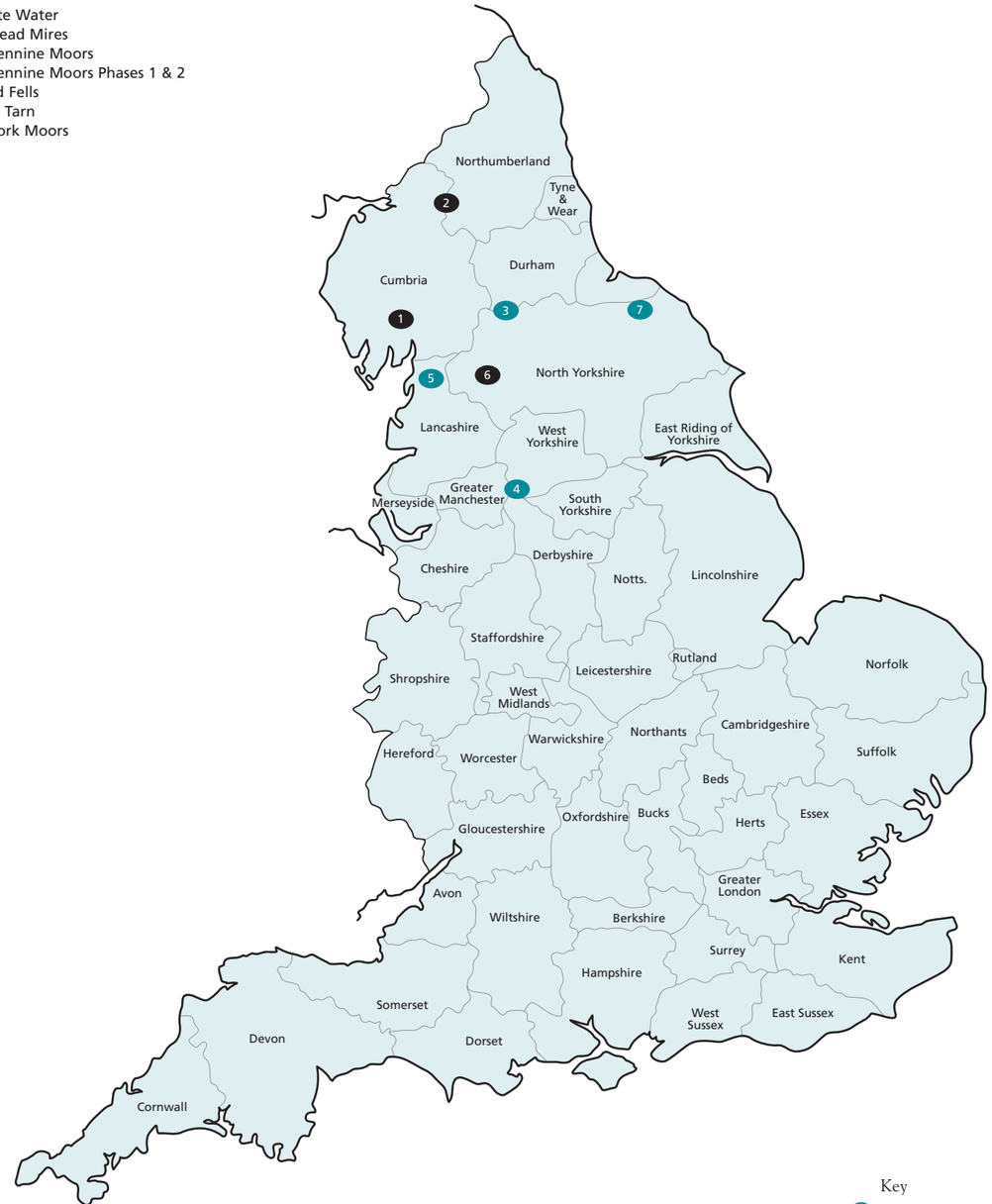
1 River Tweed
2 North Pennine Moors
3 River Kent
4 Subberthwaite, Blawith and Torver Low Commons
5 Tyne and Nent
6 Arncliffe and Park Hole Woods
7 North York Moors
8 South Pennine Moors
9 Bee's Nest & Green Clay Pits



Key
- Candidate SACs
- Proposed SACs recommended to government

Special Protection Areas (SPAs) & Ramsar sites in upland England

1 Esthwaite Water
2 Irthinghead Mires
3 North Pennine Moors
4 South Pennine Moors Phases 1 & 2
5 Bowland Fells
6 Malham Tarn
7 North York Moors



Key
- SPA
- Ramsar site

2. Upland habitats, species and natural features

SSSI condition assessment

English Nature worked with sister agencies in Scotland, Wales and Northern Ireland, and the Joint Nature Conservation Committee, to develop a common framework for determining the condition of the key features present in each SSSI.[67]

Each site is divided into units that relate to tenure, management and interest features.

Over a six-year period the condition of the interest feature(s) of each unit will be assessed against key criteria. When an interest feature meets these criteria, or its condition is improving because the necessary management is in place, it is considered to be in 'favourable condition'. Otherwise it is considered to be in 'unfavourable condition'.

The data we present in this report form a baseline against which future trends can be judged.

This chapter provides a detailed assessment of upland biodiversity and natural features, broken down into habitat types. Species-specific information is provided where this helps to illustrate trends and issues.

English Nature can now provide information on the area of habitats within SSSIs. However, as many upland SSSIs contain a mosaic of different habitats, the areas given below can be only estimates. By December 2000, we had mapped about 95% of the area of English SSSIs onto computer, so we can now publish estimates of the condition of habitats within SSSIs. Of particular concern is the poor condition of large areas of upland SSSIs, with 67% of upland calcareous grassland and 72% of upland heathland in unfavourable condition. The fact that the extent and condition of SSSIs form one of the national sustainable development indicators emphasises the need for action.[25] However, the situation is not uniform, as nearly 85% of surviving upland hay meadows are in favourable condition.

Condition of upland habitat types within SSSIs

	Percentage of area in 'unfavourable condition'
Upland woodland	29
Upland heathland	72
Upland calcareous grassland	67
Upland hay meadows	16
Blanket bog	60*
Standing waters	50

*provisional

Data for habitats within SSSIs in upland Natural Areas that have been mapped and assessed by December 2000.

Upland woodland

Lichens and mosses clothe the trees and boulders in Wistman's Wood, Dartmoor.
Photograph © David Townshend/English Nature.

Ancient woodlands (sites which have been continuously wooded since at least 1600[63]) occur throughout the uplands, especially along steep valley sides. They now rarely extend above 350 metres, whereas once they would have covered most of the uplands up to 600 metres. Extensive areas of recent planting, particularly conifers, have often replaced other habitats of higher conservation value.

Upland oakwoods consist mainly of oak and birch, with smaller trees like holly, rowan and hazel in the understorey. They are often very rich in bryophytes, because of high rainfall and the grazing which suppresses the shrub and field layers. They harbour a distinctive breeding bird assemblage which includes redstart, pied flycatcher and wood warbler. Wood ants are a notable feature of the invertebrate populations. Upland oakwoods are to be found from the north west of England, through the Welsh Borders down to the south west. There is about 100,000 hectares of upland oakwoods in the UK, and major concentrations are found in Cumbria, Devon and Cornwall.[83]

Biodiversity Action Plan species primarily associated with upland oakwood in England[70]

Carabus intricatus blue ground beetle - found in two woodlands on the edge of Dartmoor.

Procas granulicollis a weevil - occurs in a number of sites in northern England.

Melampyrum sylvaticum small cow-wheat - occurs locally in northern England.

Graphina pauciloculata a lichen - recorded from Bodmin Moor and Dartmoor in 1970s.

Pseudocyphellaria norvegica a lichen - known from only one site in England.

Lejeunea mandonii Atlantic lejeunea (a liverwort) - since 1970, only recorded from one site in Cornwall.

Campylopus setifolius silky swan-neck moss - confined to the Lake District.

Giant bellflower picture-winged fly

The giant bellflower *Campanula latifolia* is a locally common plant in upland calcareous woodlands, mainly in northern and north-western Britain. In roughly the centre of its range, in the Craven Limestone of Yorkshire, it is host to a very rare and attractive little fly, the giant bellflower picture-winged fly *Platyparaea discoidea*. The larvae of this species bore into the stems of the bellflower, and emerge as adults in early summer, at just about the same time as the flowers open.

These flies have a complex design of black markings on their wings, used in sexual dancing displays and fights between males, all of which take place on the broad leaves of the bellflower in the dappled shade of the woodland.

Formerly known from southern Scotland and South Yorkshire, this species now seems restricted to around 10 woodlands in the Yorkshire Dales, including Colt Park Wood National Nature Reserve.

Giant bellflower picture-winged flies mating. Photograph © Roger Key.

Mixed ashwoods, in which ash is the major species, occur on base-rich soils. The largest examples are found on limestone in the north west of England. They are amongst the richest woodlands in the uplands, with a diverse fauna and flora. They are noted for their fine displays of woodland flowers such as bluebell, primrose and wild garlic, together with a number of rarer woodland species such as dark-red helleborine, mezereum and Jacob's ladder. They have a rich invertebrate fauna, and in the south of their range support dormice. There is about 67,500 hectares of upland ash woodland in the UK.[77]

Biodiversity Action Plan species primarily associated with upland mixed ash woodland in England[70]

Cypripedium calceolus lady`s slipper orchid - Only one naturally surviving locality.

Upland woodland lichens[12,78]

Upland woodland supports a relatively high lichen diversity because the clean air and high light levels below the canopy are conducive to lichen growth. The beard-like lichen *Bryoria smithii* can be found growing on the bark of old oak trees and on acidic mossy boulders, where annual rainfall exceeds 1,500 mm. It is in danger of extinction in England as it is known from only two sites on Dartmoor, one of which is thought to have been lost to fire. Elsewhere, it is known from north west and central Europe, the Himalayas, southern China and Hawaii. The remaining population, within an SSSI, remains vulnerable to damage by visitors, trampling by grazing livestock, and possibly atmospheric pollution and collecting.

Dartmoor is also one of two localities for *Graphina pauciloculata*, a lichen found growing on the smooth bark of hazel, holly and young oak in moist open woodland and carr. This lichen is endemic to Britain and Ireland and is to be found only in two other localities, Bodmin Moor and one site in Ireland. It is vulnerable to damage from drying out if the surrounding tree canopy is opened up too much.

Biatoridium monasteriense is an endangered lichen found in sheltered ancient woodland, mostly on the base-rich bark of elm, ash and elder. It occurs at eight localities scattered throughout upland Britain. At each site it has been recorded growing on a single tree, making it vulnerable to the loss of these host trees. This species has been affected by acid deposition, and its recovery may still be hampered by the acid residues from pollution events in the 1960s and 1970s. Dutch elm disease also poses a threat to this species.

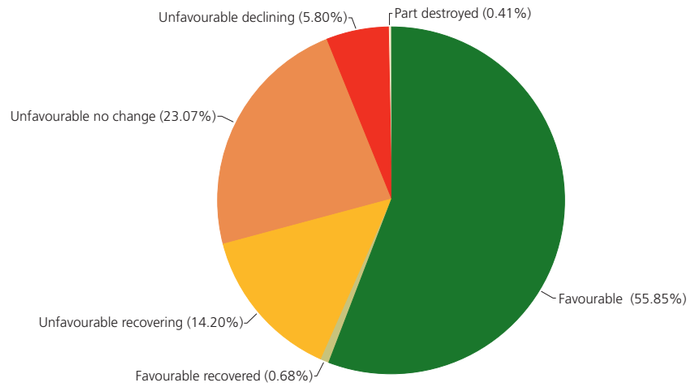
These species are priorities for action in the UK Biodiversity Action Plan.

The bark of mature trees in upland woods provides a home for rare lichens. Photograph © Peter Wakely / English Nature.

Sites of Special Scientific Interest

In England there are 217 SSSIs containing upland oakwoods, and 236 SSSIs containing mixed ash woodland. There is around 15,800 ha of upland woodland within SSSIs. 32% of upland oakwood SSSI units which have been assessed are in unfavourable condition, as are 39% of upland mixed ash woodland SSSI units.

Condition of upland woodland within SSSIs, by area



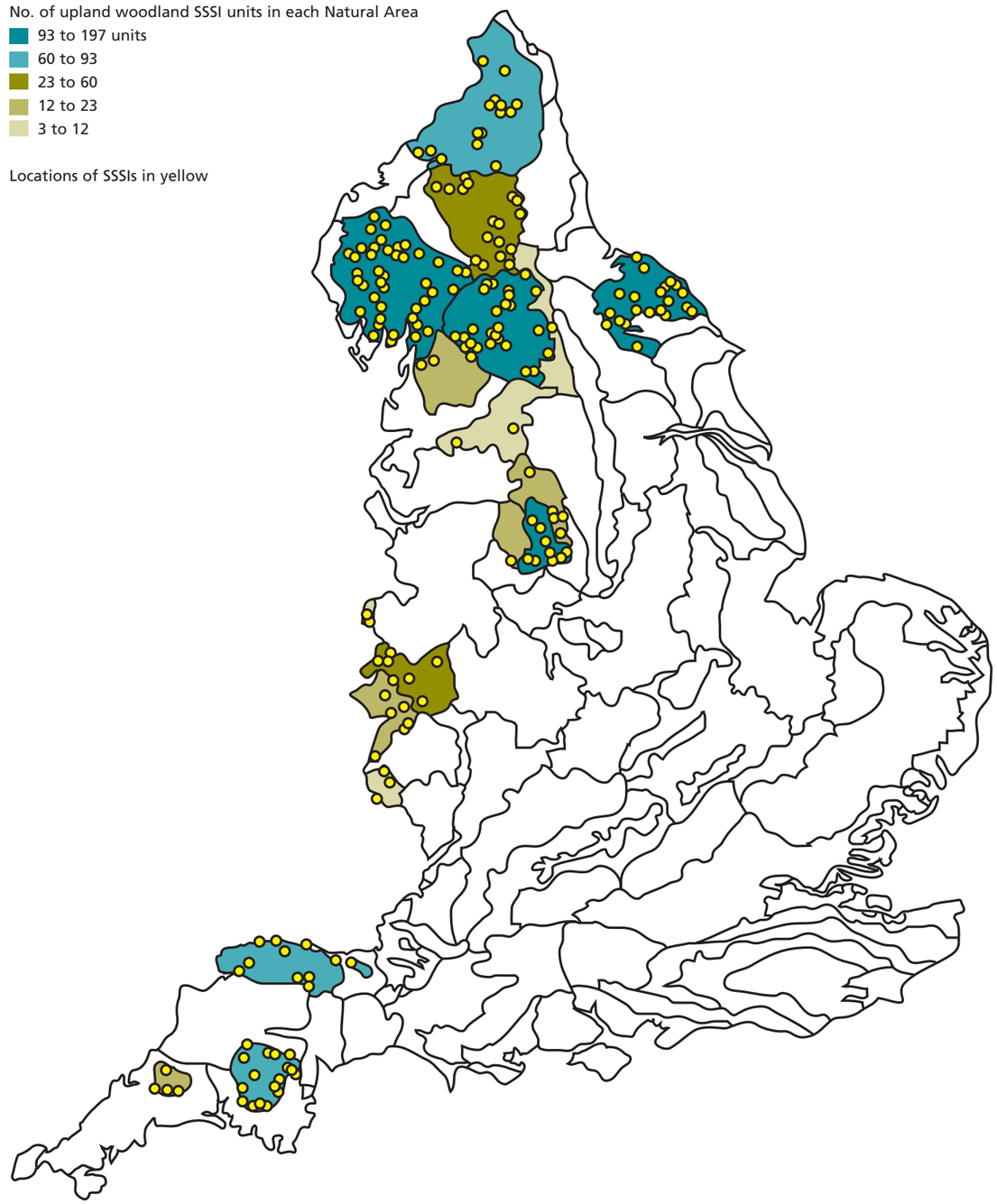
Total area assessed: 10,000 ha.

International importance

Temperate forests are one of the rarest of the world's forest types. Upland oakwoods are important in a European context, and include a habitat listed in the EC Habitats Directive (old oak woods with *Ilex* and *Blechnum*). There is around 20,000 ha of this particular type of oak woodland in England.[48] Britain and Ireland hold a substantial part of world and European populations of some species which occur in these woodlands. Internationally important sites include Exmoor and Quantock Oakwoods, South Pennine Moors, Dartmoor, and Ullswater Oakwoods.[7]

Upland mixed ashwoods are also important in a European context, encompassing three specific habitat types listed in the Habitats Directive (*Tilio-Acerion*, *Taxus baccata* woodland, and wooded limestone pavement). *Taxus baccata* woodland, and limestone pavements, are rare in Europe. Fine examples of this type of woodland are to be found on the limestone pavements around Morecambe Bay.[7]

The distribution of upland woodland SSSIs



Trends and threats

Within England, upland woodland has declined in area by some 30-40% over the past 60 years as a result of clearance, grazing, and loss to development, or has lost much of its value through replanting with conifers. The structure, and to some extent the composition, of upland woodland has also been modified by past management for coppice and/or by heavy grazing.[77,83]

New native wood planting in Littondale, Yorkshire Dales. Photograph © Keith Kirby / English Nature.

Future forestry in the uplands

In the 1980s forestry was seen as a major threat to upland habitats and wildlife because of extensive planting of non-native conifers. Since then there have been dramatic changes in forestry policies and practice and large-scale planting of non-native conifers on valuable upland habitats has ceased.[40]

The big upland conifer plantations are developing a distinctive set of habitats as they mature, and also through the re-structuring that takes place as they are felled and restocked. More attention is now paid to developing broadleaved woodland strips along stream sides and around other water bodies. In places, raptors such as goshawk and merlin are using the forest or forest edge. Conifer plantations are also being cleared from valuable habitats, for example the mires at Kielderhead and the limestone grassland at Whitbarrow.

Opportunities have been sought to develop new native woodland, notably through Forestry Commission Challenge Funding. Several hundred hectares of new woods have been created to help meet biodiversity targets for upland oak and upland mixed ash woods, and at the same time providing habitat for key species such as black grouse.

Forest Enterprise have given high priority to biodiversity in the management of their land, producing and implementing plans for their contribution to delivering Species and Habitat Action Plan targets.

Upland heathland

Heathland covers large areas of the English uplands above the enclosed agricultural land. Heather is usually the main heathland plant, although bilberry, crowberry and bell heather also occur. In the south and west, western gorse can become dominant. In wetter areas, heather is joined by cross-leaved heath, deer grass and purple moor grass over an understorey of *Sphagnum* mosses. Upland heaths often occur in mosaics with other upland habitats, including blanket bog, calcareous and acid grasslands, bracken, and streams and flushes.

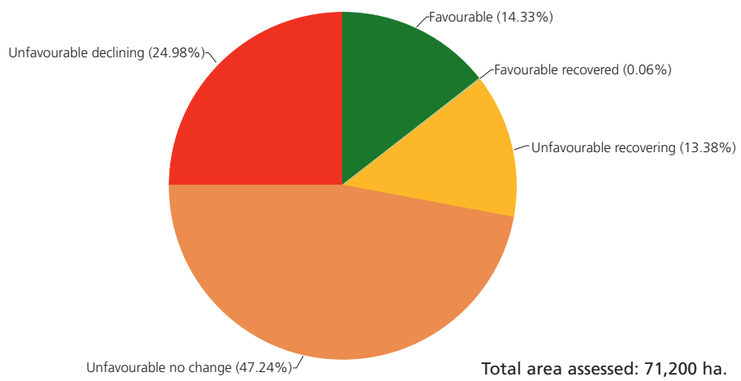
Red grouse and merlin have their strongholds on upland heathlands, along with rare and local invertebrates, mosses and liverworts, the last being especially characteristic of the wetter western heaths.

There is about 270,000 ha of upland heathland in England[81], large areas of which are registered as common land. Upland heathland is a priority habitat for action in the UK Biodiversity Action Plan.

Sites of Special Scientific Interest

There are 87 SSSIs with upland heathland, the heathland component of these sites covering approximately 179,000 ha. 72% of the area assessed is in unfavourable condition. This reflects the pressures facing this habitat, which are discussed in detail in Chapter Three.

Condition of upland heathland within SSSIs, by area



Total area assessed: 71,200 ha.

Biodiversity Action Plan species primarily associated with upland heathland in England[70]

Thereva serrulifera a cranefly - recorded in a few sites in England. Further survey work required to clarify species status.

Rheumaptera hastata argent and sable moth - thinly scattered distribution in England.

Xestia alpicola northern dart moth - restricted to mountain tops above 450 metres. Found in Cumbria and the Cheviots.

Xylena exsoleta sword-grass moth - formerly widespread, now only recorded occasionally. Found in a wide range of habitats, particularly upland moorlands.

Juniperus communis juniper - found in northern England (and also on the chalk of southern England).

Bryoria smithii a lichen - only known from two sites on Dartmoor.

International importance

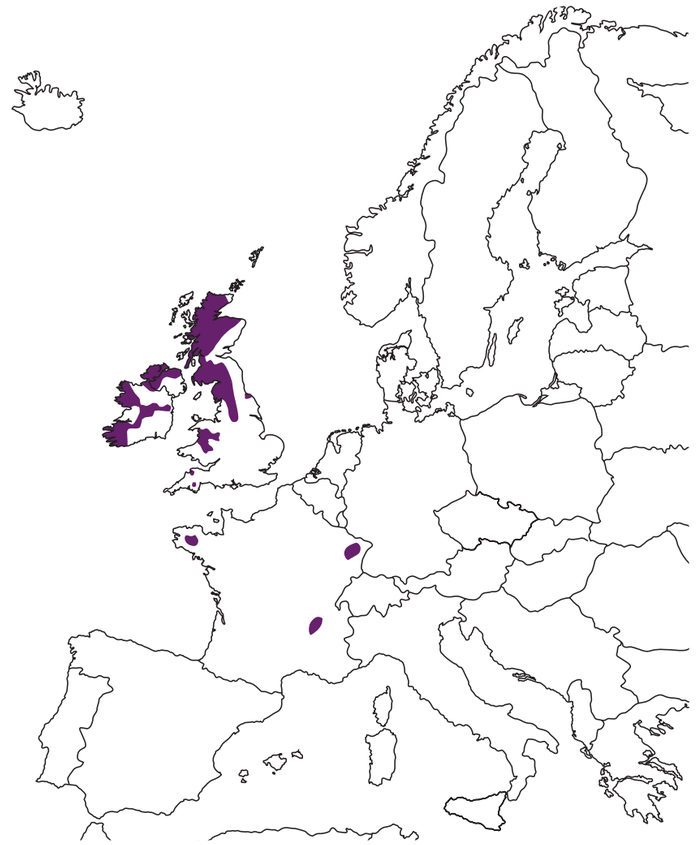
Upland heathland in England encompasses three habitat types listed in the Habitats Directive (dry heaths, *Erica tetralix* wet heaths, and juniper on heaths). Heathlands are internationally important because within Europe they are largely confined to Britain, and the western seaboard of mainland Europe. Internationally important examples include the North Pennine Moors, Exmoor Heaths, and North York Moors.[7]

Extensive areas of upland moorland have been designated as Special Protection Areas (SPA) under the EC Birds Directive because they hold internationally important populations of breeding birds.

Upland heathland at Exmoor National Park.
Photograph © Peter Wakely/English Nature.

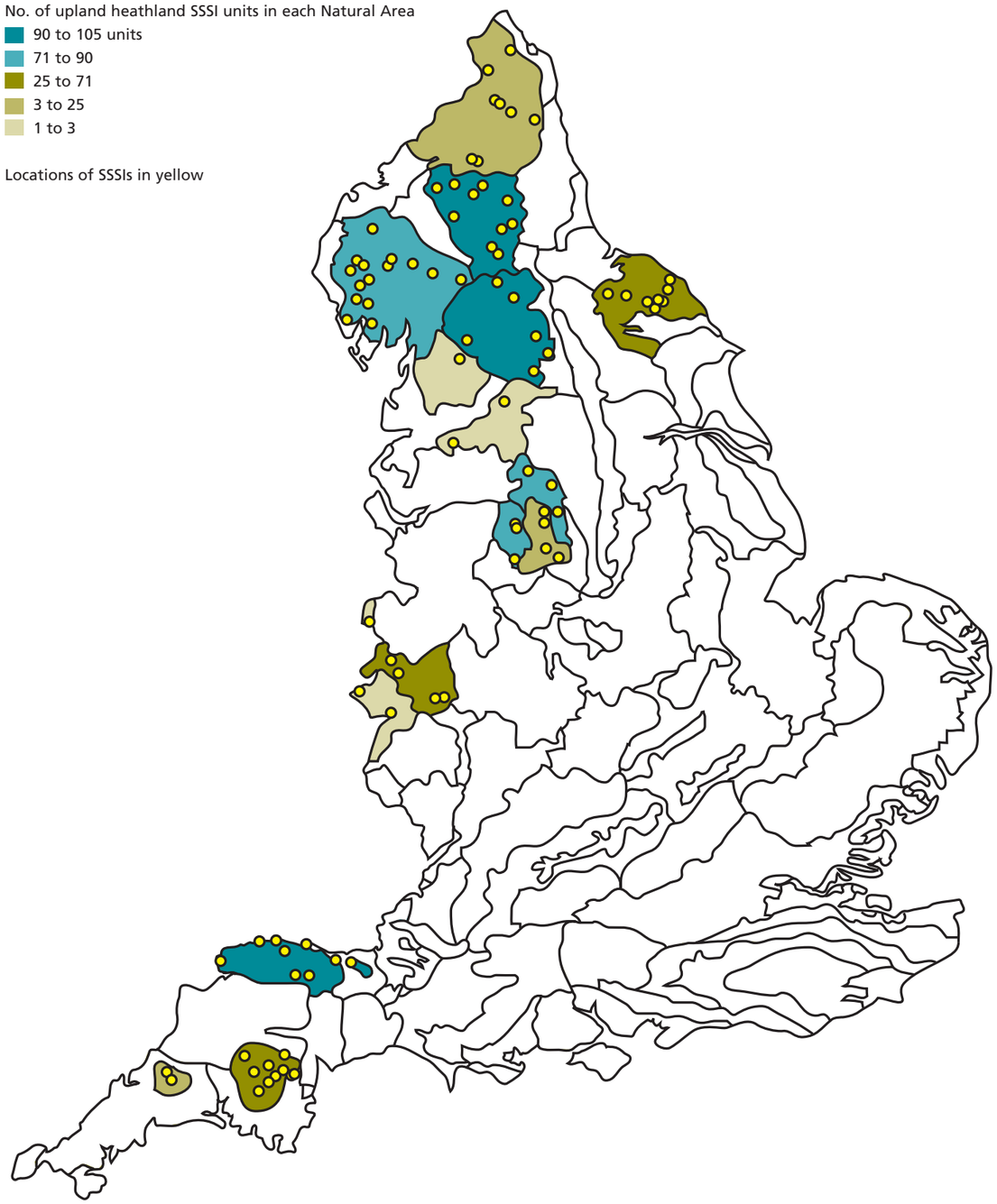
The European distribution of heather dominated upland moorland

(adapted from Thompson et al 1995 with permission from Elsevier Science).[74]



Species with internationally important breeding populations	Sites identified as SPA for these species
hen harrier	Bowland Fells, North Pennine Moors,
merlin	Bowland Fells, North Pennine Moors, North York Moors, South Pennine Moors.
peregrine	North Pennine Moors
golden plover	North Pennine Moors, North York Moors, South Pennine Moors.
curlew	North Pennine Moors
dunlin	South Pennine Moors
lesser black-backed gull	Bowland Fells
short-eared owl	South Pennine Moors

The distribution of upland heathland SSSIs



Trends and threats

Twenty seven percent of upland heathland in England and Wales was lost between 1947 and 1980, including 36% of Cumbria's heather.[39,74] On most of the remaining areas, heather was retained for grouse shooting. These losses and deterioration in the quality of remaining heathland have mainly been due to agricultural land improvement, heavy sheep and cattle grazing, poor burning practices, and afforestation. Other more localised threats include bracken encroachment, quarrying and wind farms.[81]

Black grouse - male displaying. Photograph - A E Hamblin/FLPA.

Black grouse

The black grouse *Tetrao tetrix* is declining rapidly across much of its European range. It was once found in lowland and upland areas throughout Britain, but in England is now confined to the northern Pennines and Northumberland. The population in Staffordshire appears to have died out as recently as the early 1990s. In the most recent national survey (1995-96) the English population was about 1,700 males.[44] Black grouse were once widely shot for sport, but shooting bags declined rapidly during the 20th century.

In the uplands, black grouse require a mosaic of habitats, with a close mix of heather moorland, damp rushy flushes abutting scattered trees, or light woodland and scrub with unimproved grasslands nearby. The loss of these habitat mosaics, as a result of agricultural intensification, has almost certainly caused the demise of the black grouse.

To manage upland areas to meet the black grouse's requirements would mean creating a diverse landscape, richer in wildlife. Indeed, the black grouse is symbolic of the English uplands - it is in sharp decline, yet has the potential for recovery.

Several recovery programmes are underway in England (including the North Pennines Black Grouse Recovery Project) which promote appropriate land management, for example reduced grazing, woodland regeneration and more mixed farming.

Montane habitats

Montane habitats lie above the natural tree-line, which in England is usually regarded as above 600 metres. This means they are confined to the highest mountains and hills in the north and west of the country, in the Lake District, North Pennines, Yorkshire Dales and Cheviot Hills. The majority of the montane area in the UK occurs in Scotland, where the special vegetation communities are far more widespread and extensive. Plants and animals of the montane zone are adapted to the wind-exposed summits, cliff ledges, screes, springs and flushes, or the sheltered shaded sites where snow still lies in late spring.

There are many plants and invertebrates living in montane habitats which are nationally rare and often found nowhere else in England. For example, the snowfield ground beetle lives only on Scafell Pike and Cross Fell. These species often have a relict distribution, with fossil evidence indicating that they were much more widespread during the last ice age. Further climatic warming could lead to the final loss of these plants and animals from England. Only one bird species is confined to the montane zone in England, the dotterel. There were up to 75 pairs breeding in England in the 19th century, but in the 1990s breeding took place in only 4 years, with no more than two pairs a year recorded.[72] The dotterel is unlikely to breed in England in the future because of global warming.

Sites of Special Scientific Interest

There are 33 SSSIs with an estimated 26,000 ha of land above 600 metres, but true montane habitats are very scarce indeed. 64% of the area of montane SSSIs units assessed are in unfavourable condition.

International importance

The montane habitats of England are oceanic outliers of habitats which are more extensive in continental Europe. There are several montane habitats that occur in England, including dwarf-shrub heath, moss and lichen heath, grassland, mires, tall-herbs, and juniper and willow scrub. Some are internationally important (alpine and sub-alpine heaths, siliceous alpine and boreal grasslands, species-rich *Nardus* grasslands on siliceous substrates, and eutrophic tall herb fringe communities) and listed in the Habitats Directive. Sites that support internationally important montane communities include Ingleborough, Moor House-Upper Teesdale, and the Lake District High Fells.[7]

Trends and threats

The main threats to montane habitats are overgrazing and poorly managed or accidental burning. Increased public access may have a greater impact in the future in certain areas and habitats. Continued nitrogen deposition and global warming pose threats in the longer term.[83]

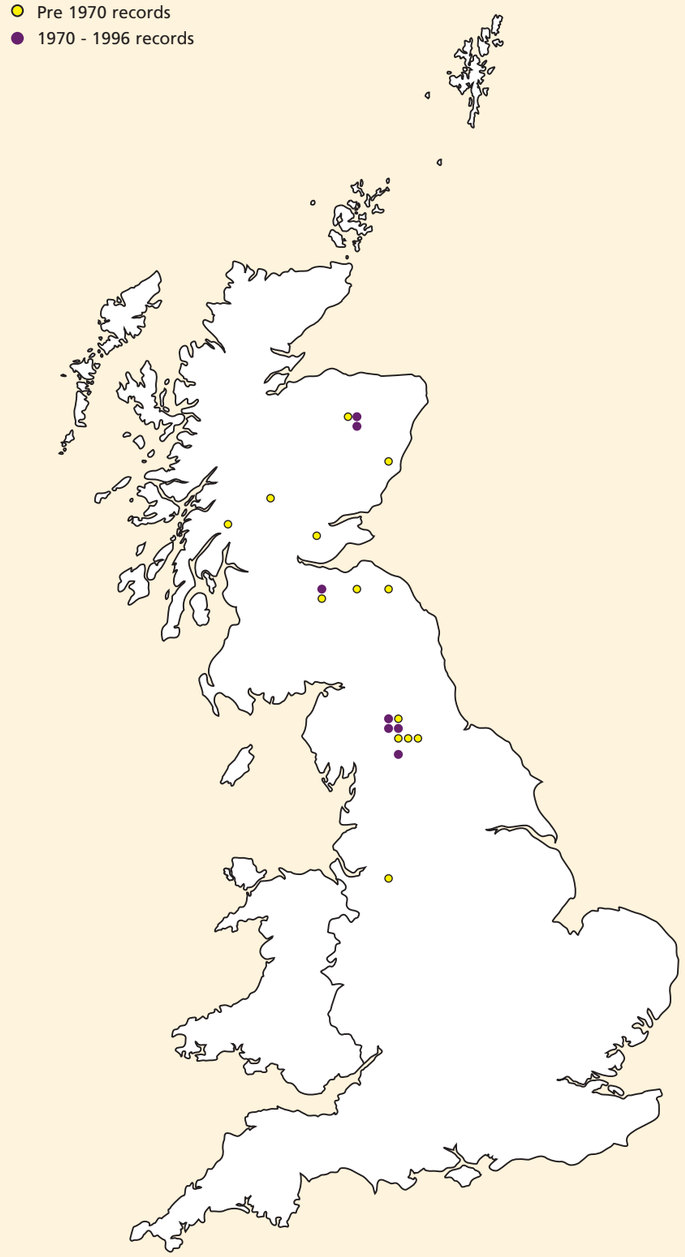
Yellow marsh saxifrage[88]

The yellow marsh saxifrage *Saxifraga hirculus* is threatened throughout its international range, and is protected under the Habitats Directive and Schedule 8 of the Wildlife and Countryside Act.

In the UK, the plant is confined to upland sites in Scotland and the northern Pennines. Its main stronghold now lies in the Pennines (where 80-90% of the UK population occurs) and where it prefers base-rich wet mossy flushes and mires. There are several populations containing more than 1,000 plants. It is widely distributed in Europe, the Caucasus and Himalayas.

The yellow marsh saxifrage is threatened by overgrazing in its upland habitats, and rarely sets seed. Competition from other vegetation, including tall grasses and scrub, can also adversely affect its survival.

Distribution of yellow marsh saxifrage in Britain, by 10km square.



Source: Biological Records Centre, CEH, Monks Wood.

Yellow marsh saxifrage. Photograph © Peter Wakely / English Nature.

The Teesdale rarities

Moor House-Upper Teesdale National Nature Reserve lies high up in the north Pennines, straddling the Durham-Cumbria border, and covers 7,386 ha. It is one of England's finest montane reserves, with extensive areas of key upland habitats, including heathland, calcareous grassland, blanket bog, hay meadows and montane habitats.

On the treeless windswept slopes near Cow Green Reservoir there are areas of 'sugar limestone', which has been created by the contact of molten rock against the limestone, converting the latter into a crystalline sugar-like marble. This unusual rock, with its special characteristics, supports a rare assemblage of plants, some found nowhere else in Britain. These 'Teesdale rarities' include Teesdale sandwort, which in Britain occurs only on sugar limestone in Teesdale, the intensely blue spring gentian, found in the British Isles only in Teesdale and western Ireland, and mountain everlasting, the closest British relative to edelweiss. Other special plants found on the sugar limestone include alpine bistort, autumn gentian and false sedge, growing in a turf of blue moor-grass and sheep's fescue, unique in Britain. Unusually, sea plantain grows here, many miles from its normal coastal habitat.

This unique collection of rare plants is susceptible to erosion damage because of the fragile nature of the rock. Overgrazing is a significant threat, in spite of the site's status as a National Nature Reserve. Many of these plants live at the edge of their climatic ranges, so that increases in temperature due to global warming could lead to changes in their distribution and possibly threaten their long-term survival.

Spring gentian. Photograph © Chris McCarty / English Nature.

Upland calcareous grassland

Upland calcareous grasslands generally occur above the upper limit of agricultural enclosure, mainly above 250-300 metres, and are restricted to shallow soils over lime-rich bedrocks, including Carboniferous Limestone in the northern Pennines and Borrowdale Volcanics in Cumbria. These grasslands are typically part of habitat mosaics with other upland habitats, such as upland heath and acid grassland, and are generally managed as rough grazing for domestic livestock. Upland calcareous grassland is a priority habitat for action in the UK Biodiversity Action Plan.

Biodiversity Action Plan species primarily associated with upland calcareous grassland in England[70]

Osmia parietina a mason bee - two populations in northern England, Gait Barrows NNR and Carnforth Iron Works.

Aricia artaxerxes northern brown argus - locally distributed in the Peak District, Yorkshire, Cumbria and County Durham.

Vertigo genesii round-mouthed whorl snail - only occurs in one site in England, Teesdale in County Durham.

Alchemilla minima an alchemilla - endemic to two fells in the Yorkshire Dales.

Hygrocybe spadicea date-coloured waxcap - known from Cumbria and Shropshire (and also Slapton in south Devon).

Mountain pansies in North Pennines calcareous grassland. Photograph © Chris McCarty / English Nature.

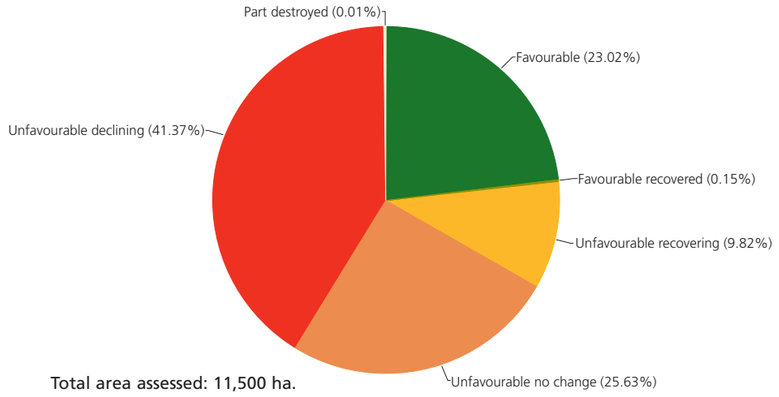
Upland calcareous grasslands typically contain many lime-loving plants such as rock-rose, bird's-eye primrose and bloody cranesbill, and can be very species-rich. However, heavily grazed areas have only a species-poor sward of the most grazing-tolerant species. Extensive areas of upland calcareous grassland are registered as common land.

It is estimated that there is 10,000 ha of CG9 and CG10* upland calcareous grassland in England, with the North Pennines and Cumbria being particularly important areas.[81] In addition there are areas of a more lowland type of calcareous grassland (CG2*) within upland Natural Areas, particularly in the Peak District.

Sites of Special Scientific Interest

There are 39 SSSIs containing an estimated 7,500 ha of CG9 and CG10 upland calcareous grassland, and a further 40 SSSI with other calcareous grassland with upland Natural Areas.

Condition of upland calcareous grasslands with SSSIs, by area

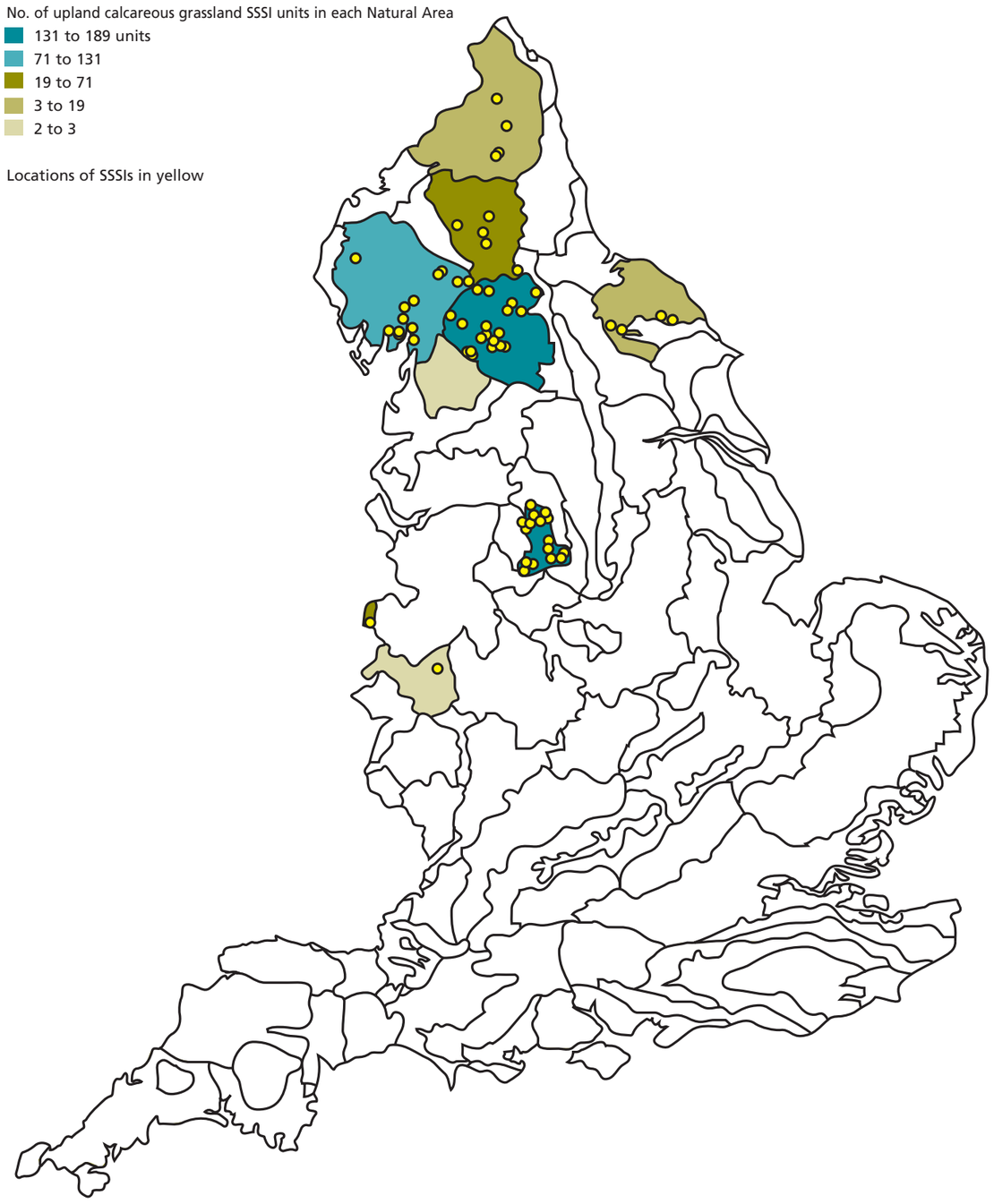


Total area assessed: 11,500 ha.

67% of the area assessed is in unfavourable condition. However, because much of this land has been entered in either English Nature's Wildlife Enhancement Scheme or the Countryside Stewardship Scheme, we anticipate considerable recovery in coming years.

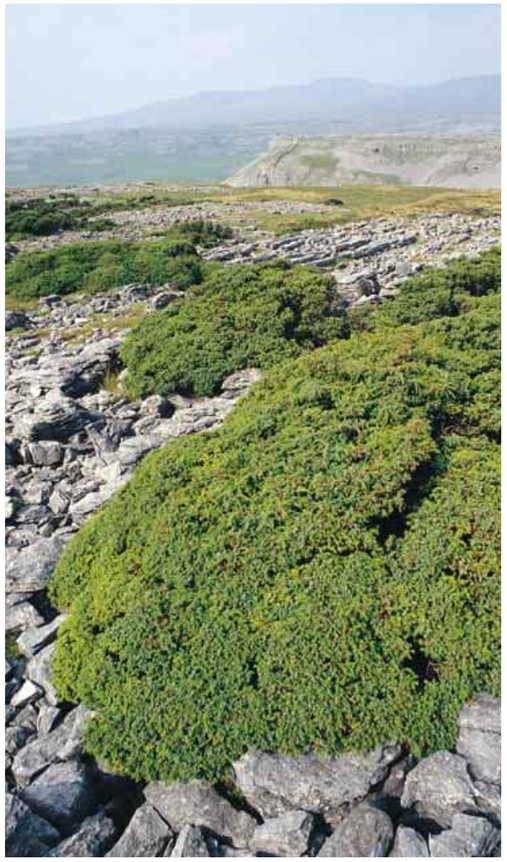
* National Vegetation Classification (NVC) communities.

The distribution of calcareous grassland SSSIs in upland Natural Areas



International importance

There are several upland calcareous grassland types listed in the EC Habitats Directive (*Juniperis communis* formations on heaths or calcareous grasslands; semi-natural dry grasslands and scrubland facies on calcareous substrates; and *Molinia* meadows on chalk and clay). Internationally important sites include the North Pennine Moors, Moor House-Upper Teesdale, and the Craven Limestone Complex.[7]



Juniper scrub on Houghton Fell, Ingleborough, North Yorkshire. Photograph © Peter Wakely / English Nature.

Juniper[13]

Juniper *Juniperis communis* has a widespread but uneven distribution from the chalk downlands of southern England and maritime cliffs in Cornwall, through to heathland and calcareous grasslands in the uplands, and the limestone pavements of Cumbria. In areas of juniper scrub the ground flora may include localised species such as twayblade and common wintergreen. Upland juniper scrub provides valuable shelter for black grouse during the winter months.

Juniper has shown a marked decline in the English uplands, caused by a number of factors, of which perhaps the most significant is overgrazing. Other impacts include burning, direct removal, and in some instances neglect. A survey carried out in 1994-95 by English Nature in Northumbria (Northumberland and County Durham), to reassess sites known to contain juniper stands in 1973, found that around 16% of colonies had been lost completely, and 54% were suffering a decline in the number of bushes. As a whole, the juniper population of Northumbria has fallen by 30% since 1973.

In the light of these results English Nature has introduced a Wildlife Enhancement Scheme to extend the area, and improve the quality, of juniper habitats in Northumberland.

Trends and threats

Upland calcareous grassland in England has been lost or damaged principally through agricultural intensification and heavy grazing, with quarrying also being a significant factor in some areas.[81]

Upland hay meadows

Upland hay meadows are the product of low intensity farming practices. Traditional management for hay has resulted in enclosed meadows rich in colourful flowers such as crane's-bill, globeflower, pignut, great burnet and lady's mantle. Upland hay meadows occur as scattered fields or isolated groups of fields, usually at a height of between 200 and 400 metres, and are found in the northern Pennines of North Yorkshire and Durham, Cumbria, Lancashire and Northumberland.

Upland hay meadows are now very rare, covering less than 1,000 ha in England. They are a priority habitat for action in the UK Biodiversity Action Plan.[77]

Globeflower

The Globeflower *Trollius europaeus* is a large and darker version of a buttercup, with globe-shaped flowers. It is the sepals which form the flower and hide the narrow petals which provide the nectar. It was first recorded in the 16th century, when it was found widely in Yorkshire and Lancashire.

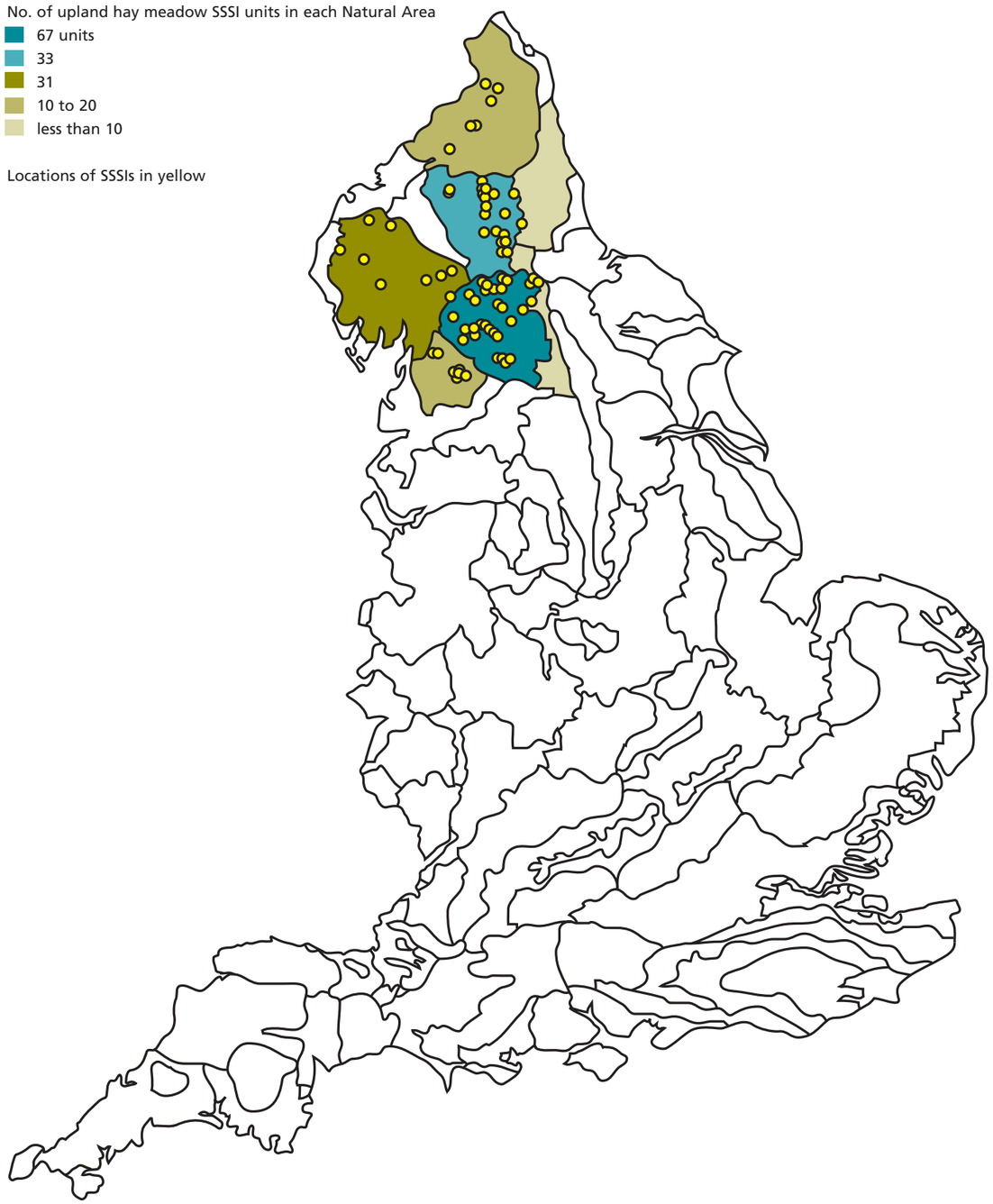
The globeflower is a typical plant of upland areas in the north and west of Britain, and scattered locations in Northern Ireland. It grows in damp montane meadows and pastures on woodland edges, or by rivers and streams.

The abandonment of traditional forage harvesting, silage making and continuing summer grazing are the main threats to the globeflower, since it is intolerant of summer grazing.

Drainage and the use of fertilisers may also be factors. Action to conserve upland hay meadows through the Biodiversity Action Plan will directly benefit this flower, so characteristic of these grasslands.

Globe flower. Photograph © W Wisniewski / FLPA.

The distribution of upland hay meadow SSSIs

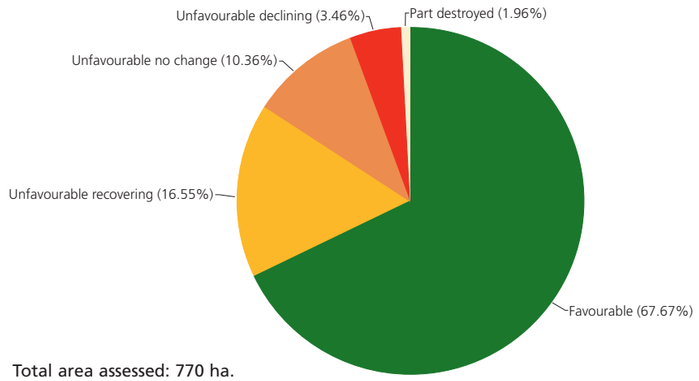


Sites of Special Scientific Interest

There are 75 SSSIs, containing a total area of around 770 ha of upland hay meadow.

Some 84% of the area assessed is in favourable condition, reflecting the effort put into conserving the few remaining areas of unimproved upland hay meadow, through schemes such as the Yorkshire Dales ESA and English Nature's Wildlife Enhancement Scheme.

Condition of upland hay meadows within SSSIs, by area



Total area assessed: 770 ha.

International importance

Upland hay meadows are listed in the Habitats Directive. Internationally important sites include Moor House-Upper Teesdale, and the North Pennine Dales Meadows.[7]

Trends and threats

Upland hay meadows have been lost or damaged through agricultural intensification, involving ploughing, drainage, reseeding, fertiliser or slurry treatment, increased grazing pressure and a shift from hay-making either to silage production, with more frequent and earlier cutting, or to grazing pasture. A further threat is increased fragmentation, leading to a greater risk of species extinctions in the small remnant areas.[77]

Blanket bog

Pool on blanket bog, Geltsdale.
Photograph © Malcolm Stott.

Blanket bog

Blanket bog is a globally rare peatland habitat confined to cool, wet, oceanic climates. However, it is one of the most extensive semi-natural habitats remaining in the UK, and in England occurs from Devon to Northumberland. It is a priority habitat for action in the UK Biodiversity Action Plan.

Peat accumulates when certain plants decompose at a very slow rate under waterlogged conditions. *Sphagnum* moss is a vital part of bog vegetation because it retains water like a sponge. In ideal conditions the peat develops not only in wet hollows but also over large expanses of the undulating uplands, creating a blanket that gives the habitat its name. Most blanket peat formation began perhaps 5,000-6,000 years ago, coinciding with clearance of the original forest cover by man. The peat within blanket bogs represents an archaeological archive which, once destroyed, cannot be restored or reinstated.

Blanket bogs are an important habitat for a wide range of species including internationally important populations of breeding waders such as golden plover, curlew and dunlin. These bogs and their associated pools support a specialised flora and fauna, including a number of rare and scarce invertebrates such as the northern dart moth and great yellow bumblebee.

There is estimated to be some 215,000 ha of blanket bog in England (14.5% of the UK total).[48,52,81] A national inventory of blanket bog habitats in Great Britain is planned for 2004, to provide an up-to-date picture of the extent of this rare habitat.

The ground beetle *Miscodera arctica* and mountain pill beetle *Byrrhus arietinus*

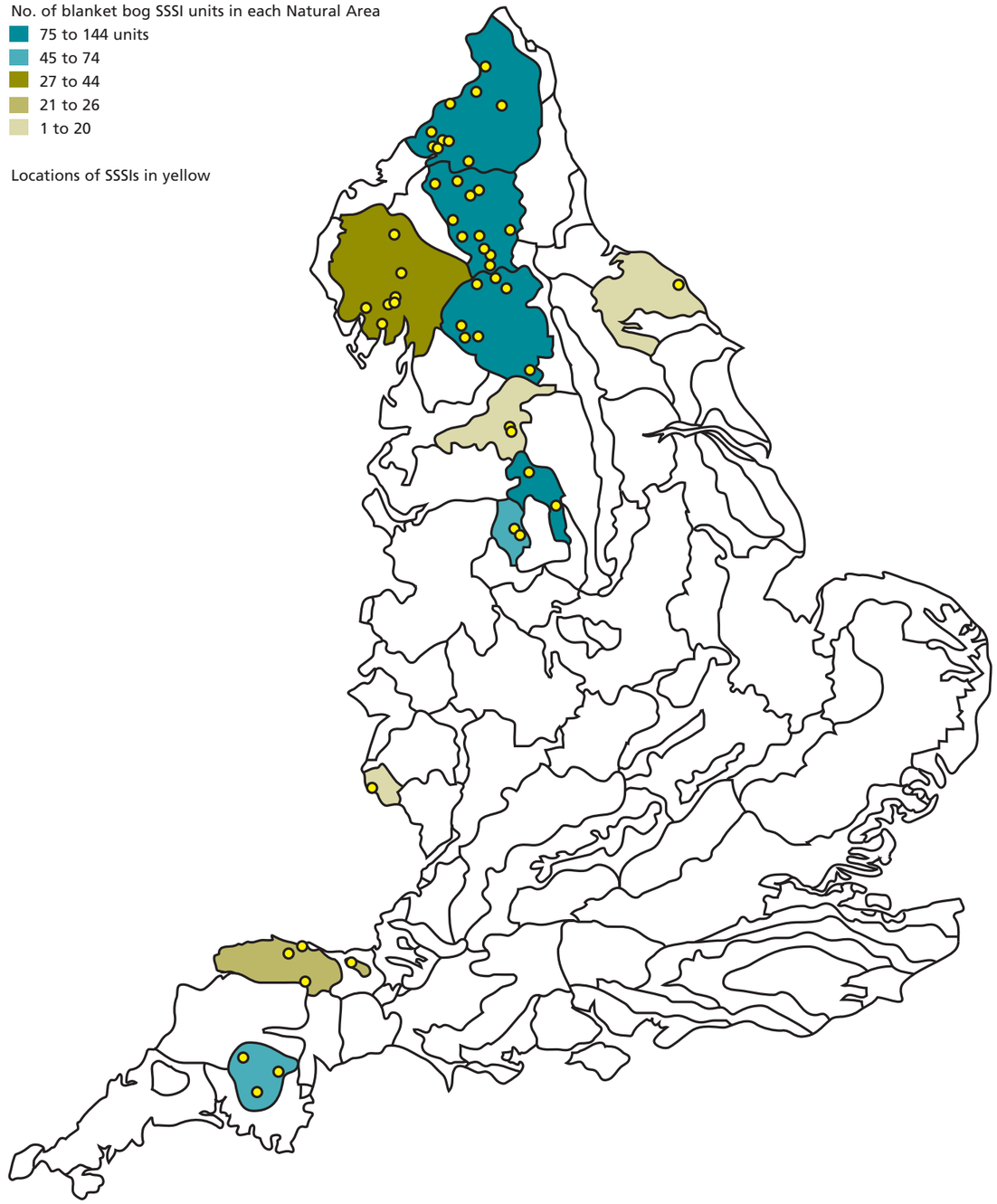
Pill beetle *Byrrhus arietinus*. Photograph © Roger Key.

These northern species of cold mountain tops, open blanket bog dominated by heather, or *Racomitrium* moss, are at the southern end of their range in England. The ground beetle is one of the very few boreal species of beetle that occurs as far south-west as Exmoor, where it is, however, quite rare. Both species are nationally scarce.

The pill beetle retracts its legs into special grooves on its body and remains motionless on being disturbed, when it very strongly resembles a sheep or rabbit pellet. It feeds exclusively on moss, one of the very few invertebrates to do so. The ground beetle is a predator of pill beetles, including the mountain pill beetle.

Both beetles are vulnerable to overgrazing, which can reduce the amount of their habitat, and are particularly vulnerable to the effects of global warming, which may render their moorland and montane habitat too warm for them to survive.

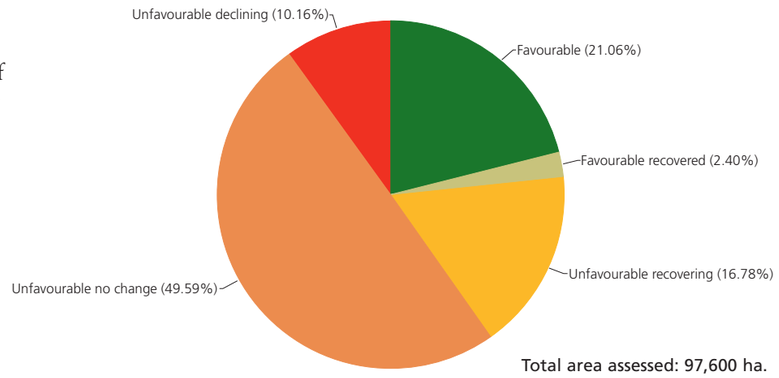
The distribution of blanket bog SSSIs (provisional)



Sites of Special Scientific Interest

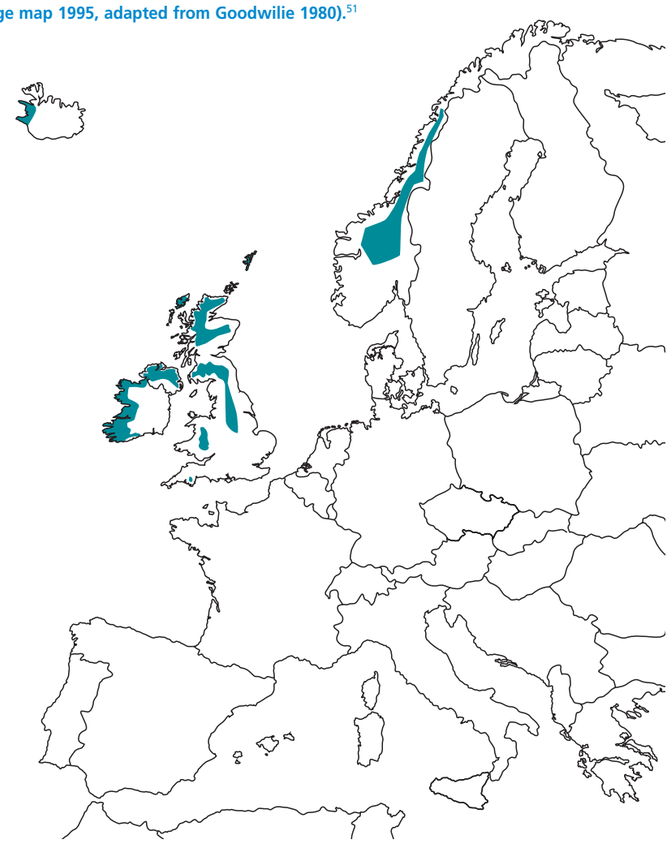
There are 51 SSSIs containing a total of in excess of 100,000 ha of blanket bog. 60% of blanket bog SSSI units assessed are in unfavourable condition.

Condition of blanket bog within SSSIs, by area (provisional)



Total area assessed: 97,600 ha.

Distribution of blanket bog in western Europe (based on Scottish Natural Heritage map 1995, adapted from Goodwilie 1980).[51]



Biodiversity Action Plan species primarily associated with blanket bog in England[70]

Sphagnum balticum
Baltic bog-moss - since 1970 recorded in Northumberland.

International importance

Blanket bog is listed in the Habitats Directive, and is found only in the north and west of the UK and in Ireland. Internationally important sites include Dartmoor, the North Pennine Moors and the Border Mires.[7]

Golden plover. Photograph © Alan Williams / NHPA.

Golden plover

The golden plover *Pluvialis apricaria* is probably the most characteristic bird of the English uplands. It breeds from Dartmoor northwards, but is numerous only in the Pennines, the Forest of Bowland and in the North York Moors. In England there are about 4,000 breeding pairs, around 18% of the UK population, and 3-5% of the European population. The English breeding population lies at the southern end of the species' world range.

Nesting golden plover favour high, flat to gently sloping plateau ground, away from the moorland edge. They nest on the ground on heather moorland, upland grasslands and on blanket bogs. They appear to nest at higher densities on short-rotation burnt heather moorland and on hummocky limestone grassland. Chicks remain on the moorland to feed, often in small marshes where invertebrate food is plentiful. Adults, by contrast, obtain most of their food well away from the nest, feeding on earthworms and other invertebrates in fields near to the moorland edge.

The loss of dwarf shrubs due to overgrazing and the consequent spread of acid grasslands (which golden plovers appear to avoid) may be a major threat to this species in England. However, golden plover also avoid tall vegetation, so a cessation of rotational burning or under-grazing may also lead to population decline. Hence they need sympathetic management of blanket bog and upland heathland for healthy breeding populations to be retained. The adjacent enclosed farmland is also important in providing feeding areas during the breeding season.

Golden plover are disturbed by walkers, and especially by unrestrained dogs, but there is currently no definitive evidence of any significant impact on golden plover breeding populations.

Trends and threats

In England, blanket bog has been lost or damaged due to burning, drainage and heavy grazing (especially on common land) which leads to erosion, or conversion to heathland and acid grassland. Burning of active blanket bog damages the floral diversity, and can initiate erosion. Afforestation, recreation, erosion and development, for example wind farms and communication masts, have also resulted in more limited loss or damage. Industrial atmospheric pollution, such as in the Southern Pennines, and climate change can also have a profound impact on blanket bog.[81]

Limestone pavement

Grikes provide a home for plants on limestone pavement. Photograph © Peter Wakely / English Nature.

Limestone pavements are large areas of rock, scoured by glaciers during the ice ages and then weathered over thousands of years. They contain complex patterns of deep crevices known as grikes, between which are massive blocks of worn limestone, called clints. Limestone pavements are scarce and non-renewable, and Britain and Ireland hold the most important and extensive areas in the world.

Limestone pavements support unusual combinations of plants. Plants grow mainly within the grikes, which provide sheltered, humid conditions with very thin soils. The grikes contain woodland and wood-edge plants such as herb Robert and dog's mercury, a number of ferns including hart's tongue, wall rue, male fern, and the rare rigid buckler fern, which is almost exclusively confined to limestone pavement. The high proportion of ferns reflects the humid shady conditions found in grikes. Grikes also provide a refuge for those plants, such as bloody crane's-bill, which cannot tolerate grazing.

Upland pavements have a distinctive flora which includes brittle bladder fern, green spleenwort and lesser meadow-rue. At higher altitudes, montane species such as alpine cinquefoil and mountain avens can be found.[86] Limestone pavements support 16 species which are rare or threatened in Britain, including rigid buckler fern, English sandwort, downy currant, baneberry, narrow-leaved bitter-cress, and the high brown fritillary and pearl bordered fritillary butterflies.

The total area of limestone pavement in England is 2,340 ha, comprising 80% of the UK resource.[48]

Limestone pavement is identified as a priority habitat for action in the UK Biodiversity Action Plan.

Biodiversity Action Plan species primarily associated with limestone pavement in England[70]

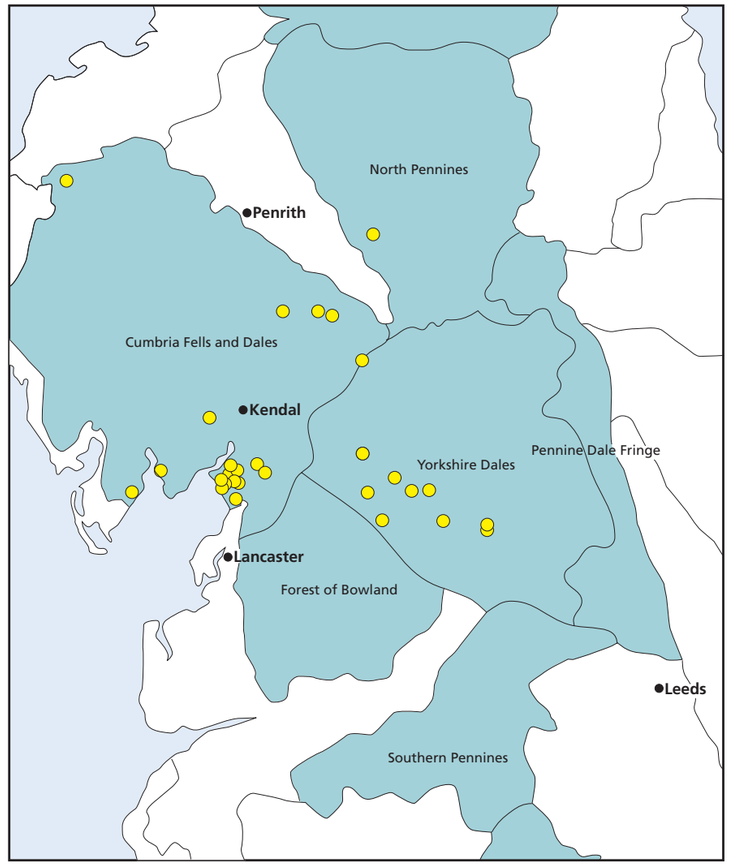
Osmia parietina a mason bee - two populations in northern England, Gait Barrows NNR and Carnforth Iron Works.

Sites of Special Scientific Interest

There are 30 SSSIs containing a total of 1,396 ha of limestone pavement. Just over a third (36%) of SSSI units assessed are in unfavourable condition.

The distribution of limestone pavement SSSIs

Locations in yellow



International importance

Limestone pavement is listed as a priority habitat type in the Habitats Directive. England holds a large proportion of this habitat within Europe, with the only other significant areas being in Ireland and Sweden. Internationally important sites include the Asby Complex in Cumbria, and the Craven Limestone and Ingleborough in North Yorkshire.[7]

Trends and threats

Limestone pavement has been in demand as 'water worn limestone' for garden rockeries since around 1870, but losses have accelerated over the last 40 years as extraction has become mechanised. Limestone rock has been removed both legally (under existing planning permissions) and illegally for garden use. A comprehensive survey of limestone pavements in 1975 estimated that while 61% of the total area of limestone pavement in the UK was intact only 3% was undamaged.[83]

Overgrazing has also resulted in habitat degradation. In 1999, 40% of all pavements were in unfavourable condition due to overgrazing, and a further 8% due to the presence of conifer plantations.[43]

Limestone pavement and the law

Limestone pavement has special protection under Section 34 of the Wildlife & Countryside Act, which permits the making by the local authority of a Limestone Pavement Order to protect a pavement. The Order makes removal of rock a criminal offence. There are currently 99 Limestone Pavement Orders, covering the best sites in England. Unfortunately, this protection has had the side-effect of transferring the pressure for removal to pavements in Ireland.

Being non-renewable, limestone pavement cannot be replaced, and conservation must be directed at protection of surviving areas. A campaign launched in 1995 by the Limestone Pavement Action Group[49, 50] has increased public awareness and support, and has led to the revocation of the last two planning permissions to extract limestone pavement in England.

Scar Close pavement. Photograph © Simon Webb / English Nature.

Asby pavement.
Photograph © Simon Webb / English Nature.

Bloody crane's-bill

Overgrazing on upland pavements threatens characteristic species such as bloody crane's-bill *Geranium sanguineum*. The pavements of the Asby area on the eastern side of Ingleborough illustrate the effects of high levels of sheep grazing, where species such as bloody crane's-bill which are intolerant of grazing survive only deep in the grikes. In contrast, lower grazing pressure at Scar Close allows the species to grow out of the grikes and onto the clint tops.

Limestone pavement, Malham Lings, North Yorkshire. Photograph © Simon Webb / English Nature.

Standing waters

Biodiversity Action Plan species primarily associated with upland mesotrophic lakes in England[70]

Coregonus albula vendace

Pilularia globulifera pillwort

Chara curta lesser bearded stonewort

The existence of standing water reflects the topography and geology of an area, as well as its annual rainfall. For example, in the Cumbrian Fells and Dales standing waters account for nearly 2% of the total area. Within our uplands, oligotrophic and mesotrophic lakes are particularly well represented.

Oligotrophic lakes are nutrient poor, often of glacial origin, and typically found in upland areas where the rocks are resistant to weathering. They support a variety of characteristic plants and animals, including quillwort and shoreweed. Floating water plantain and pillwort are two nationally scarce species found in this habitat. A nationally rare fish, the schelly, is found in Brothers Water which, along with Buttermere, Blea Water and Wast Water in Cumbria, is a typical oligotrophic lake.[7]

Mesotrophic lakes are more nutrient rich, have a high aquatic plant diversity, and support a high proportion of nationally rare and scarce plant species. England's mesotrophic lakes are particularly important for the rare fish they support, for example the vendace. Mesotrophic lakes are a priority habitat for action in the UK Biodiversity Action Plan.[83]

The vendace - England's most threatened fish[53]

In England this herring-like fish is known only from two lakes, Derwent Water and Bassenthwaite Lake. It is a plankton feeder, and is very rarely seen by anglers as it never takes a bait. It favours open waters offshore where it feeds in shoals. It is found throughout northern and western Europe as far as western Russia and Bavaria.

The vendace has declined throughout its range due to pollution from nutrient enrichment and the introduction of non-native fish species. For example the ruffe, a small predatory fish, has been introduced into Bassenthwaite, probably through its use as a live bait for angling. It is now known that this species feeds on vendace eggs.

Vendace. Photograph © IFE.

Sites of Special Scientific Interest

There are 39 SSSIs containing a total of 4100 ha of standing water. 50% of the units assessed are unfavourable condition.

International importance

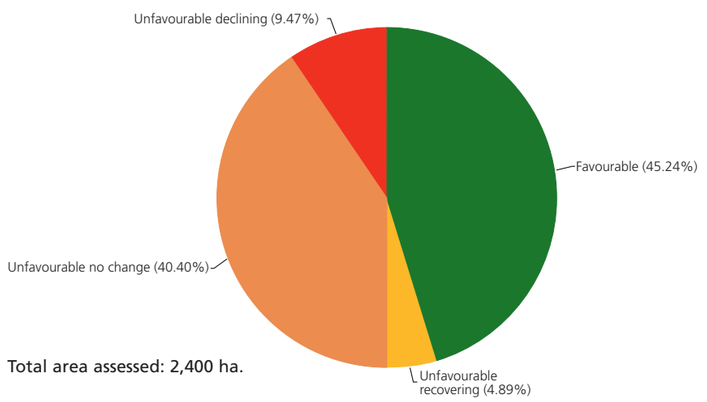
Standing waters in the uplands include two habitats listed in the Habitats Directive. In the UK there is around 150,000 ha of oligotrophic to mesotrophic waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoeto-Nanojuncetea*. Hard oligo-mesotrophic lakes with benthic vegetation of *Chara* spp(stoneworts) are more scarce, with only 1,000 ha in the UK.[48]

Bassenthwaite Lake NNR, Cumbria. Photograph © Peter Wakely / English Nature.

Trends and threats

Standing waters are vulnerable to a range of pressures, including nutrient enrichment from organic and inorganic fertilisers or phosphates in sewage. Similarly, changes in land use in lake catchment areas can also lead to increased run-off of silt, which can have detrimental effects on lake ecology. In a study of lake SSSIs, 48 of the 58 lakes studied were affected by eutrophication, and in 32 of these the special interest was judged to be adversely affected.[11] Acid deposition is of particular concern in some parts of the uplands. Large conifer plantations in upland areas can have significant effects by altering hydrology, changing erosion and sedimentation rates, and impacting on water quality by accelerating the process of acidification. Recreational use of boats can also damage aquatic plant communities, whilst fisheries management or the introduction of non-native species can alter the ecology of lakes, placing native species at risk.[83]

Condition of upland standing waters within SSSIs, by area



Total area assessed: 2,400 ha.

Cumbrian lakes

The lakes and tarns of the Cumbria Fells and Dales Natural Area are the most extensive and important in England, and a number of these are threatened by nutrient enrichment. None of the four SSSIs with oligotrophic open waters show signs of nutrient enrichment. However, of the ten SSSIs with oligotrophic / mesotrophic open waters two show signs of nutrient enrichment; Bassenthwaite is considered to be moderately enriched, and Elterwater is grossly enriched.

Five of the six SSSIs containing mesotrophic open waters show signs of nutrient enrichment; Blelham Tarn and Bog and Skelsmergh Tarn are moderately enriched, Esthwaite Water, Low Church Moss and Thurstonfield Lough are grossly enriched.

White-clawed crayfish. Photograph © Hugh Clark / FLPA.

White-clawed crayfish[46]

The white-clawed crayfish *Austropotamobius pallipes* is the only freshwater crayfish that is native to Britain. It can grow up to 120mm long, is coloured brown to olive, and has white undersides to its claws, hence its name. It was formerly widespread in clean, calcareous streams, riversand lakes in England. Since the 1980s, many populations of the native white-clawed crayfish have succumbed to crayfish plague, a fungal disease, which is spread principally by non-native, American signal crayfish *Pacifastacus leniusculus* and also transmitted as spores in water. Also, non-native crayfish are larger and more aggressive than the native species, and pose problems of direct competition and predation.

Fortunately, the upland areas of England are presently relatively unaffected by non-native crayfish or plague, and are increasingly important for the native white-clawed crayfish. A number of rivers in Cumbria, the Yorkshire Dales, the North Yorkshire Moors and the Peak District, particularly those which run off limestone, hold strong, healthy populations.[3] There are also a number of lakes and reservoirs, such as Malham Tarn, which contain good populations, and these are potentially important refuge sites if the plague advances further north. Protection of all these sites is vital to the long-term future of native crayfish.

American signal crayfish.
Photograph © John Tinning / FLPA.

Earth heritage

Limestone valley, Lathkill Dale, White Peak.
Photograph © Peter Wakely / English Nature.

Upland geology is dominated by Palaeozoic sedimentary rocks. For example, the Carboniferous limestones and sandstones which form the White and Dark Peaks of the Peak District reflect the contrasting ancient environments of the Carboniferous: shallow tropical reefs producing the limestones of the White Peak, and a vast delta complex and flood plain producing the millstone grit of the Dark Peak. In contrast, the North York Moors are formed from younger Mesozoic sandstones and limestones deposited by rising and falling sea levels and migrating rivers during the Jurassic.

Igneous rocks are also at the heart of many of our upland areas. The Lake District is dominated by volcanic and intrusive igneous rocks such as the craggy mountains of Borrowdale, and which comprise a six kilometre thickness of volcanic lava and ash erupted over a period of ten million years during the Ordovician. Upper Palaeozoic lavas and intrusions form the Cheviot massif, large parts of the south west moors and the Whin Sill which crosses the northern Pennines.

Predominantly marine sediments and volcanic rocks of Precambrian to Lower Palaeozoic age form the uplands of West Shropshire. Many of these rocks have passed through several phases of folding and faulting.

The presence of minerals containing lead, zinc, copper and fluorspar (a result of igneous intrusion) in the Carboniferous limestones in Cumbria, the north Pennines and Derbyshire has long been linked to the industrial development of these areas, and has left a rich mining heritage centred on the key mineralisation sites in the country. Similar mineralisation in more acid rocks is found widely in south west England.

The most recent geological history of these upland areas has seen the advance and retreat of Pleistocene ice sheets. These have moulded today's landscape and left a legacy of Pleistocene sediments which document some of our most recent and dramatic climate and environmental changes.

In England, there are four upland areas with major cave systems: the North Pennines, the Yorkshire Dales, the Peak District, and the Mendips. Cave development is strongly controlled by the geology, with all of these cave systems being in Carboniferous limestones. Most caves in England have formed within the last 10 million years, but some were initially formed more than 300 million years ago, shortly after the Carboniferous limestone was deposited.

Cave interests fall into a number of categories, including the nature of the cave itself and its origin, structures within the cave such as stalactites and stalagmites, cave sediments and fossils, and also mineral deposits.

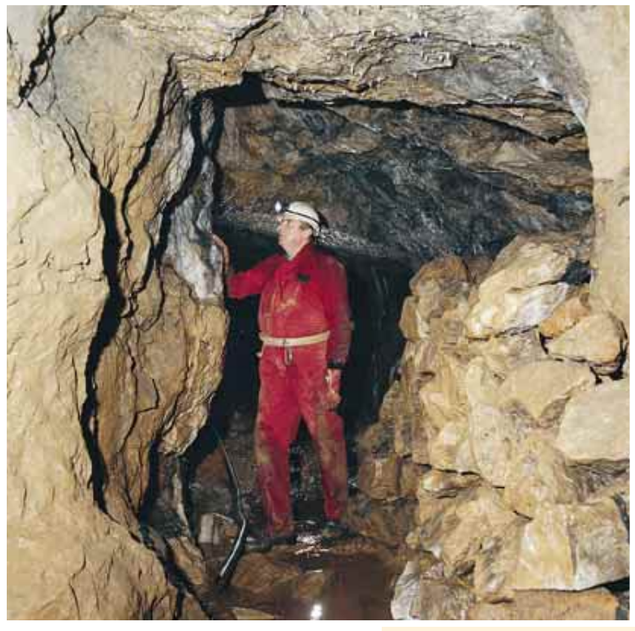
There are also rare and unusual animals, plants (at cave entrances) and micro-organisms associated with cave systems.

Sites of Special Scientific Interest

Some 30% of SSSIs in England have geological interest (927 purely geological interest, 344 with both biological and geological interest). These have been selected by the Geological Conservation Review, which identified sites of national importance for understanding the geological evolution of Britain.[31] Approximately 59% of geological SSSIs in England are important for stratigraphy and palaeontology, 27% cover Quaternary geology and geomorphology and 14% cover England's igneous, mineralogical, metamorphic and structural history.

There are 282 upland SSSI containing geological features of interest. Of those assessed, 12% of the geological SSSI units are in unfavourable condition.

Masson Hill Cave System



Caves provide an important research and educational resource but access must be managed sensitively. Photograph © P R Deakin FRPS.

This cave system is part of the Masson Hill and Masson Hill Mines SSSI, near Matlock in the Peak District of Derbyshire. The system extends for more than 2 km under Masson Hill, and includes three showcaves which attract large numbers of tourists. The caves are notified for several important geological interests[84]:

- The site is important in understanding cave development. Large parts of the site represent a very ancient fossil cave system, believed to have formed initially more than 180 million years ago;
- The caves are important for their miner alogical interest, including lead and fluorspar mineralisation. The Masson Hill caves provide ready access for research and educational users;
- Some of the cave sediments are of major importance as they show "reverse magnetic polarity". This means that they were deposited more than 780,000 years ago, when the magnetic field of the Earth was reversed, a fact that can help with dating glacial events and climatic changes within the last million years.

Currently, the main threat to conservation of the Masson Hill Cave System is recreational damage, as the caves receive large numbers of visitors. Potential problems include physical damage to cave sediments and features such as stalactites and stalagmites. Removal of mineral specimens by collectors is also a threat. Access to the Heights of Abraham Showcave is controlled, and passages into other areas from the showcave are now being gated, which should inhibit unauthorised disturbance to geological features in adjacent parts of the system. However, other parts of the cave system have less restricted access so are more prone to damage by recreational users and collectors.

The Derbyshire Caving Association has recently produced a detailed audit of the entire cave system[30], which outlines the various threats to conservation and provides suggestions for management, including:

- Maintenance of underground passages and associated natural hydrological systems;
- Establishment of regular monitoring - especially more sensitive areas;
- Promotion of good practice among caving groups;
- Continued partnership between English Nature, land owners and key cave user groups.

Threats to our Earth heritage

Caves are highly sensitive systems which can be easily disturbed. It is important to maintain natural processes, allowing a continued natural evolution. Caves have particular problems, such as damage by recreational visitors, loss of access, quarrying, water extraction, landfill and groundwater pollution. In many cases (see Masson Hill) the problems are addressed by local caving associations with guidance such as the *Cave Conservation Handbook*, which was published by the National Caving Association and supported by English Nature.[60]

Roughton Gill Mine Dump, Coldbeck Fells, Cumbria. Photograph © M Murphy / English Nature.

Mineralogical sites are, by their very nature, restricted in extent and easily prone to damage, and are amongst the most sensitive of geological SSSIs. The most common threat is irresponsible or inappropriate collecting. Other threats include removal of spoil heap material, landfill in quarries, permanent sealing or collapse of old mine shafts and, in some cases, extraction of *in-situ* material under existing planning permissions.

Geological processes have produced the dramatic Lake District landscape.
Photograph © Andy Brown / English Nature.

The Past is the Key to the Future - Earth Heritage Conservation in the New Millennium[35]

The Past is the Key to the Future is English Nature's new strategy for conserving our Earth heritage. It seeks to widen the constituency of support and understanding for this resource. Understanding and conserving our past is essential for the future conservation and management of our environment and its natural resources. Through the new strategy we will:

- Ensure that the best of England's Earth heritage is protected, enhanced and managed so that it is safeguarded and available for scientific study and education. New site-based initiatives such as the *Facelift* project have already begun in order to fulfil the aims of this theme;
- Raise awareness of our Earth heritage amongst decision makers and the general public;
- Influence policy in sectors where Earth scientists lead, namely minerals, waste and energy, and in relation to issues such as climate change where a knowledge of the past is vital in attempting to predict future trends.

Geological exposures benefit from periodic clearing.
Photograph © David Evans / English Nature.

3. Managing the uplands

The distribution and abundance of wildlife and natural features is the product of complex interactions. These result from human activity and land uses which are driven by economic, social, and environmental forces. In this section of the report we consider the key land uses in the uplands, the pressures on biodiversity and natural features that result, and the actions required to move towards more sustainable land use that both conserves the natural heritage and provides prosperous and inclusive rural communities.

Sustainable development and land management

We want to achieve sustainable use of our uplands, but how does this fit with the broad concept of sustainable development? Sustainable development has been defined as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'.[89] It seeks to achieve a better quality of life for everyone, now and in the future, while protecting and where possible enhancing the environment. Although the idea is simple the task is substantial. As set out in the Government strategy for sustainable development *A Better Quality of Life*,[24] it means addressing four objectives at the same time, through the integration of policies and programmes. The objectives are:

- Social progress which recognises the needs of everyone;
- Effective protection of the environment;
- prudent use of natural resources; and
- Maintenance of high and stable levels of economic growth and employment.

In the uplands, where road and building development is perhaps less of an issue, it is still appropriate to apply the principles of environmental sustainability to land management, so as to integrate wildlife conservation and ensure a future for local communities.

Biodiversity is a key test of sustainable development because it:

- Enhances quality of life through cultural, spiritual and recreational experiences of the natural world;
- Provides natural assets from which economic benefits can be derived, since high quality environments tend to attract inward investment;
- Demonstrates an environment in good health.

It is critical to future generations because diminishing biodiversity will affect their ability to meet future needs.

Agriculture

Pressures

Wildlife areas in the uplands are intimately linked to the livestock farming systems and are dependent on sensitive management, especially appropriate levels of grazing by sheep and cattle, and associated management practices such as burning and shepherding.

Sheep grazing has had a profound effect up on the English uplands. Photograph © Paul Glendell / English Nature.

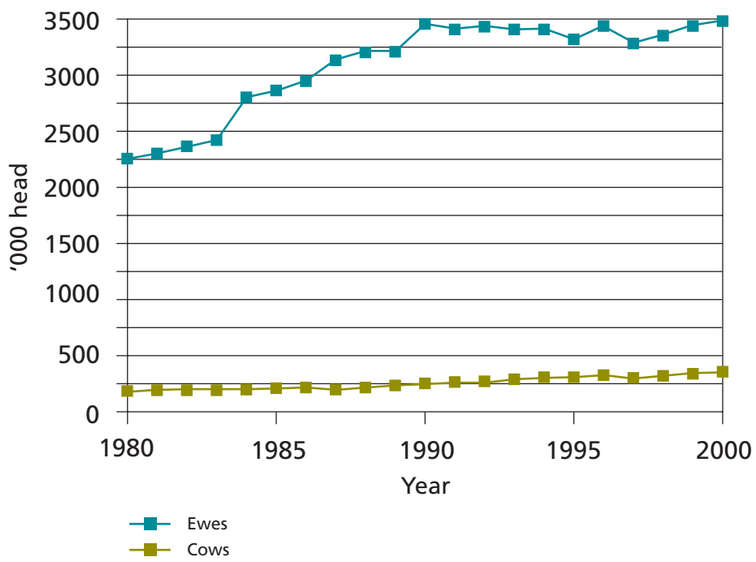
After the Second World War, financial incentives became available for farmers to improve moorland for agriculture by draining, liming and reseeding. Also, the use of supplementary feeding on moorland increased. This allowed stock to be kept on hill land at higher densities and for longer periods, leading to year-round use of the moorlands with little time for the vegetation to recover. Likewise, hay meadows and pastures were limed, fertilised and reseeded with rye grass to allow harder grazing and there was a move towards silage production. Many woods used for shelter and grazing have become so heavily grazed that tree regeneration no longer occurs.

As the number of people employed in agriculture has decreased there has been a decline in labour-intensive management practices, such as appropriate burning, bracken management and shepherding, and an increase in the use of supplementary feeding, out-wintering and ranching of livestock. This has had a marked effect on upland biodiversity. Poorly managed burning damages heather and favours grass species with little wildlife value. Bracken can provide an important habitat, for example for whinchats and the high brown fritillary butterfly, but without suitable management it can become too dense and encroach onto other important habitats. Shepherding of stock makes better use of the grazing across the hill, avoids local concentration which can lead to overgrazing, reduces the need for supplementary feeding and is better for animal welfare.

There is now a crisis in the industry, with farmers in the Less Favoured Areas (LFAs) struggling hard to retain viable businesses against the strength of sterling, low market returns for livestock products and the knock-on effects of BSE. The crisis is leading to an acceleration of the long-term trends in farm amalgamation, an ageing farming population with fewer young farmers joining the industry and the flow of capital out of farming. At this time of significant change, it is important that farmers willing to protect and enhance the conservation value of the uplands are supported in doing so, and that there is a clear message that farmers whose practices damage the upland environment will not receive financial support in the future. The existing financial support systems within the Less Favoured Areas impact upon nature conservation because the LFAs cover nearly 15% of the total area of England, over 40% of the area of SSSIs, and 20% of the area of candidate SACs in England.

Changes to technology and the structure of farming, and changing consumer demands have been responsible for increased pressure on farmers to produce more livestock. Increased stocking densities and changes in farming practice have been dramatically accelerated by the support payments for sheep and cattle under the Common Agricultural Policy (CAP). All direct sheep and cattle subsidies have been paid on a headage basis, thereby promoting increased stocking as farmers seek to maximise income from subsidies. For example the number of breeding ewes in the Less Favoured Areas in England increased by around 35% between 1980 and 2000. Many hill areas now hold more sheep than is environmentally sustainable.

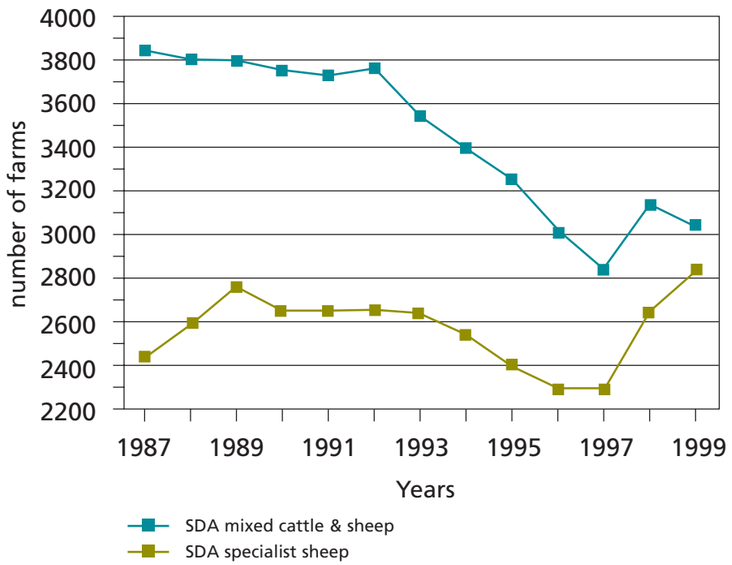
Growth in livestock numbers in the English Less Favoured Areas, 1980 to 2000 (MAFF June census)



Other changes have taken place which also affect the agricultural management of the uplands:

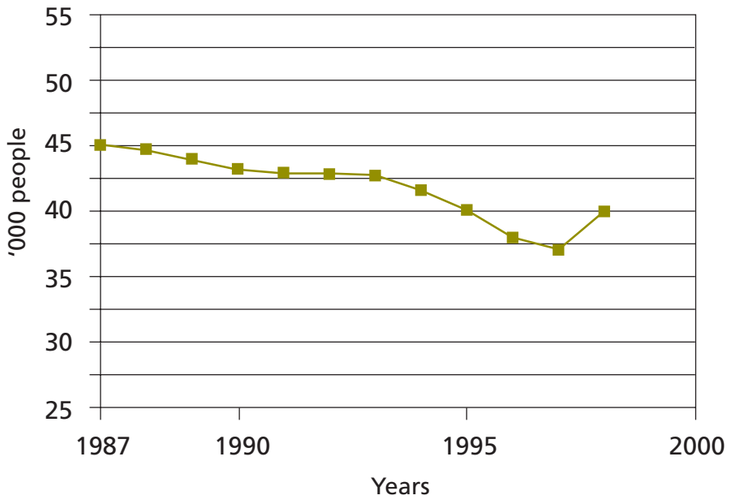
- Mixed livestock farming systems create more diverse vegetation which results in a greater range of plants and animals and is particularly important for breeding waders. Between 1987 and 1999 the number of mixed cattle and sheep farms in the Severely Disadvantaged Areas (SDA) fell by 21% whilst specialist sheep farms in the SDA rose by 17%. Sheep numbers have increased at the expense of suckler cows, except in the south west, where the hills suffer from overstocking with cattle.

Changes in LFA livestock systems, 1987 to 1999 (MAFF June census)



- The labour force employed on LFA farms declined by 11% between 1987 and 1998; as a result the more labour intensive management practices, such as shepherding, which benefit nature conservation have declined.

Decline in LFA labour force, 1987 to 1998 (MAFF June census)



- Technological change has led to the hardy hill breeds being replaced in some areas by larger and more prolific cross-bred ewes. These animals require additional feed to supplement their diet as they cannot thrive on semi-natural vegetation;

The Environmentally Sensitive Area scheme was introduced to stop the decline of traditional farming systems in designated areas of countryside which were under pressure from intensive farming techniques. Countryside Stewardship was subsequently introduced to enhance specific landscapes and the wildlife they contain. These schemes have made a contribution to stemming further habitat loss but have yet to make a large-scale contribution to restoring or re-creating upland habitats. The Countryside Stewardship upland options were launched only in January 1999 and so have yet to produce significant results.

Impacts

Overgrazing is the principal concern in the uplands. Overgrazing and other environmentally unsustainable management are widespread across a range of habitats, but are perhaps most obvious on heather moorland. Here, overgrazing leads to the gradual retreat of heather from the moor edge, atypical growth including 'topiary' forms, and lack of heather regeneration in newly burnt or cut areas.

Drumstick heather (30cm high), caused by severe overgrazing.

Definition of overgrazing

Grazing is environmentally unsustainable when the stock eat more of the vegetation than grows during a season. This leads to changes in the growth of plants, and to changes in the structure and species composition of the sward. Overgrazing affects the wildlife long before physical damage to the sward occurs. Environmentally sustainable livestock management is that which does not cause long-term damage to the vegetation but helps maintain the condition of the sward.

Overgrazing is defined by MAFF as "the result of environmentally unsustainable livestock practices brought about through overstocking, so that the growth, quality and species composition of the vegetation is adversely affected".[55] Subsidy payments are now conditional upon not contravening the overgrazing 'rules', and contravention may lead to withholding of livestock subsidies.

MAFF uses the overgrazing rules to halt continued significant damage. Unfortunately the rules do not allow for sufficient reduction of livestock numbers to permit recovery of vegetation where past overgrazing has damaged the wildlife interest. Other MAFF schemes, such as ESAs and Countryside Stewardship, are intended to provide incentives for management practices designed to restore past damage.

Although we fully support the concept of the overgrazing rules, they could be made more effective through increased resources and giving greater weight to investigating cases relating to designated nature conservation sites.

Sheep on in-bye land in winter. Photograph © Paul Glendell / English Nature.

Tackling overgrazing on heather moorland must not result in moving the problem downhill. Photograph © Andy Brown / English Nature.

Change may not be immediate but the pressures of continued heavy stocking will gradually change a moorland dominated by dwarf shrub heath to one that is grass-dominated and then to species-poor acid grassland completely devoid of heather.

The significance of overgrazing is demonstrated by the data on loss and damage to SSSIs, with agricultural activities accounting for 88% (by area) of reported cases in 1997/98[32] and continued overgrazing of upland heath and grassland being responsible for 99% of the area damaged by agriculture.

However, grazing does not occur only on heather moorland; heavy grazing pressure impacts upon the biodiversity value of all upland habitats including woods. It is therefore important that, in attempting to address overgrazing on heathland, the problem is not transferred to other habitats by moving animals down the hill. A whole-farm approach is vital in ensuring that the upland farm as a whole is grazed at environmentally sustainable levels.

The dipping of sheep to eradicate parasites is vital for animal welfare and production quality reasons. However, this has had serious consequences for aquatic invertebrates as a result of accidental spillage of sheep dipping chemicals into water courses. Following the introduction in 1996 of requirements for training and certification for those purchasing organophosphate (OP) sheep dip, the proportion of farmers using synthetic pyrethroid (SP) dips increased markedly.[2] The use of OP dips has since been banned. One consequence of this has been an increase in incidents involving SP sheep dip in rivers, particularly in upland catchments. The synthetic pyrethroids are very highly active insecticides, and there have been several serious pollution incidents in rivers containing nationally and internationally important aquatic invertebrates, including white-clawed crayfish and freshwater pearl-mussel, as well as populations of fish such as salmon.

FRCA overgrazing assessments

Where overgrazing or damage from supplementary feeding is reported to MAFF, the Farming and Rural Conservation Agency (FRCA) is instructed to carry out detailed analysis to ascertain the impact on the vegetation. The current method can be time-consuming, limiting the number of cases that can be pursued.[37] The thresholds applied to the first stage of the assessment are also set too high, resulting in many seriously overgrazed moors failing to be recorded as such. Furthermore the assessments can be applied only to heather.

FRCA and English Nature are currently working together to develop a simpler and more accurate methodology that is swifter and encompasses the full range of overgrazed habitats, including blanket bog and woodland. Pilot studies at Warcop Fell on the Appleby Fells SSSI in the North Pennines have been undertaken to integrate present assessment methodologies with the condition assessment techniques employed by English Nature.[38] This approach is currently being further developed by FRCA on 12 sites in England and Wales.

Long Mynd, Shropshire. Photograph © W Broadhurst / FLPA.

The Long Mynd

The Long Mynd is an extensive upland plateau to the west of Church Stretton, lying within the Shropshire Hills Environmentally Sensitive Area (ESA). The hill is one of the most distinctive features of the Shropshire Hills Natural Area, supporting a number of moorland and moorland fringe habitats with much of it designated as an SSSI. The majority of the Long Mynd is owned by The National Trust, of which most is common land.

Severe overgrazing has been a widespread and long standing problem on the Long Mynd. During the late 1980s there were 12-13,000 sheep (5.5 ewes/ha). The effects of sustained heavy grazing pressure are evident across the whole SSSI:

- Heather loss to grassland or bracken is widespread across the hill;
- surviving heather is suppressed, with isolated, 'topiarised' plants; regeneration of heather following burns and cuts, many dating from the 1970s, has been prevented;
- areas of acid grassland, mire and flush vegetation are closely grazed and species-poor, and wetter sites are being poached;
- supplementary feeding causes further damage to vegetation.

In June 2000 an ESA agreement was signed with the commoners for £1.7m over 10 years, which will tackle this long-standing problem by reducing stock levels, controlling bracken and reintroducing sustainable heather burning. The rate of recovery will be speeded up further by off-wintering of stock, which is partly funded by English Nature and the National Trust. This should allow the heather to re-generate and once again support a whole range of upland birds, such as red grouse, curlew, wheatear and ring ouzel.

Responses

Sustainable land management is at the heart of our vision for the uplands. This means finding ways to address the crisis for upland farmers, and also protecting and enhancing what remains of our valuable upland habitats, including heather moorland. If environmental goals are to be achieved, thriving rural communities with both traditional and new land management skills are essential. The National Trust has set an example here, with its new policy for agriculture on its land, which defines sustainable agriculture as seeking to enhance the quality of life for the millions who live, work upon, or take pleasure there.[61]

Agricultural policies have until now been dominated by measures which aim to address farming and social problems by further enhancing productivity levels on farms. This is beginning to change with the introduction of a more broadly-based rural policy under the England Rural Development Programme, with the three goals of economic viability, environmental sustainability and social inclusion.[56] Environmental schemes have become an important income source for farmers although their reliance on "income forgone" as the basis of payment calculation means that, in times of falling incomes, payment rates may not cover management costs.

Current agricultural support for livestock systems in the uplands is provided through sheep and beef premia, and LFA payments. Following the Agenda 2000 agreement in May 1999,[17] the LFA objectives were revised to:

- Ensure continued agricultural land use and thereby contribute to the maintenance of a viable rural community;
- Maintain the countryside; and
- Maintain and promote sustainable farming systems which in particular take account of environmental protection requirements.

Through the new Hill Farm Allowance (HFA) scheme the LFA payments will in future be made on an area rather than headage basis. This will reduce the incentive to overstock and hence reduce the grazing pressure. This is a significant move towards decoupling subsidies from production and instead linking them to environmental objectives. However, HFA payments will still constitute only a small proportion of the support payments to hill farmers; the majority of income will continue to be derived from the Sheep Annual Premium, Suckler Cow Premium and Beef Special Premium, which are still paid on a headage basis. Without reform of these, any environmental gains from the revision of the LFA payments are likely to be extremely limited and upland biodiversity will continue to decline.

Hill Farm Allowance Scheme (2001-2006)[57]

The new Hill Farm Allowance is an area-based scheme to support extensively grazed breeding ewes and suckler cows in the English LFAs. The payments are differentiated for moorland, common land, other Severely Disadvantaged Areas and other Disadvantaged Areas, with reduced payment rates above 350 ha and none beyond 700 ha. Payments can be increased by up to 20% for meeting "environmental enhancement" criteria relating to the proportion of arable or woodland cover, registered organic farming, 15% cattle in the farm's livestock mix or reduced stocking levels. For the first three years there is a 'safety net' which ensures that the effects of changing to the new subsidy system do not have an adverse impact on farmers' incomes and allow business restructuring to take place. This compensation gradually decreases from 90% to 50% of LFA subsidy prior to the introduction of the new HFA scheme.

To verify that overgrazing is not taking place, physical inspections will be aimed at all farms above a minimum stocking density, together with others considered to be at particular risk of overgrazing.

Action for upland agriculture

Targeting of agri-environment schemes - Target agri-environment schemes in the uplands at biodiversity priorities, tackling environmentally unsustainable management, to ensure that SSSIs are restored and maintained in favourable condition.

LFA reform - Continue reform of LFA support to an area-based, environmentally sustainable scheme that includes rewards for farmers on the basis of the biodiversity value of their land, including development of a more refined classification system for the range of land types within the LFAs.

Reform of the sheepmeat regime is urgently needed to remove the incentive to overgraze the uplands. Photograph © English Nature.

Sheepmeat and beef regimes - Reform the Sheep Annual Premium, Suckler Cow Premium and Beef Special Premium schemes to an integrated area-based scheme, with payments conditional on practical environmental standards, at the next review of the CAP.

Overgrazing rules - Give higher priority to an adequately-resourced implementation of the overgrazing rules, with an effective reporting procedure and a simpler methodology to encompass the full range of overgrazed habitats.

Rural Development Programme - Promote the effective implementation of the England programme as a mechanism to maintain the rural environment and viable rural communities in the Less Favoured Areas.

Marketing - Promote links between maintaining the environment and upland livestock producers, such as positive marketing of animals reared on upland SSSIs in favourable condition.

Whole farm approach - Establish a whole farm approach to the management agreements on upland SSSIs to ensure that management decisions do not have negative effects on other parts of a farm. Advise MAFF and partner organisations of the value of this strategy in all environmental schemes available in the LFA.

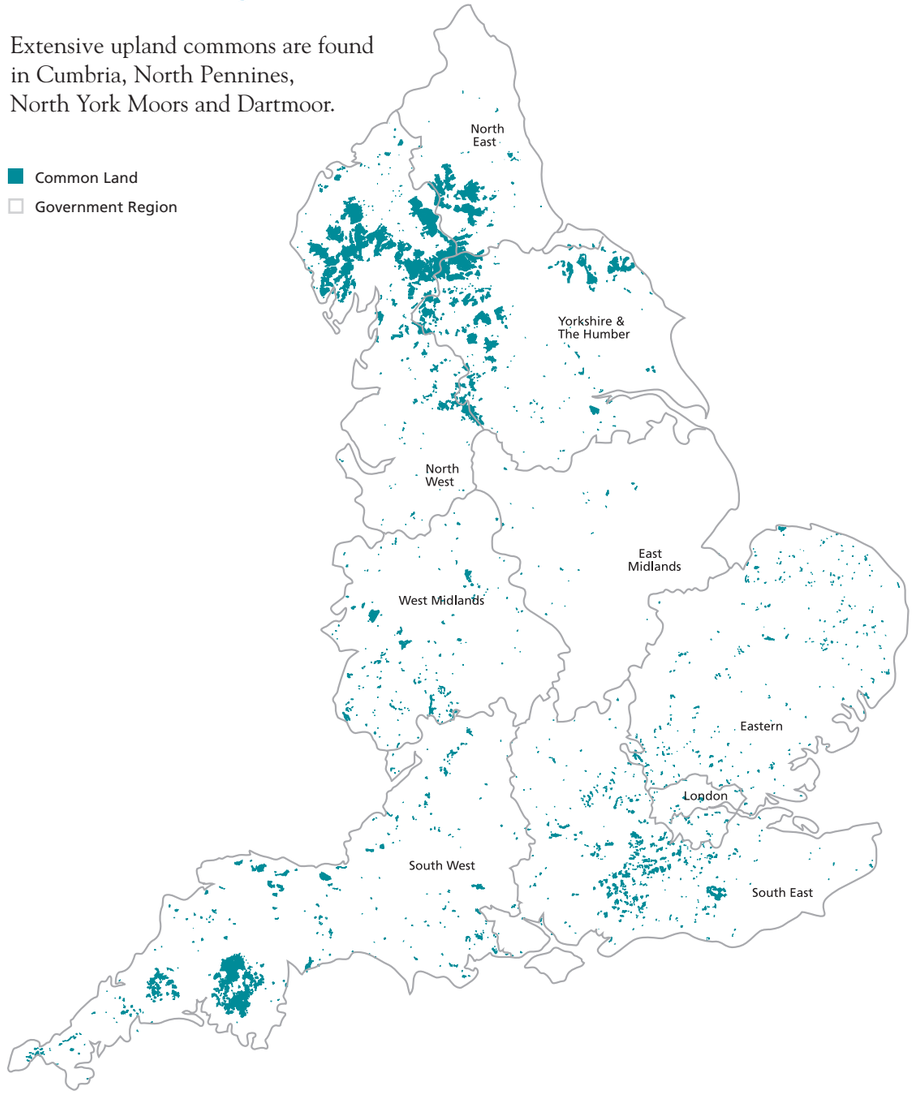
Advice and training - Develop advisory and training programmes for staff of government agencies, partner organisations and land managers on positive management for upland biodiversity. Ensure these can be integrated into whole farm management strategies.

Common land

Common land is valued for its landscape, wildlife and archaeological interest. In England and Wales there are over 8,600 commons, covering more than 550,000 ha (3% of England's total land area is common land).[23] Upland commons are often large and found throughout the English LFA. Unlike lowland commons which are marginal to agricultural production, they are integral to the upland farming system.

Common Land in England

Extensive upland commons are found in Cumbria, North Pennines, North York Moors and Dartmoor.



Map produced by FRCA GI Unit, August 2000. Common Land Data supplied by DETR.

Overgrazing has led to the disappearance of heather from much of the hill. Skiddaw Common, Cumbria. Photograph © Peter Wakely / English Nature.

Commons are especially significant in Cumbria. Thirty per cent of the total area of common land in England is in Cumbria, covering large parts of the Lake District and the Pennine fells. Approximately 25% of the total area of SSSIs in Cumbria, and 55% of the terrestrial SACs and SPAs, is common land.

Pressures

The major threat to the biodiversity value of upland commons is unsustainable practices in livestock farming. These pressures are the same as in the whole of the LFA but are exacerbated by the management structures on commons and issues of grazing rights. For example, 75% of the 155 cases of overgrazing investigated by MAFF relate to upland commons.[27]

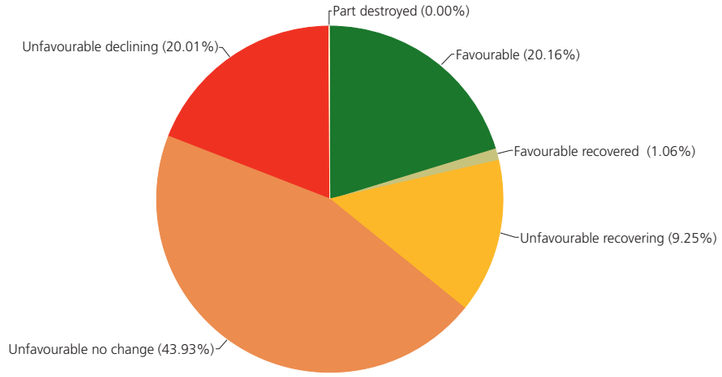
Most commons are privately owned, but activities are controlled through rights of common. These rights are not enjoyed by the public at large but by designated commoners. This is part of a tradition that has continued for hundreds of years although there was no formal record of common rights until the 1965 Commons Registration Act. The most usual right is that of using the common for livestock grazing. Unfortunately, there were problems of over-registration of grazing rights under the 1965 Act beyond the carrying capacity of the vegetation of many commons, especially in the uplands, and this has contributed to a decline in their biodiversity value.

Impacts

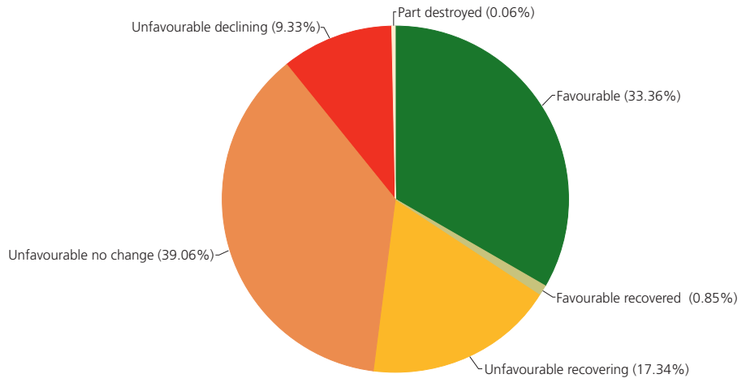
As a consequence of these pressures upland commons are in even poorer condition than other upland areas.

Upland SSSI commons are in poorer condition than other upland SSSIs

a) Condition of upland SSSI units within commons



b) Condition of upland SSSI units not in commons



The continuing deterioration of some upland commons is often exacerbated by a lack of co-operative management. Setting appropriate stocking rates, sensitive burning of heather and bracken management are examples of activities that benefit from the involvement of all commoners. The control of bracken and burning of heather, normally the responsibility of the landowner, can become the responsibility of a management committee, so ensuring that these are carried out appropriately for both wildlife and other interests. In addition, co-operation through a Management Committee makes it easier for the commoners to enter into agri-environment or Wildlife Enhancement Scheme agreements.

English Nature has published a booklet: *Common land: unravelling the mysteries*, as a contribution to a better understanding of the issues and actions required to achieve effective and environmentally sustainable management of commons.[33]

Moughton Common, North Yorkshire

Bird's-eye primrose.
Photograph © Chris McCarty / English Nature.

Moughton Common is a 347 hectare common, owned by a large private estate in the Yorkshire Dales National Park. It is notified as part of Ingleborough SSSI, and is a proposed SAC.

Its special feature is the upland Carboniferous Limestone grassland habitats, with large areas of limestone pavement, scars and screes, and the associated calcareous tree/shrub, mire and grassland habitats. Special plants include bird's-eye primrose and bloody crane's-bill, and there are breeding curlew and wheatear.

Stock rearing has been carried out for thousands of years, due to the rich grazing available, but levels of grazing, particularly by sheep, have reached an all-time high in the last 40 years. As a consequence, the flowering plants are unable to flower and set seed, and have declined in number.

The graziers who use the common have reached agreement with English Nature to co-ordinate grazing on the common at an ecologically sustainable level. Total sheep numbers and grazing period have decreased, with no winter grazing, and the graziers themselves are responsible for policing grazing on the common.

There are already signs of success with regeneration of heavily browsed juniper and expansion of heath on the common.

Responses

It has often proved difficult to negotiate stock reductions because of the need to deal with a number of different graziers on each common. On a few commons it has been possible to achieve agreement with all commoners individually, but this has proved a time-consuming process. Where a dissenting minority of commoners refuses to participate, it has been impossible to agree a management regime that would prevent overgrazing or inappropriate management practices continuing on the common.

There are a number of actions that will improve the ability of commoners to manage their common sustainably. As stocking rates on commons will continue in the near future to be driven by livestock subsidies, the actions to tackle unsustainable agricultural practices outlined in the previous section apply equally to common land. There are, however, additional measures that can be applied.

Action for common land

Legislation - Secure new legislation for common land, implementing the proposals in the recent consultation *Greater Protection and Better Management of Common Land in England and Wales*.

Management committees - Establish management committees (or commoners' associations) to bring together all legal and other relevant interests with the aim of achieving environmentally sustainable management, including control of grazing, and to enable agri-environment schemes. Give management committees the remit and legal powers to ensure that their common is managed in an environmentally sustainable way.

Management plans - Prepare and agree a simple management plan for each common, which sets the overall objectives and guides all aspects of management, including habitat management, and states who has the responsibility to carry out different activities.

Live registers - Establish a legally-binding 'live register' for each common to record and monitor activities on the common throughout the year, including the number of stock grazing at any time.

Access and recreational management - Access, especially large-scale recreational use, must be managed carefully to protect fragile habitats, or to prevent disturbance of sensitive species, such as ground-nesting birds.

Grouse moors

The management of heather moorland specifically for red grouse has a significant influence on the wildlife interest of the uplands, especially in northern England. This practice started in the early nineteenth century and reached a peak about 100 years later. There has been some decline in management for grouse in some areas, but it still remains a major land use in the North Pennines, Forest of Bowland, Peak District and North York Moors. Some moors were once managed for black grouse, which prefer a mixture of heather, scrub, woodland and wet grasslands, but this species has dramatically declined in recent years. The needs of black grouse rarely form part of modern management regimes on grouse moors.

Pressures

Management of the uplands for grouse centres on rotational burning and predator control. Adult red grouse feed chiefly on dwarf shrubs, especially heather, which are managed mainly by burning on a short rotation. The regular burning maintains heather in the young, highly productive state on which grouse prefer to feed. However, this young growth needs to be near to taller heather, which is used for nesting and cover. As a result, moors managed for red grouse tend to be burnt to produce a mosaic of stands of heather of different ages. On most managed grouse moors the aim is to burn on a ten to fifteen year cycle, depending on local conditions, but in practice the rotation on some areas may extend to twenty-five years, with a few areas never being burned.

Whilst the most commonly burnt upland vegetation type is dwarf shrub heath, some burning of blanket bog, enclosed and unenclosed grassland, bracken and scrub is also undertaken. Burning is strictly controlled by law, and MAFF guidance on good practice is provided by *The Heather and Grass Burning Code*.[54] Unfortunately the Code on avoiding the burning of blanket bog, rocky slopes and rank heather is not always followed on grouse moors. Bracken is controlled on heather moors by spraying, with the aim of increasing the amount of suitable habitat available to grouse. Most grouse moors are also grazed by sheep, which are attracted to the new growth of recently burned areas.

Red grouse. Photograph © Laurie Campbell / NHPA.

Lightly grazed grouse moor, North Pennines. Photograph © A L Drewitt / English Nature.

As with other upland habitats, overstocking can lead to loss of dwarf shrub heath cover. Moor drainage, or 'gripping', was practised historically and, whilst some moor owners are actively reversing this through grip blocking, there are still some moor managers who believe drainage should be maintained.

In order to maintain high stocks of grouse for shooting, legal predator control is undertaken on a large scale. This labour intensive control, particularly of foxes, stoats and crows, is carried out throughout the year.

Impact

Moorland management for grouse has had a profound effect upon wildlife, through maintaining the extent of open heath and some of its wildlife, and deflecting other land-use changes. The dwarf shrub cover of grouse moors was retained over the post-war period when elsewhere in the uplands large-scale afforestation took place, and agricultural pressures converted significant areas of moorland from heather to grass. Grouse shooting is now highly significant in the northern English uplands, both for the income it brings to the local economy, especially with sheep farming being economically marginal, and for management for wildlife. In some areas shooting has provided the revenue to reduce sheep numbers, and hence overgrazing, and to control the spread of bracken.

The legal control of predators on grouse moors may have the ancillary benefit of increasing the breeding success of ground-nesting birds such as the scarce black grouse and merlin, and contributing to the high densities of species like golden plover and curlew, although clear scientific evidence to support this is currently lacking.

The importance of moorland management for wildlife conservation has been recognised through the international designation of large areas of grouse moor. For example, grouse moors on the North York Moors, North and South Pennines and Forest of Bowland support internationally important numbers of breeding waders, merlin and twite.

The best moors for wildlife are those with a variety of vegetation structures, from areas of short heather and bare ground to unburnt areas, with the complete range in between. Their management also includes retaining or encouraging native woodland and scrub, which benefits black grouse. Recent studies indicate that the majority of upland bird species breeding on moor, heath and bog do not spend all their time

Patchwork of heather on intensively burnt grouse moor. Photograph © Andy Brown / English Nature.

there but depend also on a range of adjacent habitats, including adjoining farmland, marginal hill grasslands, and woodlands.[4,8,87] For these species integrated management across this range of habitats is essential for effective nature conservation. In fact, it appears that the red grouse is the only species solely dependent on heather moors.[6]

Whilst some grouse moors support important bird populations, grouse moor management also has the potential to reduce biodiversity and have negative impacts on wildlife. Too frequent burning can lead to the dominance of heather over other plant species, including other dwarf shrubs, and many species of bryophyte and lichen can be lost. Short-rotation burning can also reduce drastically the numbers of invertebrates in some areas, especially when the burned areas are large and the fire 'hot'. Upland soils are known to be damaged through frequent burning. Burning also eliminates plant species such as *Sphagnum* mosses from blanket bogs and wet heaths, and can even cause complete loss of these habitats.

Too frequent burning leads to loss of wildlife. Photograph © North York Moors National Park.

Intensively-burned grouse moors lack the diverse structure of less-regularly burnt areas. As management for red grouse tends to favour young heather, stands of taller, older heather are often burnt and are becoming rare. This practice, besides reducing shelter for grouse, destroys raptor nesting sites and may be having an impact on merlin populations in the North Pennines. In contrast, those areas of moor that are rarely burnt have a greater variety of vegetation structure and are normally richer in wildlife.

The past practice of draining blanket bogs and wet heath to improve the heather cover for grouse has now declined, with the recognition that wet areas are an important source of insects for feeding chicks. Drainage also has adverse effects on wildlife generally, with the loss of wet habitats, and the erosion of peat, which causes undesirable changes in freshwater habitats. The welcome blocking of artificial drains on some grouse moors can restore the hydrology and create some valuable wet areas.

Illegal bird persecution

There have been long-standing tensions between grouse moor managers and raptors, and it is often claimed that raptors both prey on red grouse and disrupt shoots.[65,66] This could prejudice the long-term economic viability of shoots which are already in decline. As a consequence some game managers use a variety of ways to deter raptors from using grouse moors, including illegal persecution (destruction of nests, disturbance) and killing of adults and young.

The hen harrier is the raptor worst affected by illegal persecution in England.[47] It is a bird of international importance which once bred over a much larger area of England, but was exterminated by game managers during the 19th century. It did not breed again in England until 1958,[21,41,85] and since then breeding success has been poor. In 1999 only 21 females took up territory and just 9 of these reared young. In 2000, a poor year for voles, the hen harrier's favoured prey, only 5 out of 16 females reared young, with 6 nests being lost. Illegal persecution is known to have been the cause of much of this breeding failure. However, nest protection schemes (1994-2000), primarily on RSPB and North West Water moorland, enable breeding to take place. 67% of female hen harriers holding territories in spring bred successfully, compared with just 25% on grouse moors without nest protection. Furthermore, since 1998 hen harriers have bred in England only on those grouse moors with nest protection schemes. The Game Conservancy Trust estimates that there is sufficient habitat in England for over 230 territorial female hen harriers, so the current population represents just 8% of the potential English population.[62]

Hen harriers are severely threatened by illegal persecution. Photograph © Richard Brooks /FLPA.

In 1992 the Joint Raptor Study was established to find out whether predation by raptors significantly affects the numbers of red grouse. The study, at Langholm in southern Scotland, showed that raptors may be capable of limiting grouse populations at already low density, but the long-term decline in grouse bags was due more to loss of heather habitat (48% decline from 1948 to 1988) than to raptor predation.[64]

The recent report of the UK Raptor Working Group[29] recommended working in partnership to demonstrate and implement moorland management and restoration. This, rather than the illegal and unacceptable persecution of raptors, offers the best hope for increasing grouse stocks and benefiting a wide range of other wildlife.

The Northern Uplands Moorland Regeneration Project[58,59]

Launched in 1998, the project seeks to protect and improve heather moorlands for the benefit of grouse, sheep and wildlife. This integrated management project was instigated by the Moorland Association, and is funded by the European Objective 5b Programme, MAFF, English Nature and participating farmers and landowners. Ten-year management agreements covering 30,000 ha have been signed, and over 20 jobs created in remote rural areas. The project funds bracken control, heather re-seeding, erosion control, control of sheep grazing, livestock housing for the winter, grouse and keepering management, and wetland management.

Responses

English Nature and grouse moor managers share many objectives, and environmentally sustainable grouse moor management has the potential to deliver many of our priority nature conservation targets for upland heath. Joint projects, such as the Northern Uplands Moorland Regeneration Project, are tackling overgrazing and heathland restoration on northern uplands. Our priority is to work with moorland owners to refine management techniques, and to ensure they are applied across a greater range of the English grouse moors.

Action for grouse moors

Advice and information - Promote environmentally sustainable moorland management, including sensitive burning practices, through the English Nature *Upland Management Handbook*, and forthcoming advisory literature.

Agri-environment schemes - Review and increase the contribution and effectiveness of agri-environment schemes to establish and maintain sensitive burning practices, and use English Nature's Wildlife Enhancement Scheme to diversify SSSI grouse moors, including restoration (eg grip blocking) and enhancement (eg woodland expansion).

Demonstration project - Develop a wide-scale demonstration project to show how good moorland management practice can be compatible with co-existing red and black grouse, birds of prey populations and other upland biodiversity.

Large scale projects - Deliver integrated moorland management through large-scale projects, such as the North York Moors Moorland Regeneration Project.

Raptors - Implement the recommendations of the UK Raptor Working Group, including greater enforcement of existing legislation to prosecute those found disturbing or killing birds of prey.

Public access and recreation

Visitors have long been attracted to upland areas, feeling the need to escape from towns and cities to places that they perceive to be wild and natural landscapes. These areas provide not only opportunities for recreation but also a source of inspiration which satisfies the more spiritual values of solitude, enjoyment and enrichment. New legislation will increase the opportunities to experience the countryside.

Pressures

The uplands are used for a variety of recreational activities, including hill walking, fell running and orienteering, mountain biking, horse riding, rock climbing, gill scrambling, caving, para-gliding and hang-gliding, game shooting and birdwatching. Motorcycles and four-wheel drive vehicles are also used and, in water environments, canoeing and angling are popular.

A significant proportion of the English uplands is designated as National Parks (51% of the Less Favoured Area in England). National Parks have two statutory purposes: "to conserve and enhance the natural beauty, wildlife and cultural heritage", and "to promote opportunities for the understanding and enjoyment of the special qualities by the public". In cases of conflict between purposes, the balance is in favour of nature conservation, the so-called 'Sandford principle'.

Walkers on Fleetwith Pike, Cumbria.
Photograph © Paul Glendell / English Nature

As seven of the eight National Parks in England are upland, National Park data provide a useful measure of visitor pressure on the uplands. The National Parks visitor survey of 1994 estimated that at least 76 million recreational visitor days were made to the National Parks in England and Wales and the New Forest.[18] Data from a separate survey estimated that the Peak District received up to 22.7 million visitor days.[22]

The majority of people involved in recreation in the uplands arrive by car (91% of visitors to National Parks).[18] This means that the areas around car parks are often the most heavily visited, and in some areas further parking provision is required.

The recent passing of the Countryside and Rights of Way Act introduces a profound change in the provision of access to the countryside. The Act provides for a statutory right of access on foot to mountain, moor, heath and down, subject to mapping, and to registered common land.

Opinion varies as to whether this new right will lead to an overall increase in use, but many consider the main effect may be through a redistribution of access, with people entering areas formerly closed and some highly accessible areas close to major centres of population coming under significant pressure.

Repairing heavily used foot path, Dovedale, Peak District, Derbyshire. Photograph © Paul Glendell / English Nature.

Impacts

Recreational pressures can have a range of impacts including disturbance to birds (especially ground-nesting species), disturbance to mammals, trampling and erosion. They can also create management difficulties for gamekeepers organising grouse drives, and interfere with stock grazing patterns.

When compared to factors such as climate change, overgrazing or inappropriate burning management, recreational impacts may be of minor long-term nature conservation significance. Nevertheless, in some situations in the uplands they may be the critical last link in a chain of limiting factors. Some habitats such as flushes, mires and rock outcrops are fragile and of high nature conservation value for the plants and animals they support. Activities such as hill walking have led to a loss of vegetation and to erosion. Discernible scars appear where visitor numbers are high, and this can be rapidly exacerbated by four-wheel drive vehicles, motorcycles, horse riding, mountain bikes and runners using unsurfaced rights of way. Erosion and scars are readily seen, but less evident, and more difficult to quantify are the possible long-term effects of disturbance, particularly to breeding birds.

English Nature welcomes access on foot to the countryside because it provides the opportunity for people to experience and benefit from contact with nature. Wildlife and natural features play a major role in contributing to people's quality of life. In the majority of cases access on foot for quiet enjoyment along footpaths and rights of way does not pose problems for nature conservation. Many internationally important wildlife sites, including National Nature Reserves, have thousands of visitors every year with no adverse effect.

The Stiperstones NNR

The Stiperstones is a 10 kilometre ridge of dry heathland in south Shropshire, of which 588 hectares is SSSI and 481 hectares is a National Nature Reserve. The area is of great importance both to local communities and visitors for quiet recreation and to experience and enjoy wildlife.

In order to tackle the threats of habitat loss and damage *Back to purple*, a heathland restoration project supported by the Heritage Lottery Fund, was launched in 1998. A major objective of *Back to purple* is to "Foster recreational use which is sustainable and which is compatible with the interests of wildlife, the wild landscape and the local community".

As a contribution to this objective English Nature commissioned a study which engaged the local community, landowners and interest groups to:

- Identify the positive and negative aspects of public access on The Stiperstones and its impact on local people and nature conservation.
- Examine the tourism and leisure implications and the financial costs and benefits to the local community.
- Assess the environmental impact of access and recreation on The Stiperstones, particularly in terms of numbers of visitors, footpath condition, monitoring and future trends.
- Establish a consensus for dealing with access issues on The Stiperstones.

The Stiperstones NNR, Shropshire. Photograph © Peter Wakely / English Nature.

However, to maximise the benefits of nature conservation to people, and at the same time protect the natural environment, it is important to manage how access is provided. For example, heavy use of upland gills favoured by breeding birds, such as ring ouzel, should be discouraged. There may be a need to avoid access completely on some of the most sensitive upland habitats, such as the sugar limestone grasslands of Upper Teesdale and areas used by black grouse for lekking.

Perhaps the most significant potential impact of the new open access legislation is from unleashed dogs disturbing ground-nesting birds. Even where access already occurs people tend to follow existing linear routes, whilst dogs roam more widely across adjacent land. With open access across moors, heaths and downs the potential for disturbance from dogs increases substantially. To reduce this impact the Act permits the local exclusion of dogs from grouse moors and lambing fields.

Responses

School party visiting Lathkill Dale NNR, Derbyshire. Photograph © Peter Wakely / English Nature.

We do not believe the access provisions within the new Countryside and Rights of Way Act will prejudice the wildlife interest of most special sites. However, for the few special cases where access will need to be restricted or limited, there is a range of both statutory and non-statutory mechanisms. The range of non-statutory mechanisms that can be used to manage access includes:

- Promoting less sensitive routes and sites,
- Steering visitors away from sensitive areas through waymarking, location of access points, path and vegetation management,
- Ensuring routes follow desire lines,
- Siting of car parks and bus stops,
- Provision of interpretative material, such as signs and leaflets.

The statutory mechanisms include controls on certain activities (for example dog-walking), seasonal confinement to linear routes, permanent confinement to linear routes, seasonal closure or permanent closure. It is anticipated, however, that co-operation and careful management of access will in most cases allow non-statutory mechanisms to be used to ensure the protection of wildlife. The potential impacts and appropriate actions will be examined for all, with special care taken over SSSIs. The Habitats Regulations prescribe the approach that must be taken to ensure no adverse impact on sites of European importance.

Close working between English Nature and the Countryside Agency in implementing the new statutory right of access has been reinforced through the signing of an agreement *Nature Conservation and Access Land*. This again encompasses the Sandford Principle, to ensure that where the interests of nationally important wildlife and access cannot be reconciled, wildlife will prevail.

Action for access and recreation

Information and education - Increase the range of opportunities for the public to learn about the wildlife and natural features of the uplands and to provide advice on how to avoid damage and disturbance.

Demonstration - Use National Parks and nature reserves to demonstrate good practice in managing recreation alongside wildlife.

Planning - Ensure the conservation of wildlife and natural features is given proper weight in access and recreation plans and projects in the uplands.

Green tourism - Promote the value to the local economy of visitors in upland areas, and encourage green tourism.

Research and monitoring - Commission research into the effects of increased access on susceptible wildlife, and establish long-term monitoring of the impacts to wildlife on open access land.

Integrated land management - Identify practical ways for wildlife conservation, land management and access to be integrated in the uplands.

Visitors to raptor viewpoint. Photograph © Malcolm Stott.

Climate change

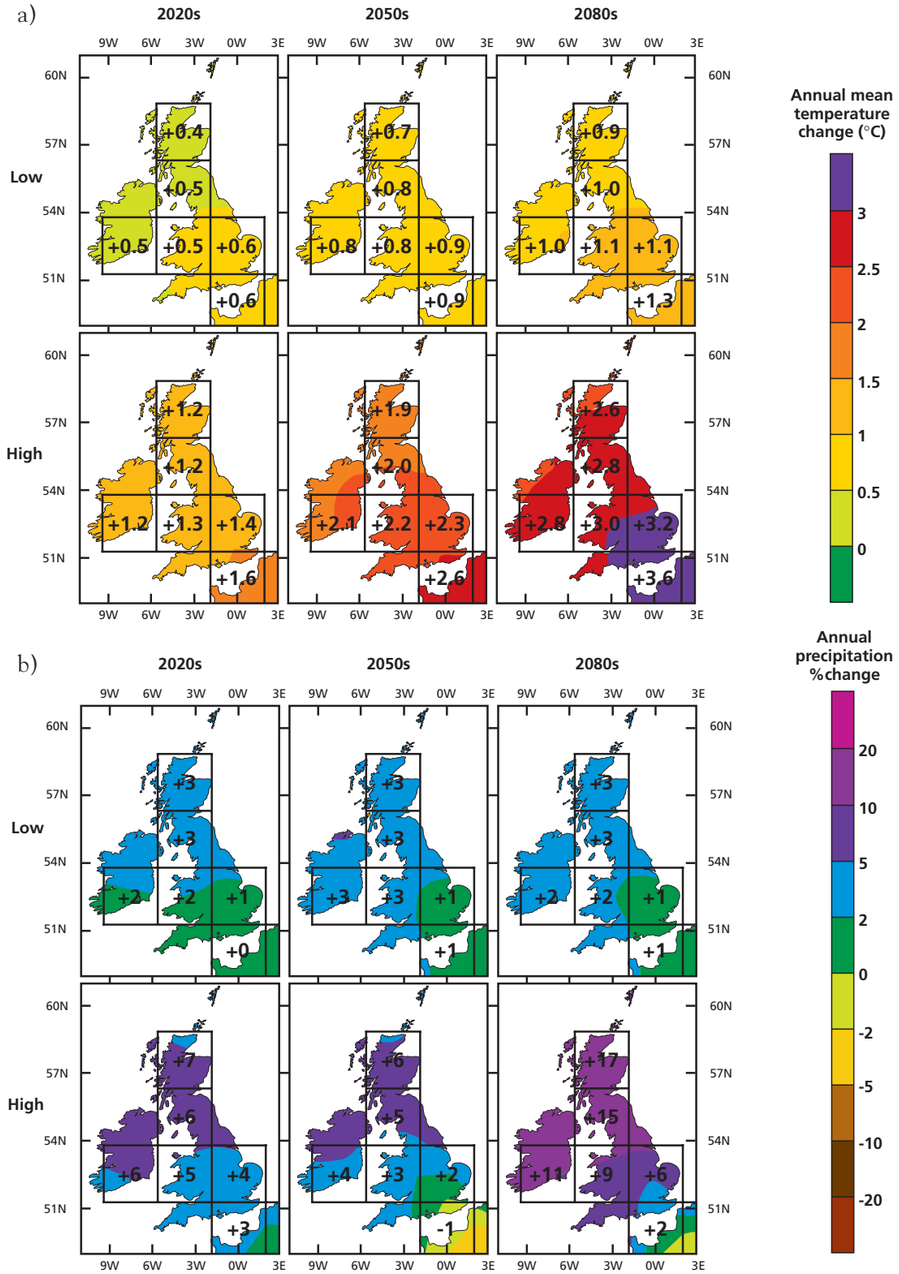
The geological record shows that climate change is a natural cyclical phenomenon. Although the climate is in a natural warming phase, research indicates that human activities are accelerating the process. The world has warmed by about 0.15° C per decade since the 1970s, and 1998 was the warmest year on record. In England, the last decade contained four of the five warmest years since recording began 340 years ago.[10,45]

These changes are believed to be happening because we have released into the atmosphere large quantities of 'greenhouse gases', chiefly carbon dioxide (CO_2). Although this gas occurs naturally in the atmosphere, and without its 'greenhouse effect' it would be too cold for life on earth, man-made emissions have increased its concentration. Carbon dioxide emissions have fallen in the UK during the 1990s as a result of the development of cleaner technologies. Reducing emissions of greenhouse gases is one of the Government's defining criteria for measuring the success of sustainable development.

Global warming will not simply increase temperatures, but will cause changes to weather patterns and raise sea levels. The UK Climate Impacts Programme (UKCIP) has modelled four possible climate change scenarios for the 2020s, 2050s and 2080s to span the range of possible future UK climates.[45] These suggest that temperature will increase at rates varying from 0.1° to 0.3° C per decade. The south east will warm more rapidly than the north west. There will be an increase in annual rainfall, particularly in winter. During the summer, there is likely to be increased rain in the north.

Climate change may lead to the loss of upland species such as cloudberry. Photograph © David Townshend / English Nature.

Predicted change in a) annual mean temperature (°C) and b) annual precipitation change (%) under low and high scenarios, for the 2020s, 2050s and 2080s.

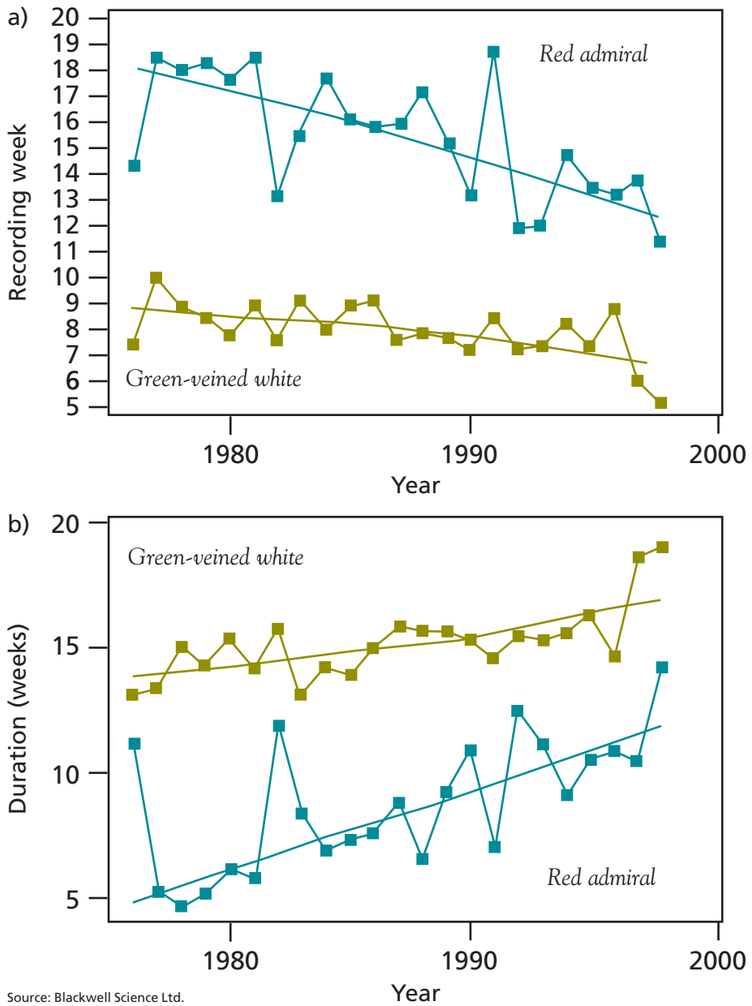


Source: Climate change Scenarios for the UK, UKCIP, 1998.
© Hadley Centre at the Met Office and CRU at UEA for the UK Climate Impacts Programme.[45]

Impacts

Some wildlife is responding now to changes in climate.[69] According to the national Butterfly Monitoring Scheme, 26 species of butterfly now make their first appearance earlier in the year. Thirteen species have shown a significant response to increases in spring and summer temperatures in central England, most notably the red admiral, where appearance advanced by 36.3 days during the period 1976 to 1998.[68] The duration of flight period has also increased for many species, markedly so for red admiral (39.8 days) and green-veined white (23.5 days).

Time trends for (a) first appearance and (b) duration of flight period for red admiral and green-veined white butterflies (week 1 is the first week in April).[68]



Source: Blackwell Science Ltd.

The impacts of climate change are, as yet, poorly understood but many of our arctic and alpine species are likely to be particularly affected by increasing temperature.[69]

Snowfield ground beetle

The shiny black ground beetle *Nebria nivalis* is one of the species likely to be affected by changes to our climate. It inhabits the summits of mountains, living amongst frost shattered rocks and beds of *Racomitrium* moss. *Nebria nivalis* is a predatory species, feeding along the edges of late-lying snow beds. It typically eats other insects which have been carried to these snow beds by the wind and have subsequently become immobilised by the cold.

Snowfield ground beetle *Nebria nivalis*. Photograph © Stuart Ball / JNCC.

This is very much a northern species, being found from the mountains of Scandinavia through to northern Russia. In the UK it has a fairly widespread distribution on mountain tops in Scotland. However, in England, it has been found only in the Lake District and north Pennines, where it is restricted to the summits of Scafell Pike and Cross Fell. Climatic warming is likely to lead to the loss of the beetle's favoured snow fields leaving it with nowhere to go.

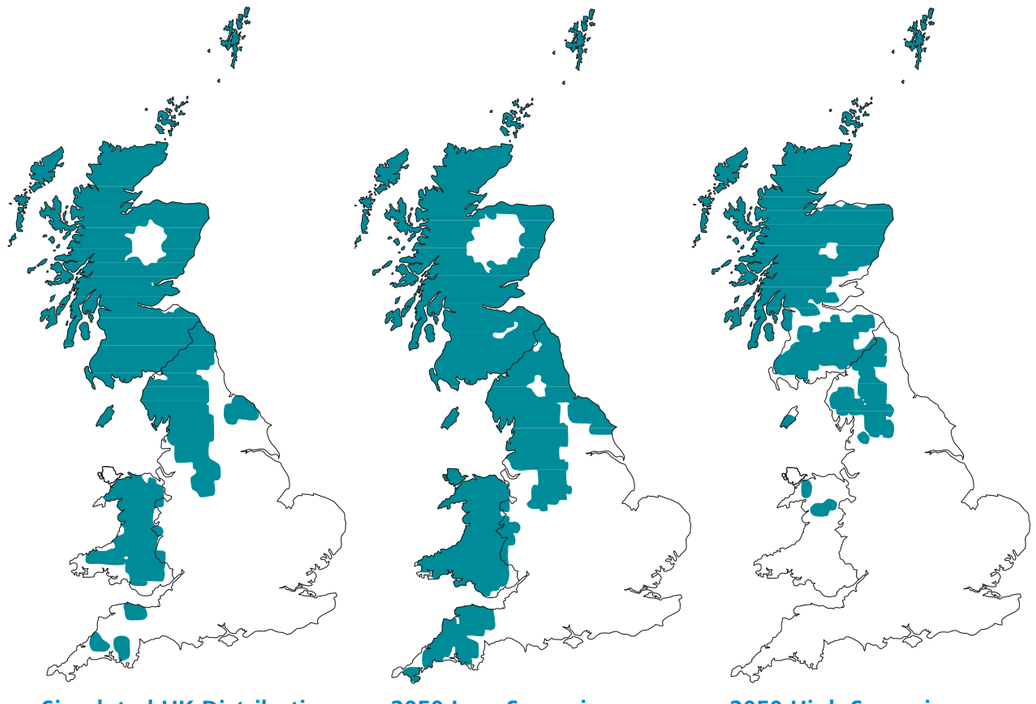
A regional study in north west England[73] recognises that upland habitats are likely to see significant impacts as a result of climate change, and identifies a range of possible effects. There are likely to be losses of arctic species, such as the fish vendace and schelly, from lakes in Cumbria. Conversely, species such as the speckled wood butterfly may move into the region's uplands. The north west uplands may face a greater risk of fires damaging important moorlands and blanket bogs. Peat uplands are a major carbon 'sink'. It is as yet unclear whether future climate changes will lead to greater decomposition of peat, which could release large amounts of carbon, accelerating global warming. Alternatively, it is possible that the peat could accumulate as a result of wetter conditions. These wetter conditions could also lead to greater soil erosion.

Large heath butterfly. Photograph © Richard Hall / English Nature.

The MONARCH Project (Modelling Natural Resource Responses to Climate Change)

English Nature is leading a consortium of 11 partners funding this major piece of research into the impacts of climate change on biodiversity and Earth heritage in Britain and Ireland.

The study will provide a quantitative assessment of the likely direct impacts by considering how the scenarios for climate change will affect terrestrial, freshwater and marine environments. It will also identify the factors driving change, indicators of change and species/habitat vulnerability and, combined with complementary results from other studies, will determine future research needs and priorities for policy development. The project will report its findings in Spring 2001.



Modelled distribution of the large heath butterfly under different climate change scenarios. The greater climate change under the 2050 high scenario would lead to a marked contraction of the large heath's range to northern, upland areas.

The SPECIES model was developed as part of a jointly funded project between MAFF, DETR and UKWIR "CC0337: Regional climate change impact and response studies in East Anglia and the North West (REGIS)" and is also used by the MONARCH project.

Responses

In December 1997, the Kyoto Protocol to the Framework Convention on Climate Change introduced legally binding targets for six greenhouse gases (of which CO_2 is the most important), to be achieved by 2008-2012. The targets for the EU was an 8% reduction on 1990 levels and, through apportionment to Member States, a 12.5% reduction for the UK. The Government aspires to reduce UK CO_2 emissions by 20% on 1990 levels by 2010, and this will in part be achieved through increased electricity generation from renewable sources.[26] In the longer term the Royal Commission on Environmental Pollution recommends a 60% reduction target for domestic CO_2 emissions by 2050.

Climate change will happen, even if the target reductions in emissions of greenhouse gases were achieved today. The global climate system is highly complex and takes time to respond to changes. We may slow the long-term rate of change, but we cannot reverse it through these measures. Action is required now if we are to plan to adapt and cope with likely climatic changes this century.

Action on climate change

Allow nature to move - Provide a landscape which allows wildlife to move in response to climate change.

Renewable sources - Support the use of renewable energy schemes, such as wind, biomass and energy from waste projects, where they do not damage wildlife and natural features.

Woodland - Increase tree planting to help reduce net CO_2 emissions, avoiding damage to existing wildlife interest.

Energy efficiency - Develop more energy efficient technologies and put greater emphasis within all new building programmes on energy conservation and demand management.

Local products - Advocate local use and processing of products to reduce energy consumption.

Atmospheric pollution

Acidification

Weathering and leaching processes over many thousands of years in a wet climate produce naturally acidic soils on the hard, resistant rocks that occur in the uplands. This natural acidification process has been accelerated by human activities which generate atmospheric pollution, particularly sulphur dioxide, ammonia and nitrogen oxides.

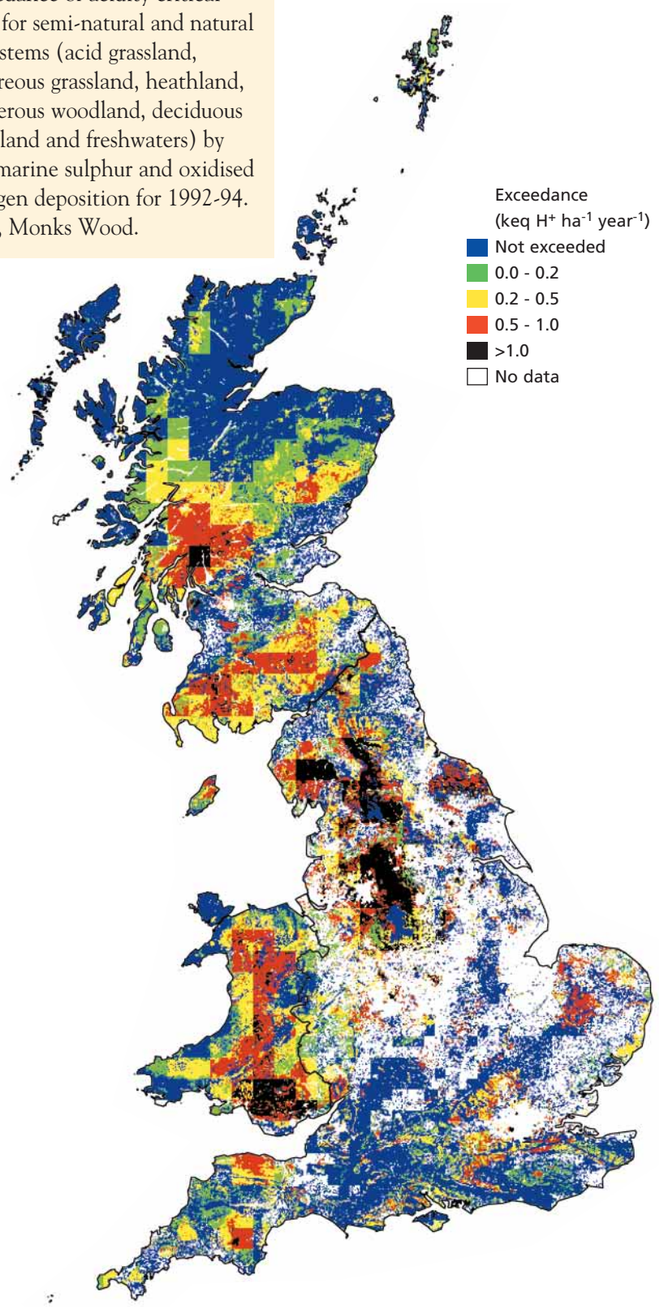
The effects of deposited sulphur and nitrogen are expressed as exceedances of the critical load. The critical load is an estimate of the annual deposition of a pollutant above which, according to present knowledge, there will be significant harmful effects on sensitive elements of the environment. In the case of acid deposition, the critical load exceedance is a measure of the extent to which deposition exceeds the capacity of the soil to neutralise it. Mapping of critical load exceedance shows clearly that upland areas are most affected by acid deposition.[19]

The major source of sulphur from human activity is the burning of fossil fuels for electricity generation. In contrast, the most significant sources of nitrogen are diffuse in origin, including emissions of ammonia from agriculture, especially livestock, and of nitrogen oxides from vehicle emissions.

At present sulphur dioxide contributes some 36% of acid deposition in England, ammonia 36% and nitrogen oxides some 28%. About 30% of upland deposition comes from mainland Europe.

Upland areas are most affected by acid deposition

Exceedance of acidity critical loads for semi-natural and natural ecosystems (acid grassland, calcareous grassland, heathland, coniferous woodland, deciduous woodland and freshwaters) by non-marine sulphur and oxidised nitrogen deposition for 1992-94. CEH, Monks Wood.



Impacts

The damage to ecosystems from acidification is most obvious in freshwater, and in its effects on plants. The losses of *Sphagnum* mosses from the south Pennines in the 19th and 20th centuries and of the pre-industrial lichen flora from large areas of the UK illustrate this.[20] Increasing acidity (accompanied by increased availability of aluminium) has led to losses of acid sensitive freshwater plant and invertebrate communities and reductions in species diversity. For example, brown trout and dipper have declined, especially in upland river catchments.[71] Acidified freshwater sites have been found in many upland areas of England, including the Lake District, Pennines, North York Moors and Dartmoor.[20]

A further influence on acidification in the uplands is the effect of conifer plantations. Conifer trees increase the acidification processes on some soils by intercepting more of the atmospheric pollutants with their leaves and changing water flows in the soil.

The 1994 United Nations Second Sulphur Protocol required a 62% reduction in sulphur dioxide by EU Member States by 2000 compared with emissions in 1980. Under this protocol there would still be over 200,000 ha of SSSIs, including internationally designated upland sites, in England and Wales receiving deposited sulphur in excess of their critical load.[36] Subsequent international agreements (which require further reductions in emissions) have implications for SSSIs which have not yet been assessed.

Responses

National emissions of sulphur dioxide, the greatest contributor to acidification, have dropped by 66% since 1980.[28] Much of this reduction is due to changes in industrial practices, such as the shift from coal to gas to generate electricity, along with tighter controls over polluting processes. Most of the decline in deposition has occurred over urban and arable areas close to sources, and the recovery of the acid-sensitive upland areas in the north and west of the country is slower than expected. There is as yet little evidence for chemical recovery of these areas.[1]

Although there is some evidence for recent reductions in emissions of nitrogen oxides, the downward trends in the deposition of nitrogen over the last decade have been small. Hence the contribution of nitrogen towards acidification has increased relative to that of sulphur and many parts of the country continue to receive levels of acid deposition well in excess of their critical load.

Eutrophication

In addition to its acidification effects, atmospheric sources of nitrogen oxides and ammonia act as plant nutrients. Since the species and communities of the uplands are adapted to nutrient-poor conditions, high levels of nutrients have significant impact on these ecological systems. This process of over-enrichment by nutrients is called eutrophication. In England, deposition of nutrient nitrogen is particularly marked in upland areas.

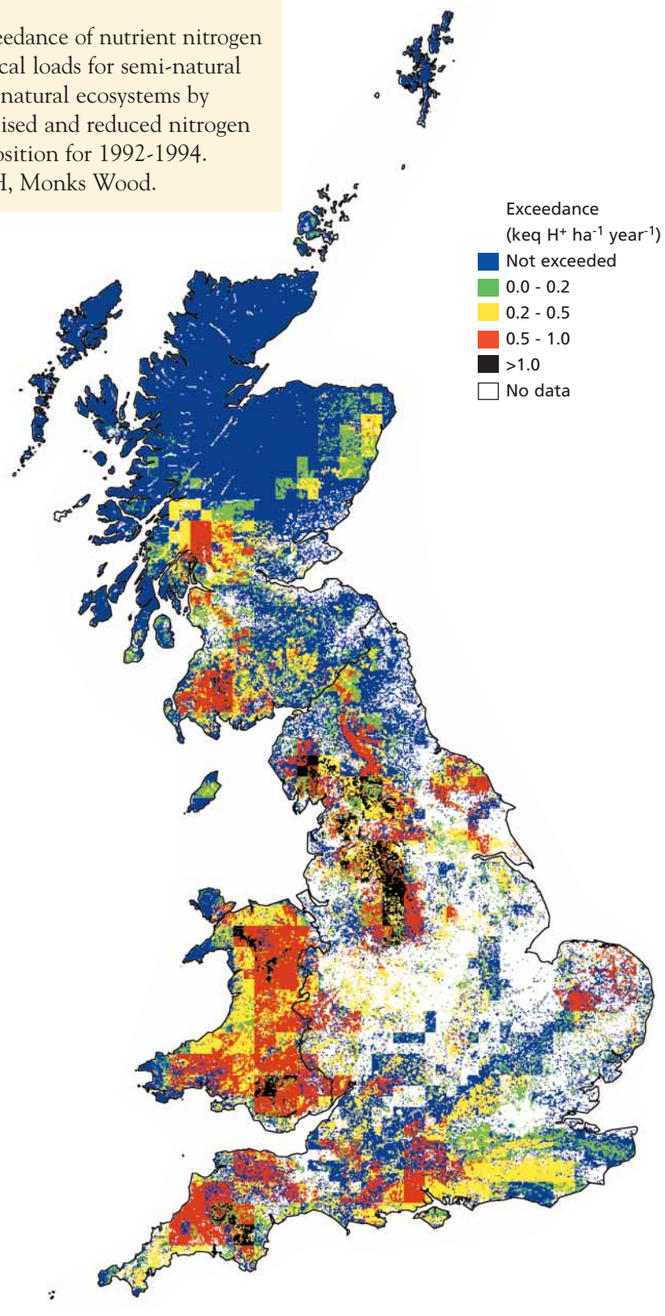
The major sources of nitrogen oxides are emissions from industry (20-30%) and vehicles (50-60%), whereas agriculture produces 90% of the ammonia. Hence diffuse rather than point sources are the major sources of atmospheric nutrient nitrogen.

Impacts

Experimental studies have shown that major changes to plant communities can be caused by the addition of nitrogen at rates comparable to those currently experienced through atmospheric deposition.[42] Eutrophication caused by the deposition of nitrogen can alter the species composition of upland swards, and result in the decline of, for example, dwarf shrubs. Plant species characteristic of nutrient-poor soils become displaced by species that thrive in the presence of increased nitrogen. In upland areas with high nitrogen deposition, increased levels of nitrate are being measured in lakes and streams, suggesting that deposition exceeds the natural carrying capacity of the surrounding soils.[5]

Upland areas are most affected by deposition of nutrient nitrogen

Exceedance of nutrient nitrogen critical loads for semi-natural and natural ecosystems by oxidised and reduced nitrogen deposition for 1992-1994. CEH, Monks Wood.



Responses

The EU has set ceilings for emissions of nitrogen oxides by Member States aiming to achieve an overall 55% reduction by 2010 compared with 1990. Emissions from power stations are declining following the fitting of low nitrogen oxide burners as well as the switch from coal to gas. However, despite the mandatory requirement for fitting catalytic converters to all new vehicles manufactured after 1993, data from government monitoring networks showed an initial 8% increase in concentrations of nitrogen oxides. Although the trend is now downwards, a further rise in emissions is predicted from this source over the next 15-20 years, as increasing road usage counteracts reductions gained through emission controls.

Action on atmospheric pollution

The overall aim is to reduce emissions such that critical loads within SSSIs are not exceeded for acidification or eutrophication.

Protocols and commitments - Reduce the impact of acidification and eutrophication through full implementation of the proposed National Emissions Ceilings Directive, and the Convention on Long-Range Transboundary Air Pollution.

Vehicle emissions - Reduce pollutants from vehicle emissions, by implementing the National Air Quality Strategy. Targets should be based on the protection of sensitive ecosystems and backed by regulation.

Diffuse agricultural pollution - Reduce the impacts of diffuse atmospheric emissions from agriculture through greater enforcement, adherence to MAFF codes and guidance.

Integrated pollution control - Tackle impacts on important wildlife sites of atmospheric pollution from major agricultural and industrial point sources, through Integrated Pollution Control (and subsequently Integrated Pollution Prevention and Control (IPPC)) authorisations.

Research - Promote studies into risk assessment for SSSIs, monitoring and remediation. Encourage research to determine the relationships between critical load exceedance and ecological change, and develop models for recovery of affected ecosystems.

4. The way forward

The wildlife of the English uplands is in crisis. Evidence in this report demonstrates serious on-going declines in biodiversity affecting many upland habitats and species. Monitoring shows that overall some 55% of the area of upland SSSIs is in poor condition. Worst affected are upland heathlands, blanket bogs, calcareous grasslands and montane habitats.

As we have shown, the principal cause of this decline is overgrazing by animals, mostly sheep. Whilst livestock farming has been instrumental in maintaining many open upland habitats, excessive stocking in recent decades, supported by CAP subsidies, has caused severe damage. Although overgrazing is the biggest problem, it is by no means the only pressure on our fragile uplands. Other pressures include environmentally unsustainable grouse moor management, illegal persecution of raptors, lack of integrated management of commons, increased visitor access, diffuse pollution and climate change. The message is clear. We are failing to achieve the sustainable management of upland wildlife.

Our vision for the uplands is a mosaic of more diverse habitats supporting characteristic wildlife and at the same time environmentally sustainable economies and communities. To realise this we must work with those who use and manage the land to maintain, restore and enhance the wildlife and natural features of the English uplands.

We recognise that sustainability is about more than just biodiversity, and that we need to build understanding and co-operation between all those involved in the uplands. The landscape of the uplands is not, nor ever has been, static. We recognise that it will continue to change, and we want to contribute to the decisions that will shape the landscape of the future. Towards this, English Nature is working on a pilot initiative, 'Lifescapes', which will explore how to restore the ecological quality of landscapes in ways that meld with the social and economic interests, and which reflect local character.

Exmoor National Park, Holnicote. Photograph © Peter Wakely / English Nature.

Crucial to our vision for biodiversity in the uplands is the future of agriculture. There has been significant recent reform of the CAP designed to promote integrated rural development. In the uplands the financial support provided through the CAP is essential to help sustain both communities and wildlife. The England Rural Development Programme (ERDP), launched in October 2000, provides the blueprint for rural development in England over the next six years. Two priority areas are identified for funding in the Programme: the conservation and improvement of the environment; and the adaptation and development of rural businesses and communities. The key measures under the ERDP which can contribute to the sustainable management of the uplands are:

- The suite of agri-environment schemes, including the Countryside Stewardship scheme which has received significant extra funding;
- The refocusing of support for livestock farming in the Less Favoured Areas; and
- The introduction of risk assessments for potential overgrazing cases.

Whilst these are welcome moves in the right direction, these trends have been too small and too slow to address the rapidly changing economic and environmental difficulties facing the uplands. We need both a greater shift of funds from agricultural production support to rural development and environmental measures. Further changes in policy are needed to ensure support for farmers who are willing to protect and enhance the wildlife value of the uplands, with clear signals that farmers whose practices damage the environment will not receive public financial support.

The Upland Challenge

To achieve our vision for sustainable uplands we need urgent action. From the recommendations in the preceding chapter we have selected the ten most critical next steps to make early progress. We call this the Upland Challenge. We hope to see progress on these vital issues within the next two years and intend to conduct a review of progress in 2003.

Targeting of agri-environment schemes - Target agri-environment schemes in the uplands at biodiversity priorities, tackling environmentally unsustainable management, to ensure that SSSIs are restored and maintained in favourable condition.
Sheepmeat and beef regimes - Reform the Sheep Annual Premium, Suckler Cow Premium and Beef Special Premium schemes to an integrated area-based scheme, with payments conditional on practical environmental standards, at the next review of the CAP.
Overgrazing rules - Give higher priority to an adequately-resourced implementation of the overgrazing rules, with an effective reporting procedure and a simpler methodology to encompass the full range of overgrazed habitats.

Upland moor enriched by scattered trees in gill. Photograph © English Nature.

Rural Development Programme - Promote the effective implementation of the England programme as a mechanism to maintain the rural environment and viable rural communities in the Less Favoured Areas.
Common land legislation - Secure new legislation for common land, implementing the proposals in the recent consultation *Greater Protection and Better Management of Common Land in England and Wales*.
Grouse moor management - Promote environmentally sustainable moorland management, including sensitive burning practices.
Raptors - Implement the recommendations of the UK Raptor Working Group, including greater enforcement of existing legislation to prosecute those found disturbing or killing birds of prey.
Access and recreation - Provide advice and demonstrate good practice in managing land for people and wildlife.
Climate change - Provide a landscape which allows wildlife to move in response to climate change.
Diffuse atmospheric pollution - Reduce the impacts of diffuse atmospheric emissions from agriculture and vehicles, basing targets on the protection of sensitive ecosystems backed by regulation.

We hope that this report achieves a wider ownership of the vision for the uplands and the problems facing wildlife there. We share responsibility for securing a sustainable future for the uplands. **We can achieve this only if we work in partnership, and hence we urge partners to work with us to meet our Upland Challenge.**

Meeting the upland challenge will mean that upland birds, such as the golden plover, have the chance to thrive. Photograph © Andy Brown / English Nature.

Our commitment to review

As part of this regular series of publications we intend to review progress and take stock of the condition of wildlife in the uplands in three years. We intend to hold a stakeholder meeting as part of this review and set new objectives to further progress, with others, toward the goal of realising a sustainable future for the English uplands.

Future reports

We have seen how wildlife in the uplands is in crisis, but there are serious threats to lowland and maritime wildlife too. Recent decades have seen large-scale losses and fragmentation of semi-natural habitats, some of which continue to the present day as a result of neglect (30% of all SSSIs remain in unfavourable condition). In parallel with habitat loss, species extinctions have increased in the past century and many other species continue to decline. In contrast, an increasing number of non-native species are becoming established, some of which pose a risk to native plants and animals. We will look in greater detail at the factors driving these changes in maritime and lowland habitats in future assessment reports. It is clear that we face major challenges to reverse these trends, particularly the decline in the countryside outside special sites. Developing successful partnerships, together with better targeting of schemes and incentives, will be critical for future success.

Data and information

Compiling this snapshot of the state of England's upland wildlife and geology has revealed gaps in the knowledge of our natural resources. To accompany changes in policy and improved management of the uplands there need to be improvements in the way biodiversity information is collected, managed and made available.

This is the central aim of the National Biodiversity Network Trust. The Trust has been established to deliver the network connecting all those who collect and record biodiversity information in the UK. As a central contributor to the information held by the National Biodiversity Network (NBN), we will continue to assess the condition of special sites. As well as sharing our approach with other agencies and NGOs, there is a need to capitalise upon technological developments that enable improved monitoring and data sharing.

To enable the NBN to contribute to improving our knowledge of upland natural resources more money is needed. Presently English Nature is able to lead the development of the NBN in only one English Region (the South West). We will, however, explore the costs of establishing a full network of data centres and creating inventories of BAP priority habitats. The inventories would provide the basis for a programme of regular surveillance to report on the state of these habitats and to inform future policy.

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