Responding to the impacts of climate change on the natural environment: The Cumbria High Fells

A summary

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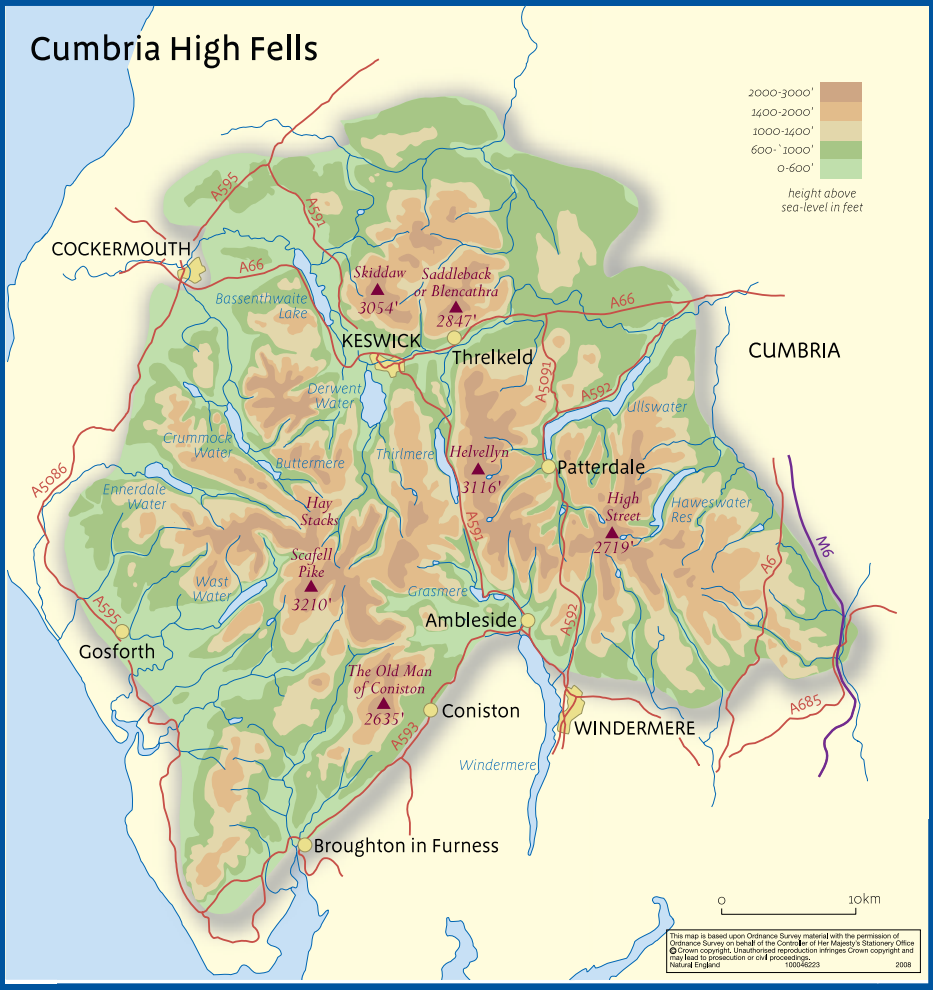
Cumbria High Fells
2000-3000'
1400-2000'
1000-1400'
600-1000'
0-600'
height above sea-level in feet
COCKERMOUTH
A595
A591
A66
Skiddaw
3054'
Saddleback or Blencathra
2847'
Bassenthwaite Lake
KESWICK
Threlkeld
CUMBRIA
A5091
A592
Derwent Water
Ullswater
Crummock Water
Buttermere
Thirlmere
Helvellyn
3116'
Patterdale
A5086
Ennerdale Water
Hay Stacks
High Street
2719
Haweswater Res
M6
A6
Seafell Pike
3210'
Wast Water
Grasmere
Ambleside
A595
Gosforth
The Old Man of Coniston
2635'
Coniston
WINDERMERE
A685
A593
Windermere
Broughton in Furness
0
10km
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Natural England 100046223 2008

Introduction

Natural England is working to deliver a natural environment that is healthy, enjoyed by people and used in a sustainable manner. However, the natural environment is changing as a consequence of human activities, and one of the major challenges ahead is climate change.

Even the most optimistic predictions show us locked into at least 50 years of unstable climate. Changes in temperature, rainfall, sea levels, and the magnitude and frequency of extreme weather events will have a direct impact on the natural environment. Indirect impacts will also arise as society adapts to climate change. These impacts may create both opportunities and threats to the natural environment.

Natural England and its partners therefore need to plan ahead to secure the future of the natural environment. One way in which we are doing this is through the Character Area Climate Change Project.

The project aims to identify the local responses required to safeguard the natural environment and our enjoyment of it. In the pilot phase we are focussing on four of the 159 'Character Areas' in England, one of which is the Cumbria High Fells. The others are the Shropshire Hills, the Broads, and Dorset Downs and Cranborne Chase.

This leaflet is a summary of the more detailed findings from the pilot project (these are available on our website at www.naturalengland.org.uk). The leaflet:

- identifies significant biodiversity, landscape, recreational and historic environment assets;
- assesses the potential risks climate change poses to these assets; and
- suggests practical actions that would make them more resilient to the impacts of climate change.

What we learn from the four pilot projects will be used to extend the approach across England as part of our aim to build a healthy and resilient natural environment for the future.

Although the project is primarily concerned with the natural environment, it has also considered the impacts of climate change on other areas of Natural England's remit, including access and recreation, landscape, and the historic environment.

Great Langdale © Robert Goodison

About the project

The objective of the Character Area Climate Change Project is to ensure that when decisions on the future of places like the Cumbria High Fells are made, proper account is taken of impacts on the natural world, as well as on communities and their livelihoods. It is not Natural England's role, or intention, to take such decisions, but to initiate debate on the impacts of climate change on the natural world, so that well informed decisions about its future can be taken.

Communities and their livelihoods are vital considerations in the development of any future strategy to respond to climate change. This leaflet does not attempt to cover these issues, not because they are unimportant, but because our role is primarily in relation to the natural environment.

Ensuring a strong, healthy, diverse and inclusive society that lives within environmental limits is the key objective of sustainable development. Natural England seeks to contribute to this through its management of the natural environment. We recognise that environmental and social solutions need to proceed in tandem. Informed by this project, we will engage with communities, other organisations and Government to find approaches that deliver successful and long-term adaptation to climate change.

Taking action to respond to climate change will also depend on the cooperation of those who own and manage the land. We do not take that cooperation for granted and are aware that many measures will require appropriate incentives. At this stage we wish to explore with others potential responses which are feasible and acceptable in principle, and have not yet considered the detailed mechanisms of change.

Significant natural assets

The Cumbria High Fells Character Area is the most mountainous landscape in England, containing its five highest summits and deepest lakes within a diverse landscape of varied geology. The rocks have been sculpted and shaped by the last glaciations into a landscape of U-shaped valleys, steep-sided mountains, corries and tarns. There are significant areas of semi-natural vegetation, especially above the fell wall, which support extensive sheep grazing. Improved pasture in the valley bottoms allows slightly more intensive farming. Farms are scattered between villages and small towns, and are dominated by vernacular buildings of local materials.

The Cumbria High Fells contain some of England's richest and most diverse areas of habitat. There are 110 Sites of Special Scientific Interest (SSSI) that cover about 18 per cent or 35,852 hectares (ha) of the High Fells area. The majority of the SSSI area (31,286 ha) is also designated as 'Special Areas of Conservation' (SAC) of European importance. A further 7,786 ha of habitat has been classified as County Wildlife Sites. Outside these extensive designated areas, Biodiversity Action Plan (BAP) habitats exist which have no formal designation.

The most significant biodiversity assets found in the Cumbria High Fells include:

- the Lake District High Fells SAC for heathlands, arctic and montane communities, and blanket bogs;
- Borrowdale Woodland Complex SAC, which has the most extensive block of western oak woods in Northern England;
- Bassenthwaite Lake and River Derwent SAC complex, which provides the best English example of a nutrient-poor lake and undisturbed river;
- internationally important assemblages of breeding birds;
- 153 protected species;
- montane rocky ledges (often damp and base-rich), that support sixteen nationally scarce plants and five nationally rare plants of Arctic-alpine

Derwent Water © Charlie Hedley

flora at the UK southern limit of their distribution; and

- iconic species such as golden eagle, short-eared owl, osprey, freshwater crayfish, vendace, sea lamprey, otter, marsh fritillary butterfly, natterjack toad, great crested newt and freshwater pearl mussel.

The vegetation combines with the geology, topography, historical management and settlement pattern to create one of the most iconic cultural landscapes in the world. The majority of the Character Area falls within the nationally designated Lake District National Park.

Significant landscape assets include:

- spectacular and rugged mountain scenery of open fells with an expansive character;
- radiating patterns of deep glaciated valleys with extensive lakes;
- farmland and sheltered valley landscapes at lower altitudes;
- traditional stone farm buildings and walls;
- extensive areas of ancient, semi-natural, broadleaved, mixed and conifer woodlands;
- lakeshore landscapes of managed grassland with occasional boathouses and dwellings;
- the historic environment, which includes a long history of slate and mineral extraction, still visible in today's landscape; and
- farms, villages and small towns dominated by vernacular buildings in local materials, with some Victorian and later tourist-related development.

The spectacular scenery and easy access have attracted people to the lakes in large numbers for well over a century. It provides a great place for many varied outdoor activities on the fells, down in the valleys, or on the lakes and rivers. The Cumbria High Fells is widely used for recreation and tourism and the Lake District National Park presently receives more than 12 million visitors a year.

Access and recreation assets include:

- large areas of open access land;
- extensive water-based recreation activities;
- woodland and lakeside walks with stunning views;
- sites for outdoor sports including fell walking, climbing and mountaineering;
- long distance footpaths and 2,458 km of public rights of way; and
- steep, rugged slopes and trails, popular with mountain bikers.

The most significant ecosystem services provided by the Cumbria High Fells, from which we all benefit, include:

- water supply – the catchments are used extensively to supply water to the North West region, supplying a quarter of the region's water from Thirlmere and Hawswater reservoirs alone;
- carbon storage – peat and carbon soils are particularly significant in the Cumbria High Fells where there is extensive blanket bog;
- flood protection – flood plains and upland catchments in the Cumbria High Fells provide natural protection from fluvial flooding;
- food, fibre and building materials – meat, fish, wool and wood;
- recreation, tourism and education; and
- climate regulation, especially through water and wetlands.

Blanket Bog Erosion, Matterdale Common © Ian Crosher

Likely impacts of climate change on the Cumbria High Fells

Cyclists in Langdale © Charlie Hedley

Evidence from the UK Climate Impacts Programme (2002) shows that the climate in the Cumbria High Fells over the coming century is likely to become warmer and wetter in winter and hotter and drier in summer. In addition, rainfall intensity will probably increase. Extreme events such as heat waves and storms are predicted to increase in frequency and severity.

Impacts due to temperature rise

- The structure, species composition and dynamics of some habitats may alter due to seasonal changes.
- Some species may only survive if they can colonise and survive in different places.
- Upland areas will become refuges for species moving into them from lower levels.
- Montane habitats of the Cumbria High Fells are particularly susceptible to the impacts of climate change.

Under warmer conditions, it is likely that a number of arctic-alpine species will be lost as they face increasing competition from other species moving into the same ecological niche.

- Climate change may increase the number of non-native and invasive species.
- The parts of the lakes supporting deep, cold water fish species such as the ice age relict the Arctic Char, will be 'squeezed' because of a rise in temperature and increasing oxygen depletion at depth.
- A consequence of an increase in temperature and a decrease in rainfall in summer may be an increase in the risk of peat and bracken fires.

Impacts due to winter and summer rainfall changes

- An increase in winter rainfall may increase erosion, resulting in more nutrients being washed into lakes and rivers. This will interact with run-off from agriculture and erosion caused by walkers and cyclists on the fells.
- An increase in pests such as midges may affect outdoor activities and tourism.
- A decrease in summer rainfall may lead to a decrease in lake water levels. This will impact on water resources.
- The ability of species and habitats to recover from repeated seasonal drought and flood events may be compromised.
- Summer drought could lead to a decrease in the water that is available for recreation. A decline in water quality (due to reduced dilution of pollutants) and an increase in algal blooms may also affect the recreational potential of the lakes during summer.
- Peat soils will be more easily lost through erosion due to drying out. Drying out of peat soils and blanket bog would release significant amounts of carbon dioxide to the atmosphere, exacerbating climate change.

Impacts due to increased storminess

- Where semi-natural woodland is of a similar age structure, storm events may open up areas where young tree regeneration can take place.
- Ancient trees in parkland and wood pasture will be more susceptible to wind damage.

Other impacts

- Air quality can be affected by climate change and there may be consequent impacts on biodiversity, for example nitrogen deposition on upland habitats.
- Drying out of peat soils may lead to the disturbance of buried archaeology.

Impacts on tourism, recreation and the landscape

- Woodland based recreation is likely to increase in popularity as people seek shade in the hottest months.
- An increase in fire risk in the Cumbria High Fells may impact on tourism in terms of people's perceptions of safety and the need to close areas to manage fire risks.
- The 'hazardous season' could shift from winter to summer as heat becomes more of an issue than cold.

- There is likely to be an increase in footpath erosion rates due to increased intensity of rainfall, and some path sections could become prone to sudden erosion events. However these effects may be countered to some degree by reduced 'freeze-thaw action' in warmer winters.
- Higher winter temperatures will reduce the extent of ice and snow in the uplands, resulting in the loss of winter climbing and mountaineering opportunities.
- Increased visitor numbers may have negative impacts on wildlife and the landscape.
- While broad habitat types may persist (for example heathland and lakes) the characteristic species that make up these habitats may be different, subtly altering the appearance of the landscape.
- A more extreme cycle of wetting and drying may affect the foundations of walls and historic buildings, causing them to collapse. This in turn will affect the look of important vernacular buildings and walls within the landscape.

Indirect impacts

There will also be impacts caused by our responses to climate change, rather than by climate change itself. These include:

- An increase in the intensity of grassland management and, potentially, in the area of cultivation in the valley bottoms as a response to longer growing seasons. Coupled with demands for more or new crops, this may exacerbate pressures on land use and semi-natural habitats in the valley bottoms and lowland fringes.
- The timing of grazing and cutting and stocking levels will have to change in response to seasonal changes in grass production.
- A longer growing season may favour more commercial tree species and could provide more wood for coppicing, charcoal production and fuel. This has the potential to have both a positive and negative impact on the landscape depending on species and where they are planted.
- Renewable energy infrastructure could lead to conflicts with landscape, biodiversity and tourism interests and will be another pressure on land use within the area.
- Increasing pressure for food production on land use in valleys, in response to concerns about food security and population growth, may reduce the extent of floodplains, increasing flood-risks downstream.

It is important to remember that climate change will not be the only change over the coming century. Changes in farming systems, the economy, population patterns and cultural values will also affect the natural environment of the Cumbria High Fells. Indeed, climate change may have a greater impact on natural assets through changes in agriculture than through direct biophysical impacts. Changes in the types and varieties of crops, sowing dates, irrigation, pests, diseases and soil erosion are all likely. Our project does not try to assess these, although they will have significant implications for the area and any proposed adaptation measures.

Adaptation options

Responding to the impacts of climate change requires adaptation to prevent natural environmental assets and the social and economic benefits that they provide from being lost. The Cumbria High Fells is a large and complex area, with a varied topography and relatively rich mosaic of habitats. Consequently, it will be more resilient than many other areas in England to the impacts of climate change. However, its position as an upland refuge will mean that adaptive action will be critical.

The management of the fells over many years has been far from ideal for the ecosystems that occupy them. As a result, the majority of habitats are less resilient to climate change than they might have been. More recently, management and grazing levels in Cumbria have been more favourable. However, it will take a long time for these habitats to attain a good condition and therefore be more resilient to climate change.

Priorities for adaptation are outlined below. It should be noted that there may be policy, economic or other constraints to delivery of adaptation responses. Additionally, some of the actions identified may not have a delivery mechanism at present.

Managing the natural environment so it is more resilient to climate change

Areas such as the Cumbria High Fells will remain important for biodiversity as they have characteristics such as low soil nutrients that favour important habitats and species. To date, biodiversity action in the Cumbria High Fells has concentrated on trying to get sustainable grazing on upland Cumbria habitats. This has been done through the excellent work of local land managers changing the grazing behaviour of their stock. This needs to be expanded into the extensive areas of other BAP habitats within the Cumbria High Fells.

Further adaptation actions include:

- Improving the condition of all existing upland habitats, and particularly high carbon ones like blanket bog.

Footpath on Blencathra © Ian Crosher

- Ensuring that grazing regimes (intensity, seasonality, type of animal) are appropriate.
- Collecting long-term data sets and undertaking studies to assess environmental change. This information will be very important to inform adaptive management.
- Changing management policies to reflect the likelihood of compositional changes in species and communities.
- Using the spatial planning system to maintain adequate land for the natural environment.
- Removing conifers where they occur on ancient woodland sites and other habitats, particularly peat ones, and encouraging a return back to semi-natural habitat.
- Accepting the loss of certain species in montane habitats where the impacts of climate change may be more severe. However, not all arctic alpine species will be lost and there are many positive actions that can be taken to conserve these for the future.
- Improving the robustness of mountain areas, which will become refuges for species moving into them from the lowlands.
- Encouraging new native woodland expansion up the fell side for species to move up into.

Develop a high carbon landscape

The Cumbria High Fells has the potential to help mitigate climate change by locking carbon in soils and vegetation.

Upland land needs to be managed to help to deliver climate change mitigation by protecting vulnerable soil carbon stores, and improving the ability of upland habitats (such as blanket bog, scrub and woodland) to sequester carbon dioxide.

The addition of native woodland into upland agri-environment agreements is one possible way to help create a high carbon landscape. A recent Higher Level Stewardship agreement involving the graziers and landlord on Mungrisdale Common is one example of how this might be achieved.

Reduce sources of harm not linked to climate

When the natural environment is under stress it is less able to cope with additional complications. Consequently, climate change may be the 'tipping point' that prevents habitats and landscapes from recovering from the combined effects of other pressures that have been operating over the last couple of decades.

Major sources of harm include pollution from agriculture, discharge from sewage treatment works and air pollution such as nitrogen deposition. Significant progress has been made with freshwater habitats, for example through work funded by United Utilities on sewage treatment and consequential river quality improvements. The Bassenthwaite Lake Restoration and Catchment Sensitive Farming Programmes have started to demonstrate that there are multiple benefits associated with whole system catchment management. Projects such as 'Fix the Fells' will be essential to continue to repair the most eroded footpaths and reduce run-off, and some upland grips (field drainage ditches) now need to be blocked up. This will often lead to the rapid recovery of sphagnum moss species.

Develop ecologically robust and varied landscapes

Variation is key; more diverse landscapes are more resilient and better able to adapt to changes. This may well mean choosing different management options on the fells and dales. For example:

- Expanding habitats through restoration and creation will be required to address multiple sources of pressure and help ensure that the landscape is more 'permeable' so that species can move through it.
- Increasing the variation within existing habitats through changes in management will increase their resilience to climate change.
- Promoting naturally functioning and healthy ecosystems that are more resilient and so better able to adapt to climate change.
- Accepting new species, such as heath fritillary butterfly and sycamore, and managing for them. These species will be moving in from their southern distribution and finding a suitable climate within Cumbria. At present many have been introduced into area, but are often removed because they are considered 'non-native'.

St. John's Beck © Ian Crosher

- Expanding and linking habitats around existing high quality sites can help to buffer the effects of climate change.
- Creating space to allow rivers to take their natural course will allow the development of more resilient wetlands and habitats.
- There will be multiple benefits from implementing the national Wetland Vision' within the Cumbria High Fells.
- Any adaptation work needs to incorporate and protect the historic and cultural landscape.
- Monitoring change and adapting management accordingly will be critical.

Recreation, tourism and economic adaptations

Recreation and tourism is very important for the economy of the area. The visitor experience can be further enhanced by the landscape and habitat improvements that will result from the climate change adaptation actions identified below:

- Extensive farming systems are more appropriate than intensive ones for delivering an adapted natural environment and for enhancing the visitor experience.
- A sustainable food economy that is less energy intensive and less reliant on fossil fuels, and where more food is produced and consumed locally, will be a critical part of adapting to and mitigating climate change.
- A local wood fuel economy would bring many more undermanaged woods back into active management, improving their landscape and biodiversity value and giving an economic return to woodland managers, while also helping to mitigate and adapt to climate change.
- Upland hydrology is very important for water resources. There are two major reservoirs in the Cumbria High Fells which serve Manchester, and good water management can help reduce flood risk for downstream settlements. In addressing impacts on water resources and water quality it will be necessary to manage river catchments in a more holistic manner within and beyond the Cumbria High Fells boundary. The ability of catchments to hold water can be increased by allowing the development of natural vegetation such as sphagnum rich habitats and woodlands. Restoring the natural hydrology of catchments, including rivers and bogs, will be important in ensuring that water environments can adapt to climate change.
- Provision of shade for livestock within the hot summer months could be addressed through tree regeneration in the intake fields on deep bracken areas.

Adaptive management

Although the direction of climate change is clear, the detailed impacts and responses required are less so. Given this uncertainty, and to avoid the development of inappropriate solutions, a process called adaptive management will need to be used. This involves modifying existing practices and carefully monitoring the results to ensure that the response is effective. It may involve making further modifications to management until the response is effective.

Next steps

Adaptive management will require:

- Monitoring and planning for future potential catastrophic events such as storms or pests and diseases that may occur as a result of, or be exacerbated by, climate change.
- Identifying research needs and commissioning appropriate studies to inform decision making about adaptation and increase the effectiveness of strategies when implemented.
- Collating long-term data sets and studies assessing environmental change.
- Adopting policies that reflect the change in the distribution of species and the make-up of habitats.

This project on how climate change is likely to affect the natural environment of the Cumbria High Fells Character Area, and the adaptation responses required, is a significant first step but cannot be conclusive. It provides an indication of what may happen. However, the future impacts of climate change are still uncertain and are partly dependent on the amount of greenhouse gases that society releases and how much is released by natural feedback loops from the environment (one of our biggest unknowns).

When identifying adaptation actions, existing strategies, policies and initiatives need to be considered. Some actions defined as climate change adaptation are already occurring under a different name and it may be possible to modify existing programmes to provide a mechanism for delivering adaptation. An example of this is the planned incorporation of climate change adaptation into Natural England's Environmental Stewardship Scheme.

Natural England is now working on the following:

- An implementation plan, which may include a demonstration project. Natural England will work with local stakeholders, through the Lake District Partnership, to ensure that this builds upon and dovetails with other initiatives.
- An assessment of the contribution to climate change mitigation that an adapted Cumbria High Fells landscape will make.
- An economic assessment of adaptation measures in the Cumbria High Fells.
- Learning from the pilot process to assess likely climate change impacts and the required adaptation strategies for other Character Areas both regionally and nationally.

It is also clear that there is a lot we still do not know or understand and further work will be needed. Areas of research that we feel would be particularly useful in the short term are:

- A more detailed ecosystem services assessment for the Cumbria High Fells using a rapid assessment such as that used in the 'Moors for the Future' project.
- An assessment of the condition of blanket bog habitat in the Cumbria High Fells and the development of a restoration strategy to maximise carbon storage and capture.
- Investigating whether geology, trampling, grazing, climate or Victorian collections are the likely reason for the current distribution of arctic alpine flora, and how they might possibly survive under a substantially different management regime.

The future of the Cumbria High Fells depends on the actions we all take today to reduce our greenhouse gas emissions. This, combined with decisions we make about managing our landscapes to adapt to unavoidable climate change, will determine whether we continue to have a high-quality landscape that is cherished and respected by all.

Front cover photograph:
Looking towards Angletarn Pikes
© Charlie Hedley

NATURAL ENGLAND

Natural England is here to conserve and enhance the natural environment, for its intrinsic value, the wellbeing and enjoyment of people and the economic prosperity that it brings.

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