DRAFT Climate Change Adaptation Plan for Forest of Bowland National Landscape

Forest of Bowland National Landscape

Date of Report: January 2026

Contents

Executive Summary: Key Climate Issues for the Forest of Bowland National Landscape

Climate Breakdown in the Forest of Bowland

Climate breakdown is the overarching term given to the changes taking place in the Earth's climate systems. It is largely attributed to the increased levels of greenhouse gases in our atmosphere which are produced by humans using fossil fuels. This is compounded by human destruction of natural habitats which either act as carbon sinks or stores – this reduces the compensation effect natural systems have on absorbing carbon released into the atmosphere.

Please note, we are using the term 'climate breakdown' throughout this plan as opposed to the term 'climate change' as the term 'change' infers to warming and a more gradual shift. We are now aware of the urgent possibility of the catastrophic and high impact and range of effects caused by the very real breakdown in climate patterns, and the irreversible changes in systems which we are projecting, beginning to experience, and need to be prepared for.

We already know that the natural world is facing climate breakdown in the form of droughts, floods, and an increase in extreme weather events. We also know that the natural world is resilient and can adapt to this change in some circumstances. In other cases we (humans) will need to intervene to help build this resilience, and that is what this plan intends to set out and support. However, we need to be mindful that some aspects of climate breakdown may be extreme and, in the longer term, may lead to irreversible changes in our landscape, the nature it supports and the way we live and make a living in the Forest of Bowland. We therefore also consider some of these scenarios here too, and plan to manage conversations with stakeholders which will hopefully lead to a considered approach to transitioning to the new environments, methods of land management, and economy that this creates.

In this plan we seek to identify how climate breakdown will affect our ability to deliver the National Landscape's key purpose, namely to *"conserve and enhance the landscapes' natural beauty, including wildlife and cultural heritage, and promote opportunities for the public understanding and enjoyment of its special qualities*." (This definition will be termed 'natural beauty' for short in this document from now on.)

The Government has said[1] that National Landscapes need to embed the principles of climate adaptation planning into their Management Plans and to take account of the risks that climate breakdown presents. This plan will enable us to do that.

This Adaptation Plan is designed to be used by land managers, planners, nature recovery teams and a wide range of policy makers to develop and deliver community, land, habitat and species management plans that can reduce the vulnerability of the Forest of Bowland National Landscape to the impacts of climate breakdown.

[1] https://www.gov.uk/government/publications/management-plans-for-protected-landscapes-in-england/management-plans-for-protected-landscapes-in-england

Local Climate

The climate changes projected for the Forest of Bowland National Landscape area are broadly:

- **Warmer wetter winters**
- **Hotter drier summers**
- **More extreme rainfall, storms and drought periods throughout the year**

Changes are projected against a 2°c change and a 4°c change in temperatures above the pre-industrial baseline 1850-1900. these are explained in more detail in the report, but in summary they are:

In Lancashire the **hottest summer day** so far on record was 30.1°c in 2023. In the 2°c scenario summer temperatures will reach 32.6°c, and in the 4°c scenario summer temperatures will rise to 37.5 by 2100.

On average temperatures only rose above 25°c for one day a month during summers 1991-2019, this is likely to rise to 2 days a month over 25°c in the 2°c scenario, and 5 days a month in the 4°c scenario.

Summer months currently see an average of 13 days of rain and this is projected to stay the same in a 2**°c** scenario, but it would fall to just 10 days in a 4°c scenario in Lancashire. In the summer of 2025, we saw a five month drought starting unusually early in the year in May.

The **warmest Lancashire winter** temperature recorded to date was 18°c and this is in line with the 2°c scenario. A 4°c scenario projects winter days reaching 19.5°c.

Winter months in Lancashire usually see 16 days of rain and this is projected to remain the same in the 2 and 4**°c** scenario. However, the intensity of rainfall and also of storm events is projected to rise. Read more in the BBC summary reports https://www.bbc.co.uk/news/resources/idt-d6338d9f-8789-4bc2-b6d7-3691c0e7d138

Summary of the Natural Assets at highest risk

In the medium term, where we expect to see a 2°c rise in temperatures by 2050, the main risks to the Forest of Bowland landscape are all due to hotter drier summers and more frequent heatwaves and droughts. These will affect the following assets:

- Peatland: drying out
- Species rich grassland: losing diversity
- Lowland bog: drying out
- Woodland: suffering from drought stress
- Land use change: due to lack of viability of current farmland and moorland management practices

The one opportunity identified is to create more hedgerows and woodlands

In the longer term, ie by 2100 when we expect temperatures to reach the 4°c scenario, there are many more high risks identified: the severity of change being due to higher temperatures, drier summers and wetter winters, with increased incidence of extreme and storm events. Additional assets affected by the end of the century are:

- Rivers: suffering from low flow and floods causing erosion, a crash in aquatic life and increased impact of pollution
- Farming: difficulties including disrupted water supply for stock, waterlogged and degraded soils, increased pests and diseases
- Surface and groundwater: not meeting water quality standards

Again, the few opportunities identified include tree and hedgerow planting, especially where farming is facing viability issues, and land use change providing space for renewable energy and other green technology

Summary of Recommended Key Actions

The key actions identified in this plan are also included in our Management Plan for 2026-31 and they will be updated and continually fed into future plans.
The table below shows these key actions, and the code refers to the specific measures in the management plan (eg 2A)

More details are in chapters 5 and 6, and the full list of actions is listed in the accompanying Action Plan and in the Risk Assessment

ASSET	IMPACT	KEY ADAPTATION ACTIONS
Peatlands	Both drought conditions and warmer winters reduce the function and condition of peatland	Improve the hydrological function and condition of peatland through re-wetting and re-vegetating 2A
Species rich grasslands	Both drought and heavy rain affect viability of habitat	Ensure existing and potential species-rich meadows, pastures and scarce grasslands are in good condition and well connected 4A
Hedgerows	Drought stress can cause loss of species, plus good opportunity for new hedgerows	Manage woodlands in line with UK Forestry Standard and bring existing woodlands and hedgerows into good condition 3A Plant trees, woodlands (including riparian woodlands) and hedgerows to act as wildlife networks and natural solutions to climate change. Plant species that may be more resilient to climatic change, pests and diseases 3C
Veteran trees & Historic landscapes	Drought and storm events cause tree loss and damage	Survey and retain existing significant / veteran trees in the landscape and plant new ones to act as habitat, stepping stones and future landscape features, in line with UKFS 3D

Woodlands	Dry weather and storms damage woodlands, pest & disease also increase. Opportunity for new planting	Manage woodlands in line with UK Forestry Standard and bring existing woodlands and hedgerows into good condition 3A Plant trees, woodlands (including riparian woodlands) and hedgerows to act as wildlife networks and natural solutions to climate change. Plant species that may be more resilient to climatic change, pests and diseases 3C Support research into future woodland resilience to climate change, pests and diseases 3I
Species abundancy & diversity	Extremes in weather affect viability and distribution	Deliver habitat and species conservation measures at a landscape scale. Increase habitat connectivity and undertake adaptive management to increase species diversity and abundancy 6H
Headwaters, streams & ponds	Liable to dry up in drought, loss of habitat	Restore and create ponds, scrapes and dams on farmland, moorland and in woodland 5F
Rivers and waterbodies	Drier summers cause low flow affecting aquatic life, pollution impact, spawning etc; Storm events cause erosion & sedimentation harming aquatic life	Strengthen the resilience of river systems to climate change and extreme weather events, encouraging the development of nature- based solutions in rivers and wetlands as climate adaptation methods 5C Restore natural processes to watercourses to improve in-channel habitats, reconnect rivers to their floodplains, increase biodiversity and enhance the landscape 5E
Ground & surface water	Drier weather causes low flow and poorer water quality, connectivity etc	Maintain, create and expand wetland habitats promoting good hydrological function and diverse abundant species 5A
Forestry - pests & diseases	Storms, drought and wet weather can cause damage. Good opportunity for new planting with advised resilient species mix	Support research into future woodland resilience to climate change, pests and diseases 3I
Public Rights of Way	Extreme events cause erosion and overgrowth of paths – costly to repair	Utilise adaptive management techniques and practice that create and restore rights of way which are more resilient to climate change 7I

1. Introduction to the Forest of Bowland National Landscape

The Forest of Bowland was designated as an Area of Outstanding Natural Beauty in 1964. It is internationally important for its heather moorland, blanket bog and rare upland birds. The components of natural beauty in the Forest of Bowland were set out in a Statement of Significance when the AONB was assessed and designated.

The Forest of Bowland is in Northwest England and covers 803 square kilometres of the Pennines (730 in Lancashire and 73 in North Yorkshire). The area is bounded to the north and south by the Rivers Lune and Ribble respectively. To the west is the Fylde plain, while the eastern side of the boundary matches the Yorkshire Dales National Park for a short distance, with Ribblesdale bordering the remainder. On its south-eastern edge, Pendle Hill (557m) forms a discrete landscape feature, which is geologically linked to the rest of Bowland, but separated from the main area by the Ribble valley.

The Rivers Brock, Calder, Conder, Hindburn, Hodder, Loud, Roeburn, Wenning and Wyre all originate in the upland core of the Bowland Fells. The highest point is Ward's Stone at 561m, alongside other notable landmarks such as Fairsnape Fell at 510m and Hawthornthwaite Fell at 479m.

The boundaries of the National Landscape include parts of five Lancashire district council areas, namely: Lancaster, Pendle, Preston, Ribble Valley and Wyre; plus a part of North Yorkshire Council that was formerly Craven District. The urban centres of Preston, Lancaster, Blackburn, Blackpool and Burnley are all near to Bowland, with over one million people living within a 30-minute journey of the area. Bowland is also within a 90-minute journey from the major conurbations of Liverpool, Manchester and Leeds.

The designation is overseen by a partnership of local councils, government agencies, landowners, farmers, local businesses and wildlife and recreation interest groups, who work to conserve and enhance the natural beauty of this special landscape.

Natural Beauty

The Forest of Bowland is treasured by so many thanks to its unique character and sense of place. The interplay of nature and human interaction over many centuries has resulted in a landscape of great beauty and diversity, which feels "wild" but accessible.

Bowland's natural beauty encompasses everything that makes this landscape distinctive: its geology, topography, climate, soils, flora and fauna. It also embraces the area's archaeological, architectural and industrial heritage, along with its farming history and key cultural elements.

The National Landscape has few large settlements and has an estimated population of just 17,500. Still relatively undiscovered, the Forest of Bowland holds a special place in the heart of visitors who have discovered the beauty of this captivating landscape.

This appeal, in part, comes from the combination of contrasting but complementary scenery in close proximity. The grandeur of the upland gritstone fells, heather moorland and steep escarpments provides an impressive backdrop to the more intimate scale of scattered, stone-built farmsteads, small villages, undulating farmland and wooded river valleys; these being woven together by steep-sided cloughs, dry stone walls and hedgerows, and all underpinned by a tangible sense of tranquillity.

Forest of Bowland Vision for 2040

If you find yourself in Bowland in 2040, this is a vision of what it is hoped you will experience.

The Forest of Bowland landscape retains its sense of local distinctiveness, notably the wide open moorland character of the Bowland Fells, undulating lowland farmland, clough woodlands, traditional buildings and the settlement patterns of its villages, hamlets and farmsteads.

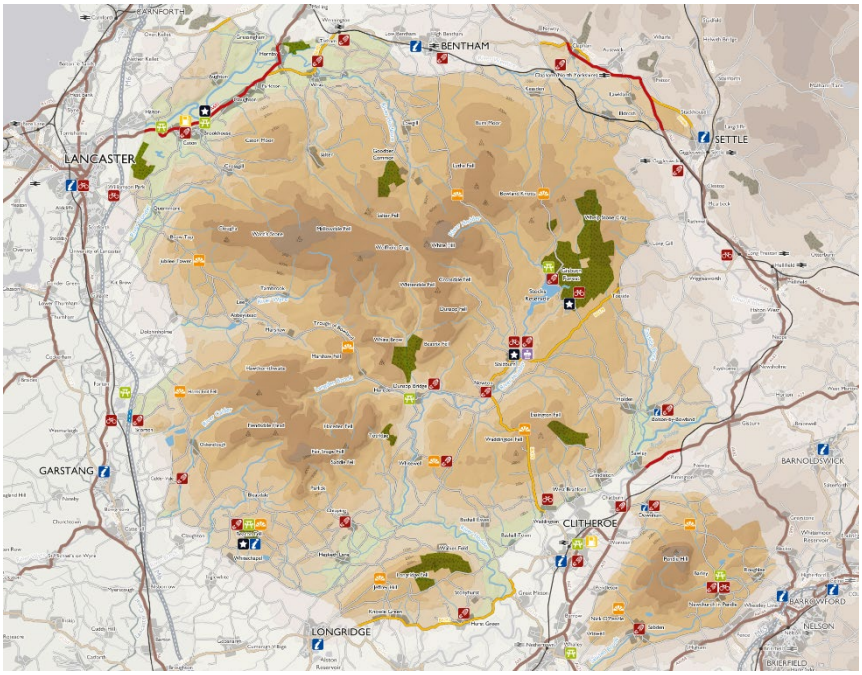
The landscape, and the habitats found here, are resilient to the impacts of climate breakdown and provide services and benefits that people value – carbon storage and sequestration, clean air and water, flood resilience and increased health and well-being. The restoration of our species-rich hay meadows has gathered pace, and they are the equal of anywhere in the English uplands in their beauty, diversity and extent. Our peatlands are fully restored wetland ecosystems. The names of the rivers Ribble, Lune and Wyre are synonymous with clear, naturally flowing wildlife-rich watercourses. Our breeding waders thrive and the decline in our songbirds has reversed; our raptors, including the hen harrier that is so emblematic of Bowland, breed successfully, free from the persecution of the past.

Profitable farming and land management are at the heart of nature recovery and vice versa, and they sustain natural processes and help them to flourish. The partnership-working between farmers, land managers, conservation bodies, communities and businesses is focused on delivering more for nature together.

The rich cultural heritage of the area is known for being well-understood and well-managed. Like our natural heritage, our cultural heritage is helping to support a resilient and sustainable local economy. More people, whatever their circumstances, can responsibly enjoy all that Bowland has to offer – local people are proud to live here, whilst communities from nearby towns like Preston and Colne think of it as their special place to visit close to home.

The Forest of Bowland is nationally regarded as a truly outstanding landscape, where it can clearly be demonstrated that the partnerships that have been developed to support nature, climate, people and place are bringing benefit for everyone.

[Management Plan 2026-2031 | Forest of Bowland National Landscape]



2. Update to Climate Adaptation Plan (2011)

The Forest of Bowland first published a Climate Adaptation Plan for the AONB (now National Landscape) in 2011. This can be seen in full here, under Climate Change publications: https://www.forestofbowland.com/plans-strategies-reports

Whilst the majority of this report and its findings still stand, there have been some changes which we want to include in this update/review.

These are as follows:

1. In the original report, UK Climate Change Projections (UKCCP) for 2009 were used, which projected hotter drier summers and warmer wetter winters. These projections were updated in 2018[2]. In addition, our knowledge and experience of both climate breakdown itself, and of the impact it is having on our flora and fauna, have increased.
2. Climate breakdown and its impacts on some of our natural assets in the National Landscape area have become more noticeable in the last ten years or so.
3. Adaptations to climate breakdown have become a key part of our conservation work. In fact, the original plan provided us with good evidence to prioritise work on peatland and hay meadow restoration. Since then, other actions such as natural flood management and landscape recovery have also become part of our adaptation toolkit.
4. Government Policy and Legislation on Net Zero, climate mitigation and adaptation has been introduced and updated [3]
5. Adaptation work has developed further and become more streamlined. For example, this report and risk assessment follows a template developed by the National Landscapes Association and the Protected Landscapes Risk Assessment used in ARP4[4], with input also taken from the Adaptation Manual published by Natural England.

It is important to note that the key recommendation of the previous adaptation plan was to build resilience of our natural assets so that they could better adapt to the changes in climate. This idea revolves around the idea of the 2010 'Lawton principles[5]' ie to manage nature in the landscape as a series of 'bigger, better and more joined up' sites. This approach has been overtaken by a more holistic landscape scale approach to nature recovery in the intervening years. Although it is still valid, it is now widely accepted that managing nature at a protected sites scale alone is not effective either for nature recovery or for building resilience to climate breakdown.

This updated adaptation plan therefore still identifies the need to build resilience in natural systems, but particularly at a landscape scale. However, it also considers the longer term

[2] https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/using-ukcp/guidance
[3] The Third National Adaptation Programme (NAP3) and the Fourth Strategy for Climate Adaptation Reporting
[4] https://static1.squarespace.com/static/6597fda162aceb478f7ad2f3/t/6825f21de454333966897f4a/1747317290478/Protected+Landscapes+ARP4_High-Level+Report+%28Final+Version%29.pdf March, 2025; and NE751, 2020 https://publications.naturalengland.org.uk/publication/5679197848862720
[5] https://www.gov.uk/government/news/making-space-for-nature-a-review-of-englands-wildlife-sites-published-today

fundamental changes that may need to take place in the landscape, and indeed in the rural economy, to adapt to a changed climate and a different set of operating systems for land management.

3. Methodology

As this Adaptation Plan is a review of that produced for the Forest of Bowland in 2011 by Atkins Consulting we will briefly re visit the methodology used there.

This model identified four factors contributing to vulnerability to climate breakdown:

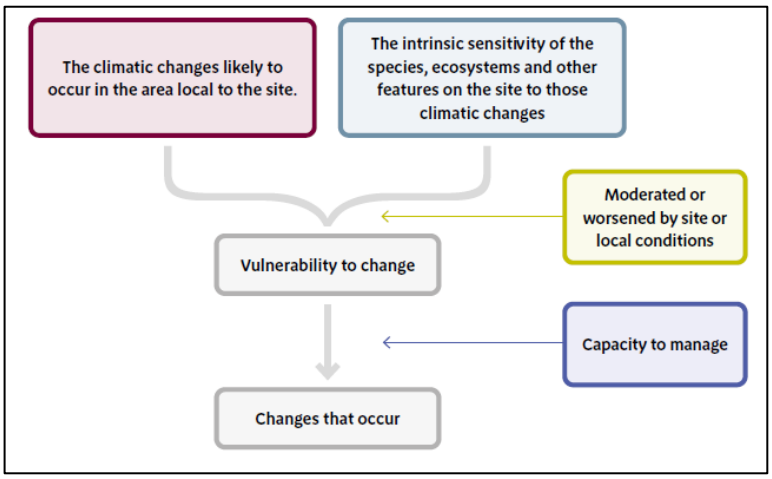
1. The **changes in climate**, both type and magnitude, that are likely to occur in the local area (in adaptation terminology, this is 'exposure' to climate change)

2. The **intrinsic sensitivity** of the species, ecosystem or other feature of the site to those climatic changes. (In adaptation terminology, this corresponds to 'sensitivity' as well as aspects of inherent natural 'adaptive capacity')

3. The **site-specific** or local area conditions that could make things better or worse (taking account of both direct and indirect impacts) In adaptation terminology, this aspect relates to 'adaptive capacity', as well as influencing the 'exposure' of environmental features of interest

4. The **capacity** to manage those conditions, or 'adaptive capacity'

This methodology therefore looked at changes in climate locally and the sensitivity of each occurring habitat or species to climate breakdown. These two factors contribute to the habitats' overall vulnerability to change, and their capacity to manage that change (resilience).



Ref: From NE751

The 2011 Adaptation Plan for the Forest of Bowland, and others completed at the same time contributed to the suite of risk assessments and a climate vulnerability mapping system which

Natural England then went on to produce as a series of habitat and species-specific guides making up a Climate Change Adaptation Manual (2020)[6]

This was then utilised in the Risk Assessment template produced as part of the Protected Landscapes Climate Change Adaptation Report (2025)[7] This methodology seeks to:

1. Identify the assets and features of the protected landscape
2. Assess the impacts of climate breakdown, based on the UKCP18 projections
3. Assess the vulnerability of the assets to the impacts
4. Consider the sectoral risks for principal land uses
5. Score the risks and opportunities based on likelihood, impact and overall risk at the short, medium and longer term
6. Identify adaptation options and the acceptability of these options, any interdependencies or barriers to their delivery
7. Identify planned delivery actions at the short, medium and longer term

The assets considered are as follows:

Landscape, landscape character and related qualities

- ✓ Landscape character & features
- ✓ Land use change
- ✓ Geology, landform and soils

Water, soils and resource protection

- ✓ Surface & groundwater
- ✓ Water quality & availability

Natural Environment

- ✓ Habitats
- ✓ Species abundancy & diversity

Historic Environment

- ✓ Historic buildings & settlements
- ✓ Cultural heritage
- ✓ Archaeology
- ✓ Scheduled monuments & features

Built Environment

- ✓ Planning
- ✓ Towns & settlements
- ✓ Water infrastructure
- ✓ Energy infrastructure

Agriculture, Land Management and Forestry

[6] NE 751 Climate Adaptation Manual – evidence – see note 4 above
[7] High Level Report for Adaptation Reporting Round 4 (ARP4) by the Protected Landscape Family – see 4

- ✓ Farming, food production & security
- ✓ Land management
- ✓ Forestry

Local Communities

- ✓ Community resilience
- ✓ Public health & wellbeing
- ✓ Local economy

Recreation and Access

- ✓ Tourism & the visitor economy
- ✓ Recreational infrastructure
- ✓ Public access & rights of way

The 2025 Risk Assessment template is used in this plan. Here is an example extract:

Area of Impact	Headline Projection	Impacts	Risks/ Opportunities
RIVERS AND LARGER WATER-BODIES	Hotter drier summers	River levels may fall and also be at threat of increased abstratction	Low flows & high water temperature affects spawning sites
			Low flows causes increased sensitivity to pollution
	Increase in storm events	Increased risk of flooding	Risk to adjacent land, especially if flood plain capacity is already reduced due to agricultural change or development. Increased sedimentation and erosion/change of river channel morphology
	Warmer wetter winters	Streams experience flashy & higher peak flow	Changes in sedimentation and channel morphology
			Increase in agricultural and road run-off entering the watercourse

The Risk is then assessed for each risk or opportunity identified, and action/s proposed, for example:

Short term			2050 medium term			2080 long term			Actions
Like-lihood	Impact	RISK	Like-lihood	Impact	RISK	Like-lihood	Impact	RISK	
1 to 5	-5 to 5	-25 to 25	1 to 5	-5 to 5	-25 to 25	1 to 5	-5 to 5	-25 to 25	
3	-2	-6	3	-4	-12	4	-5	-20	xxxx
3	+3	+9	3	+4	+12	4	+4	+16	xxxx

The full risk assessment spreadsheet is available via our website www.Forestofbowland.com

4. Future Climate for the Forest of Bowland NL

These are the four summary statements from the Met Office[8] that will characterise the UKs climate in the future:

1. Warmer and wetter winters
2. Hotter and drier summers
3. More intense rainfall events
4. Higher frequency of heat waves (3 or more days and nights over a temperature threshold).

In Lancashire the expected changes are shown in more detail in the table below.

GWL indicates the **Global Warming Level** above the pre-industrial baseline 1850-1900. Limiting this rise to 1.5°c was the aim of the Paris Agreement and it is suggested that we have already reached this level in 2024. Forecasts for GWL 2 and 4 are therefore increasingly likely to happen, and nationally Government (Climate Change Committee NAP3 report) is now advising we plan for a **2°c change by 2050 and 4°c by 2100**

Changes shown here are relative to the 1981-2000 baseline, Median change is shown **in bold**, with an uncertainty range showing the 10th and 90th percentiles

Lancashire data from the Met Office	**0.6°c GWL Baseline 1981-2000**	**1.0°c GWL Recent Past 2001-2020**	**1.5°c GWL Paris Agreement**	**2°c GWL Guidance: Prepare**	**4°c GWL Guidance: Assess risks**
TEMPERATURE	°c	°c	°c CHANGE	°c CHANGE	°c CHANGE
Summer maximum	**27.1°c** Range 26.6 to 27.5	**28.9°c** Range 27.7 to 29.7	**+2.6 (ie 29.7)** Range +0.4 to +3.3	**+2.9 (ie 30)** Range +1.6 to +4.8	**+6.0 (ie 33.1)** Range +4.4 to +8.4
Summer average	**14.5** Range 14.5 to 14.5	**15.5** Range 15.1 to 15.9	**+1.2 (ie 15.7)** Range +0.9 to +1.8	**+1.8** Range +1.2 to +2.2	**+3.7** Range +3.1 to +4.5
Winter average	**3.9** Range 3.9 to 3.9	**4.6** Range 4.3 to 5.1	**+1.0 (ie 4.9)** Range +0.6 to +1.4	**+1.3** Range +0.6 to +1.8	**+2.7** Range +1.7 to +3.3
Winter minimum	**-6.8** Range -7.2 to -6.6	**-5.3** Range -6.6 to -3.9	**+2.4 (ie – 4.8)** Range +0.2 to +3.2	**+2.8** Range +1.8 to +4.0	**+4.5** Range +3.6 to +6.5
Annual average	**9.0** Range 9.0 to 9.0	**9.7** Range 9.6 to 9.9	**+1.0 (ie 10)** Range +0.9 to +1.2	**+1.5** Range +1.1 to +1.7	**+3.1** Range +2.7 to +3.6

[8] https://www.metoffice.gov.uk/research/approach/collaboration/ukcp https://climatedataportal.metoffice.gov.uk/pages/lacs https://www.reports.esriuk.com/view-report/b8eb3cee8f764147a2cfcd69cf36238f/E10000017

PRECIPITATION	mm/day	mm/day	% change	% change	% change
Summer precipitation rate	**2.78** Range 2.77 to 2.79	**2.73** Range 2.38 to 2.85	**-4** Range -20 to +7	**-6** (ie 2.6 mm/day) Range -18 to 0	**-28** (ie 2mm) Range -39 to -17
Winter precipitation rate	**3.76** Range 3.74 to 3.78	**3.99** Range 3.66 to 4.45	**+10** Range -1 to +14	**+9** (ie 4.1 mm/day) Range -3 to +16	**+21** (ie 4.5 mm/day) Range +17 to +23

Lancashire data from the Met Office	**0.6°c GWL Baseline 1981-2000**	**1.0°c GWL Recent Past 2001-2020**	**1.5°c GWL Paris Agreement**	**2°c GWL Guidance: Prepare**	**4°c GWL Guidance: Assess risks**
Summer Days with daily max temp > 25°c	**5 days** Range 4 to 5	**9 days** Range 8 to 12	**10 days** Range 9 to 14	**13 days** Range 10 to 16	**26 days** Range 24 to 36
Hot Summer Days Daily maximum temperature > 30°c	**0 days** Range 0 to 0	**1 day** Range 1 to 2	**1 day** Range 0 to 2	**1 day** Range 1 to 2	**5 days** Range 4 to 10
Extreme Summer Days Daily maximum temperature > 35°c	**0** Range 0 to 0	**0** Range 0 to 0	**0** Range 0 to 0	**0** Range 0 to 0	**1 day** Range 0 to 2
Tropical Nights Nightly minimum temperature > 20°c	**0** Range 0 to 0	**0** Range 0 to 0	**0** Range 0 to 0	**0** Range 0 to 0	**1 day** Range 1 to 2
Frost Days Daily minimum temperature < 0°c	**47 days** Range 46 to 47	**36 days** Range 27 to 42	**32 days** Range 26 to 38	**26 days** Range 21 to 38	**10 days** Range 4 to 19
Icing Days Daily maximum temperature < 0°c	**2 days** Range 2 to 2	**1 day** Range 0 to 2	**1 day** Range 0 to 1	**0** Range 0 to 1	**0** Range 0 to 0
Growing Days Daily mean temperature: °c > 5.5°c	**66 days** Range 1,582 to 1,586	**75 days** Range 1,743 to 1,878	**78 days** Range 1,810 to 1,923	**84 days** Range 1,898 to 2,058	**103 days** Range 2,387 to 2,627

This data shows that compared to UK average projections, in Lancashire we should expect a slightly higher than average increase in summer temperatures, slightly less dry summers and slightly less wet winters than the UK average changes.

We would also expect a far longer growing season and fewer days with frost. This will affect the crops grown here, with a possible decrease in grass fodder able to grow in summer droughts, but maybe more in Spring and Autumn. It may also bring an increase in pests and diseases affecting vegetation, particularly trees and wetland plants including sphagnum mosses.

These differences have been factored into the Risk Assessment, which was originally calculated based on UK averages.

5. Impacts of a changing climate on the Forest of Bowland National Landscape

Specifically in the Forest of Bowland we consider the main **direct** impacts of climate breakdown to include:

- Scouring of riverbeds and banks, loss of soil from fields, loss of peat and vegetation cover on the moors, and footpath erosion due to increased heavy rains and flooding
- Increased number of pests and diseases: the area has already been particularly affected by Ash dieback and outbreaks of heather beetle
- Woodland damage and loss of field trees, often older or veteran specimens which are of landscape importance due to increased occurrence of storms and drought
- Drying out of soils and wetlands, early flowering of species, disruption of seed sources and potential mismatch of food sources with birds and pollinators due to prolonged dry, early, and warm Springs
- Increased risk of wildfire

Using the Risk Assessment matrix we are able to consider what specific impacts the key components of climate change will bring about.

Hotter drier summers

These will bring an increased incidence of drought periods, directly affecting species abundancy, and a shift in the species composition and range, and an increase in soil erosion, particularly peat, erosion. Drying of peatland will lead to a lower survival rate of sphagnum mosses and therefore less water retention and slower accretion of new peat. Moorland soils and grasses will dry out and be at more risk of erosion and also to fire. Increased incidence of heather beetle outbreaks due to warm early springs may affect vegetation cover on the moors, again leading to erosion of soils and peat and an increased risk of fire.

The change in species composition of grasslands may bring about a decline in overall diversity if particular insect, bird and small mammal species are dependent on those species disappearing, with a knock-on effect on the entire food chain.

Woodlands, trees and hedgerows are commonly affected by drought stress, newly planted saplings and old and veteran trees are at particular risk. Species such as beech, at the northerly edge of their range, may also struggle under stress such as drought and summer storms. Hot dry weather can also enable a spread of pests and diseases. Ground flora may see a shift in species composition, again affecting the wider foodchain.

Rivers and streams will experience lower flows affecting water temperatures and chemical composition; increased impact of pollution on, for example, algal blooms, and insect and fish life (particularly in the upper reaches of catchments). Spawning grounds will be affected by low flows, poor water quality and temperature changes.

Overall the species composition of many habitats will be affected by hotter drier summers, with some species not surviving and others moving in as their range moves north or south. Impacts on species phenology will also occur – a crucial mis-match of timing of breeding seasons with availability of food source or nesting cover.

Farming will face multiple issues with hotter drier summers and increased incidence of drought conditions. These might include difficulties providing water to stock, a reduction in grass growth (impacting on availability of winter fodder), animal dehydration and stress, and increased incidence of new and existing pests and diseases.

For rural communities we project hotter drier summers may drive and increase in tourism and visitor footfall, causing traffic congestion and possible impact on sensitive habitats and species, for example ground nesting birds. Wildfires may begin to occur and footpaths and bridleways experiencing greater use may become eroded and infrastructure worn. Extreme droughts may lead to public water rationing and the drying up of private water supplies such as springs and boreholes. Heritage features may also be impacted by soil shrinkage, wildfire and humidity.

Warmer wetter winters with more intense storm events

Since the early 2010s moorlands in the Bowland Fells, with their peat soils, have been undergoing restoration works to reinstate their capacity to hold water and to store carbon. Traditional drainage ditches have been filled and in many places vegetation restored on what was bare peat. Increased rainfall will continue to impact on those areas not yet restored, and may damage some of the restoration infrastructure already in place in heavy sustained rain. The stability of peat soils is quickly undermined (especially after prolonged dry periods) and can lead to washouts and erosion, affecting habitats and the species dependent on them. Warmer winters may also increase mould attacks on moss species and lead to increased pest infestations in heather cover.

A reduction in frost events and increased waterlogging will affect the germination of some grassland and woodland species leading to a change in composition and a knock-on effect on food chains made up of invertebrates, birds and small mammals. Damp winters may also cause fungal bacteria and disease to affect trees and hedgerows.

With the majority of our rivers and watercourses being in the upper catchments they already experience ‘flashy flow’ and this will increase with more extreme and more regular storm events. Heavy flow can cause erosion, movement of rocks and boulders, changes in channel morphology, and increased sedimentation affecting invertebrates and fish spawning sites. Floods in recent years have also contributed to the spread of invasive species such as Himalayan Balsam across the landscape. Increased overland flow can bring increased soil and agricultural run off into the watercourses.

The frequent severe storms now being experienced are likely to continue, and this can have a devastating effect on woodlands, hedgerow trees and parkland features. Shallow rooted trees, particularly if they are still in leaf in autumn or early spring, are susceptible to these heavy winds and can also cause damage to buildings and infrastructure they fall. Impacts on rural settlements include a loss of power (often for several days in remote areas) and water supplies, which can lead to health problems, especially for elderly and vulnerable people. Flooding too can affect the human population, resulting in isolation, inconvenience and increased costs, and there is an increasing likelihood of landslides

The longer growing season and reduction in frosts can bring benefits to farmers and to nature but can also cause overgrown footpaths for leisure users.

The **indirect** impacts of these climactic changes in Bowland principally concern farming and land management.

Farming has already started to adapt to shifts in climate: since the 1980's silage has replaced hay making in most areas due to the high risk of wet summers hampering harvest. Droughts have led to reduced grazing, and a need for more supplementary feeding later in the year. However, the longer growing season can lead to increased grass cropping early and later in the year. These changes impact the ability of pollinators, birds and mammals to live and breed in these fields, causing their numbers to drop and food chains to be impacted. Wetter winters causing waterlogged ground may lead to increased indoor housing for cattle and sheep – requiring extra fodder, removal of slurry and increased costs all round for the farmer. Regenerative methods are encouraging more farmers to overwinter stock outdoors, often switching to hardier breeds and lower stocking rates, but this is not for everyone and even where it is, indoor housing may be required in the worst winter periods.

Overall impacts and stress on farming may lead to abandonment in the future, and this can have both positive and negative impacts. Habitats requiring grazing and cutting, such as species rich grasslands, will become overgrown if management cannot be sustained.

Similarly, many grouse shoots on the moorlands have been badly affected by heather beetle destroying vegetation cover and food for game birds, and by wet Springs affecting successful breeding of young birds. If this continues the viability of shooting and game management may be reduced and alternative uses for the moors will have to be explored by landowners.

Other indirect impacts will include an increased chance of wildfires, a possible intensification of grassland (increase in improved grassland with lower species diversity and a fragmentation of habitats), a reduction in water quality due to increased concentration of pollution and algal blooms and increased run off from farmland soils into watercourses.

Longer term impacts

As more extreme climate breakdown continues into future decades it may cause the following impacts:

1. Increase in wildfires
2. Increased stress on habitats and soils, especially due to the rapid change from drought conditions to intense rainfall
3. Major shifts in farming and land management due to loss of viability of current land use
4. Loss of ability of, and our increasing reliability on, natural systems (woodland and peatland in particular) to function as carbon storage and sequestration systems – leading to increased carbon in the atmosphere and therefore increased climate breakdown and greater impacts
5. Increased stress on vulnerable species and fragmented habitat

Opportunities

Climate breakdown and our efforts to reduce the effects of it can also present opportunities for the natural beauty of the Forest of Bowland. More tree planting to create shade, carbon stores and biodiversity will also help to provide good habitat for birds and small mammals; hedgerow

planting for similar reasons will help to strengthen the landscape structure and also connect habitats and enable the movement of species; changes in farming to include elements of regenerative practice and agro forestry will improve soil health and opportunities for biodiversity.

However, tree planting, peat restoration, and soil carbon initiatives are themselves dependent on stable climatic and ecological conditions: drought and water stress will limit the survival of young trees and germination of some plants, it will also increase the risk of destruction by wild fire. Without careful design, monitoring and adaptive management measures, these initiatives may fail due to climate impacts. Adaptation needs to be resilient.

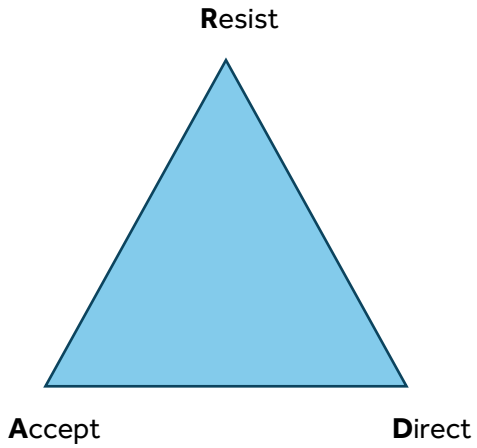
For a more detailed assessment, visit our website.

6. Action Plan

The direct and indirect effects of climate breakdown will have a cumulative impact on our Protected Landscape. These effects are expected to increase over time. We need to effectively plan for and adapt to these effects, and to meet the challenges and opportunities they present.

Future Action Planning

This action plan will be monitored and updated every 5 years with the Management Plan cycle so that adjustments can be made as we see the climate breakdown unfold and understand better the factors under our control. For many landscape assets, the focus of our action will change over time. For example, we may be able to resist change to moorland management, habitats and soils over the next 20-30 years. However, after this we may need to consider 'allowing' change to habitats and communities in the face of irreversible climate shifts. Our approach is to be flexible and to respond to stakeholder needs and opportunities. We therefore need to consider utilising the RAD approach[9]:



Resist: maintain ecosystem in current or historical state

Accept: let changes proceed with minimum intervention, eg new species appear

Direct: steer habitat towards desired future state

In future years we will convene a range of stakeholder meetings to discuss the ongoing and future climate breakdown we experience and the impact it is having on the National Landscape. These sessions will look to draw up more detailed, often site-based, action or delivery plans which set out the precise actions required to deal with climate impacts, and align these to business plans, staff workplans and funding proposals. Hopefully these can explore both adaptive management and new opportunities for the Forest of Bowland National Landscape.

With these discussions in mind, we will then be able to decide the RAD option for each key asset in the table below and in the more detailed Action Plan in the next section.

[9] Adaptive management is likely to be necessary on sites/habitats where resilience is impossible in their current state https://researchbriefings.files.parliament.uk/documents/POST-PN-0679/POST-PN-0679.pdf

Key actions to take to tackle climate breakdown

This Action Plan is taken from the Risk Assessment and refers to the key natural assets we identified as being at risk. Most of these actions are also listed in our Management Plan for 2026-31 and the reference is shown in column 2. More detail is in the full plan shown below.

Proposed Action	Management Plan code	Resist. Accept. Direct?
Support a more targeted and practical fire severity index, and maintain up-to-date fire plans for moorland areas	2D	
Improve the hydrological function and condition of peatland through re-wetting and re-vegetating	2A	
Restore peatlands to support a diverse mosaic of vegetation; manage this with appropriate grazing regimes and stock management	2B	
Carry out surveys and long term monitoring of Bowland Fells SSSI, using a county-wide standard, to build a strong evidence base that monitors the condition of sites and the effectiveness of restoration and management	2E	
Ensure existing and potential species-rich meadows, pastures and scarce grasslands are in good condition and well connected	4A	
Expand and connect areas of priority grassland through bespoke grassland restoration and enhancement, using locally sourced seed and plant material and appropriate management practices.	4B	
Survey and monitor SAC and SSSI upland meadows and ensure their favourable condition is a priority in management agreements	4I	
Encourage appropriate management of purple moor grass and rush pasture	4G	
Manage woodlands in line with UK Forestry Standard and bring existing woodlands and hedgerows into good condition	3A	
Plant trees, woodlands (including riparian woodlands) and hedgerows to act as wildlife networks and natural solutions to climate change. Plant species that may be more resilient to climatic change, pests and diseases	3C	

Survey and retain existing significant / veteran trees in the landscape and plant new ones to act as habitat, stepping stones and future landscape features, in line with UKFS	3D	
Facilitate the natural growth and expansion of woodland and scrub habitat to especially to promote habitat connectivity	3E	
Support research into future woodland resilience to climate change, pests and diseases	3I	
Maintain, create and expand wetland habitats promoting good hydrological function and diverse abundant species	5A	
Use regulatory powers, advice and enforcement to ensure watercourses and wetlands are in good ecological condition and free from pollution, barriers and artificial modification	5B	
Strengthen the resilience of river systems to climate change and extreme weather events, encouraging the development of nature-based solutions in rivers and wetlands as climate adaptation methods	5C	
Restore natural processes to watercourses to improve in-channel habitats, reconnect rivers to their floodplains, increase biodiversity and enhance the landscape	5E	
Deliver habitat and species conservation measures at a landscape scale. Increase habitat connectivity and undertake adaptive management to increase species diversity and abundancy	6H	

Area of Impact	Headline Projection	Projected Impact Direct (D), Indirect (ID)	Risks and Opportunities	Proposed Action	Additional Actions
Built Environment – Development Management, Planning and Infrastructure					
Historic buildings	Hotter, drier summers	Key historic assets may be vulnerable to drought and dry weather	Increased risk of fire damage	Identify historic buildings most at risk, make a comprehensive record and develop a scheme of investigation if necessary/feasible. Work with sector bodies to develop local risk assessments to identify key vulnerabilities, the historic building most at risk. Develop and prioritise action plans for highly vulnerable buildings, structure and features. Follow the latest guidance from Heritage England and statutory bodies to ensure adaptation and alterations follow best practice in terms of building conservation.	
		soil shrinkage and drying out of substrates in areas prone to subsidence	Damage to buildings due to soil shrinkage and subsidence		
	Warmer, wetter winters	Key historic assets may be vulnerable to damage	Historic building may become more susceptible to decay and damage from damp, water ingress and higher humidity.		
			increased risk of infestation by wood boring beetles and other pest species that can damage or destroy historic buildings and their contents		
	Increased seasonal rainfall	Historic assets may be damaged	Damage and deterioration of heritage assets caused by flooding or waterlogging.		
	Increase in severity and occurence of seasonal storms		significant damage to historic buildings e.g. damage to ruins and masonry		
Cultural Heritage	warmer, wetter winters	Increased humidity and likelihood of pests	historic documents, artefacts and museum pieces may be susceptible to damage		
Archaeology	Warmer, wetter Winters and hotter, drier Summers	drought and flooding (d) leading to increased in extremes (high and low)of soil moisture content	Changes in preservation conditions caused by higher humidity and soil moisture and PH leading to degradation of quality of remains	Work with sector partners to improve data and evidence on the hydrological impacts of climate change. Identify archaeological assets that are vulnerable or at risk - record and protect if appropriate.	

Scheduled monuments and features	More severe seasonal storms	Loss or damage to archaeological assets caused by extreme weather events.t	Damage and degradation of scheduled monuments caused by flooding, waterlogging or increase soil erosion caused by run off as a result of severe weather events.	Identify structures at risk, make a comprehensive record and develop a scheme of investigation if necessary/feasible. Work with sector bodies to develop local risk assessments to identify key vulnerabilities, prioritised action plan for highly vulnerable sites.
Planning pressures - new development	Wetter Winters	damage to housing and infrastructure (D)	poorly designed new devlopments are susceptible to flooding damage using construction materials that contribute negatively towards climate change. Hard surfaces which encourage run off, flooding and pollution elsewhere	Encouragement for sustainable building techniques and materials.
		floodplain disruption (ID)	Where existing land was mitigating flooding pressure and is developed, this can then cause flooding elsewhere	Highlight the benefit of the natural floodplain and how these can be enhanced to deliver benefit for nature.
				SUDS, net zero, BNG, shade and landscape around new development sympathetic to climate of the future
				Need for considerations across catchment and design that accomdates floodplain improvements
				Prepare for and accommodate landscape change.
		Energy related development e.g. solar, wind, cables, pylons, etc.. Driven by low carbon electricity generation nearby	opportunity: cleaner, greener energy. Potential for positive impact on landscape and ecosystem function though these assets may still change or alter the extant landscape character.	Support opportunities for community-based renewable energy production where they deliver additional social and economic benefits locally.
	Hotter Summers	Increase in development pressure for building adaptation and alterations e.g. solar panels		Develop green infrastructure plans and nature-based solutions to help build resilience to climate change at a landscape scale.
			opportunity: if designed well these could be alongside land management that supports pollinators/grazing,etc...	Guidance on good design required
			risk: Poor design could lead to loss of green/bio-diverse spaces, e.g. species rich meadows	Develop design codes that result in more sustainable building and schemes, with the best design, layout and materials to make them resilient to climate change.
			Opportunity for new design codes or sustainable build policies to improve resilience and provide cleaner, greener energy	
Planning or development responses to climate change impacts		Major infrastructure developments e.g. rail, water, power transmission, road	Impacts on landscape character and on iconic or distinctive views within and from the Protected Landscape.	Ensure the planning process takes account of the new requirement to 'Seek to Further'.
			Introduction of technology and new infrastructure will impact on the character and historic feel of the landscape	Ensure all relevant bodies are aware of their duties under Sc245 of the LURA Act (2023).
				Ensure that the Protected Landscapes are effectively considered and represented in national and regional planning discussions i.e. Regional and Local Area Energy Plans (RAEP/LAEP's)

Towns and settlements	Hotter Summers	health stress on residents (D)	Heat stress and exhaustion becoming more common (elderly particularly at risk)	Promote the role for Green Infrastructure (GI) and Sustainable Urban Drainage Schemes (SUDS) to enhance the resilience of urban areas.	
		Air quality impacts (ID)	Increased exposure to poor air quality for residents and vulnerable groups causing impacts on public health (respiratory illness and risk of premature death).	Increase permeability of urban surfaces and use of rain gardens to improve storage and infiltration.	
				Encourage an increase in urban trees to provide ecosystem service benefits within towns and villages.	
				Promote the value of trees, parks and other Green Infrastructure.	
Natural Environment – Species diversity, habitats, water, soils and resource protection.					
Moorland and peatland, including blanket bog	Hotter drier summers	moorland soils become dry, grasses also dry out.	increased risk of large scale and uncontrolled wild fires which may burn down into the peat	Support a more targeted and practical fire severity index, and maintain up-to-date fire plans for moorland areas	Increase rate and scale of re-wetting
		peatland soils dry out. Sphagnum mosses bleach/die and sphagnum plug plants do not establish/ survive	peat shrinks and becomes easily eroded, faster loss of peat and carbon emissions to atmosphere and watercourses. Peat therefore less able to absorb heavy rains and fulfill natural flood management role. Flood risk increases downstream in catchment	Improve the hydrological function and condition of peatland through re-wetting and re-vegetating	provide training and support for land managers to increase take up of adaptive management practices. Future proof peatland restoration specifications, eg dam materials and design
	Warmer wetter winters, with more intense weather events including storms	changes in condition and structure of habitat	loss of distinctive or rare species associated with habitats in good condition (eg sphagnum is sensitive to mould attack in warmer winters)	Restore peatlands to support a diverse mosaic of vegetation; manage this with appropriate grazing regimes and stock management . Carry out surveys and long term monitoring of Bowland Fells SSSI to build a strong evidence base that monitors the condition of sites and the effectiveness of restoration and management	target funding at mesures that increase resilience
		blanket bog experiences more intense rainfall, often following periods of drought, more pronounced variations	impact on the stability of peat soils on slopes and in gullies. Risk of bog burst, wash outs and resulting damage to habitats	Improve the hydrological function and condition of peatland. Reduce net emissions from peatland with more areas becoming functional carbon sinks	Work with sector partners to deliver large scale moorland restoration, stabilisation and re vegetation. Increase remote sensing to identify areas at risk eg of bog burst
Upland Heath	Hotter drier summers, warmer wetter winters	increased severity and frequency of heather beetle outbreaks due to early warm Springs	Increase in standing deadwood heather cover leading to increased risk of fire, change in species composition and possible spread of bracken	improved heather management and grazing, optimise stock levels and develop wild fire plans. Review bracken removal strategies	Support a more targeted and practical fire severity index, and maintain up-to-date fire plans for moorland areas
		change in species towards a lowland heath mix (inc in bell heather, reduced calluna)	overgrazed and burned areas are at higher risk and have less adaptive capacity	encourage appropriate moor management and grazing regimes	
		Greater incidences of drought	Species-rich grassland may see changes in species composition and and decline in overall species diversity	Ensure existing and potential species-rich meadows and pastures are in good condition and well connected. Encourage appropriate management of purple moor grass and rush pasture	Target project funding and environmental grant funding towards measures that increase resilience to a changing climate

Unimproved, species-rich and semi-natural grassland	Hotter drier summers	Greater incidences of drought impacting on grassland, especially where soils are thin and/or grazing is heavy	Reductions in insect populations as a result of the above and knock on impact on others species within food chains		resilience to a changing climate. Work with partners and specialists to collect and use of appropriate seed stock in habitat restoration or creation of new habitat.
		INDIRECT Dry weather may encourage more grassland improvement/intensification and increasing number of cuts per year	Fragmentation of some habitat types will limit their adaptive capacity, small isolated sites are less resilient and more vulnerable	Ensure existing and potential species-rich meadows, pastures and scarce grasslands are in good condition and well connected. Expand and connect areas of priority grassland through bespoke grassland restoration and enhancement, using locally sourced seed and plant material. and appropriate management practices. Survey and monitor SAC and SSSI upland meadows and ensure their favourable condition is a priority in management agreements	Increase habitat connectivity and the permeability of the landscape to wildlife. Undertake adaptive management and ensure that areas of valuable habitat are bigger, better managed and joined up. Increase the quality and habitat diversity of wildlife sites.
	Warmer wetter winters, with more intense weather events including storms	Reduction in frost events and/or waterlogging can affect the reproduction and germination of some species. Summer storms can delay cutting of hay meadows and ultimately reduce species composition	Species-rich grassland may see changes in species composition and and decline in overall species diversity	Ensure existing and potential species-rich meadows and pastures are in good condition and well connected. Encourage appropriate management of purple moor grass and rush pasture	
Lowland raised bog (Valley mires)	Hotter drier summers and warmer wetter winters with more extreme weather events	High summer temperatures could lead to lowering of water table and peat may oxidise. Wetter winters and summer storms may lead to bog burst	Poorly managed sites are more susceptible to climate events, leading to loss of habitat, and key associated species	adopt management practices to increase and stabilise ground water levels. Ensure buffer area around site to prevent drying out. Restore bog mosses. Restore any areas of bare or eroded peat. Manage scrub	
Hedgerows	Hotter drier summers and warmer wetter winters with more extreme weather events	Impacts upon species diversity in hedgerows due to changes in climatic conditions and vulnerability of some species to temperature change or waterlogging/ flooding	Decline in species diversity and loss of resources to wildlife. Loss of species due to drought stress. Some increased incidence of pests and diseases. Loss of connectivity of habitat in the landscape	Manage woodlands in line with UK Forestry Standard and bring existing woodlands and hedgerows into good condition	Promote the benefits of hedgerows and encourage best practice in terms of their management. Improve habitat connectivity, help retain soils, manage surface run-off and increase the permeability of the landscape to wildlife.
			Opportunity to increase hedgerow creation to connect habitats, provide shade and shelter for livestock and reduce flooding if planted across slopes experiencing overland flow during high rainfall events. Also potential for carbon capture, clean air etc	Plant trees, woodlands (including riparian woodlands) and hedgerows to act as wildlife networks and natural solutions to climate change. Plant species that may be more resilient to climatic change, pests and diseases	Develop projects and policies that encourage the retention of hedgerows and that encourages new planting.

Woodlands	Hotter drier summers, increased strong wind events/gales	Impacts on woodland habitat due to greater incidence of drought and water deficit . Upland and wet woodlands are most vulnerable and sensitive to climate stress and impact on species and associated wildlife.	Loss of veteran or landscape trees that are more susceptible to increased temperatures, water stress or are less drought tolerant e.g. Beech	Survey and retain existing significant / veteran trees in the landscape and plant new ones to act as habitat, stepping stones and future landscape features, in line with UKFS	Plan ahead in terms of planting schemes, select species that may be more resilient to prevailing climatic conditions in the medium/long term. Promote the benefits of wood pasture, landscape, in-field and boundary trees. New planting schemes should include rides to mitigate fire risk but also to crerate marginal habitat
			Broadleaved and native woodland will see changes in species type and composition.	Manage woodlands and bring existing woodlands and hedgerows into good condition. Plant trees, woodlands and hedgerows to act as wildlife networks and natural solutions to climate change. Plant species that may be more resilient to climatic change, pests and diseases. Facilitate the natural growth and expansion of woodland and scrub habitat to promote habitat connectivity. Support reserach into future woodland resilience to climate change, pests and diseases	
			Changes in species and composition of woodland ground flora due to a shift in climatic conditions.		
			Extended periods of dry weather, and increase in dry vegetation in the understorey, may increase the risk of forest fires.		
			Oportunity for some tree species to expand their range		
	Warmer wetter winters	Less frost and warmer damp conditions would increase the prevalence of pests, diseases (ID)	Damage and loss of landscape trees to disease and fungal bacteria such as phytophthora e.g. Ash, Horse Chestnut and Beech.	Survey and retain existing significant / veteran trees in the landscape and plant new ones to act as habitat, stepping stones and future landscape features, in line with UKFS	
		Extended growing season and fewer frosts	Opportunity to increase woodland cover benefits biodiversity, carbon sequestration and other ecosystem service benefits. Also potential for increased wood pasture and agro forestry	Plant trees, woodlands (including riparian woodlands) and hedgerows to act as wildlife networks and natural solutions to climate change. Plant species that may be more resilient to climatic change, pests and diseases	
	Increase in severity and incidence of seasonal storm events	Damage to woodlands and trees due to strong winds and increased strength of storms, especially when trees are in full leaf	Loss of older trees that are important in the landscape and to cultural history, damage including windthrow to woodlands and hedgerows	Bring existing woodland into good management and wherever possible enable natural regeneration and expansion. Retain significant trees in the landscape and plant new ones to act as habitat, stepping stones and future landscape features	
	Hotter drier summers	habitats may dry up or flow is substantially reduced due to reduced rainfall and drought	Changes in the chemical and biological status of some water bodies due to reduced flows.	Strengthen the resilience of river systems to climate change and extreme weather events, encouraging the development of nature based solutions in rivers and wetlands as climate adaptation methods	Work with farm cluster groups, catchment partnerships and sector groups to improve the ecological/chemical status of rivers and watercourses.
			Greater incidences of algal blooms and concentration of pollutants in rivers and stream due to reduced flows.	Use regulatory powers , advice and enforcement to ensure watercourses and wetlands are in good ecological condition and free from pollution, barriers and artificial modification	Create buffer strips around source protection zones and water courses to reduce excessive nutrient and sediment input into water bodies.
			Potential drying up springs and streams in their upper courses with impacts upon their associated wetlands.	Strengthen the resilience of river systems to climate change and extreme weather events, encouraging the development of nature based solutions in rivers and wetlands as climate adaptation methods	

Headwaters, streams & ponds			Impact on spawning ground and fisheries due to drought conditions, temperature changes, decreased flow rates or poor water quality.	Strengthen the resilience of river systems to climate change and extreme weather events, encouraging the development of nature based solutions in rivers and wetlands as climate adaptation methods	Promote catchment level approaches and examine potential for natural flood storage and habitat creation which reduces pollution run-off during extreme weather events.
	Warmer wetter winters, with more intense rain events	Streams experience flashy higher peak flows	changes in sedimentation and channel morphology	Strengthen the resilience of river systems to climate change and extreme weather events, encouraging the development of nature based solutions in rivers and wetlands as climate adaptation methods	Promote uptake of high precision and/ or low-input farming techniques so that the application of nitrate fertilisers does not result in excess nutrients passing into the aquifers at key times of recharge (Autumn/Winter)
			increased agricultural run off entering the watercourses	Use regulatory powers , advice and enforcement to ensure watercourses and wetlands are in good ecological condition and free from pollution, barriers and artificial modification	
Rivers and larger waterbodies	Hotter drier summers	River levels may fall, possibility of increased abstraction in drought events	Low flows can adversely affect the biodiversity and biological condition of rivers and their associated wetlands	Strengthen the resilience of wetalnd and river systems to climate change and extrme weather events, encouraging the development of wetland and river based natural solutions as climate adaptation methods	
			Low flow can increase the sensitivity to pollution in the watercourse	Use regulatory powers , advice and enforcement to ensure watercourses and wetlands are in good ecological condition and free from pollution, barriers and artificial modification	
			spawning sites and fisheries are badly affected by low flows and increased river water temperature	Strengthen the resilience of river systems to climate change and extreme weather events, encouraging the development of nature based solutions in rivers and wetlands as climate adaptation methods	
	Increase in incidence and severity of seasonal storm events	Increased risk of flooding	Flood risk to adjacent and downstream land is increased as the natural capacity of flood plains is reduced due to agricultural change and development on the floodplains	Maintain, create and expand wetland habitats promoting good hydrological function and diverse abundant species	
Species Abundancy	Hotter drier summers and Warmer wetter winters.	Potential shift in species range due to changes in climatic conditions.	Decline in overall species abundancy	Deliver habitat and species conservation measures at a landscape scale. Increase habitat connectivity and undertake adaptive management to increase species diversity and abundancy	Undertake adaptive management and ensure that areas of valuable habitat are bigger, better managed and joined up.
		Potential shift in species range due to changes in climatic	Loss of species due to the contraction in extent of their range or from the change in climatic conditions.	Deliver habitat and species conservation measures at a landscape scale. Increase habitat connectivity and undertake adaptive management to increase species diversity and abundancy	

		conditions	Increase in range and extent of new species, and species at the edge of their range, due to change in climatic conditions.	Undertake adaptive management and increase the genetic diversity and heterogeneity of key species on wildlife sites.	
Species Diversity	Hotter drier summers and warmer wetter winters	Loss of habitat or ecological niche for species due to changing climatic conditions.	Loss of species due to their inability to adapt to the change in climatic conditions.	Increase habitat connectivity and the permeability of the landscape to wildlife.	
			Species with a limited range of environmental conditions or habitat specialists may be lost or replaced by more adaptable or common species.	Undertake adaptive management and ensure that areas of valuable habitat are bigger, better managed and joined up.	
		Potential shift in species range due to changes in climatic conditions	Loss of species due to the contraction in extent of their range or from the change in climatic conditions.	Increase the quality and habitat diversity of wildlife sites.	
			Increase in range and extent of new species and species at the edge of their range due to change on climatic conditions.	Promote the collection and use of appropriate seed stock in habitat restoration or the creation of new habitat.	
			Increase in extent and occurence of invasive or pest species	Develop a strategy for tackling invasive and non-native species. Work to reduce their impact and spread within the Protected Landscape.	
Farming and Forestry – Agriculture, land management, food security, plantation and managed woodland.					
Agriculture	Hotter, drier summers	Higher summer temperatures and incidence of drought impacting on livestock farming	reduced availability of water, causing dehydration, heat stress and animimal welfare issues	Support for farmers in terms of diversification to new crops and livestock breeds that may be more resilient to changing climatic conditions.	
			supplying water will increase farming on costs and makes business less viable	Move towards farming systems with a reduced need for irrigation.	
			reduction in stocking rates may reduce business viability OR may improve profitability if inputs are reduced too	Use of natural pest controls or pest resistant crop species to reduce the need for pesticide use.	
			opportunity for increased tree planting and wood pasture to provide shade for livestock	Encourage sustainable land management that protect the environmental assets and ecosystem services while maintaining the profitability of farming.	
			reduced grass growth and cutting for fodder leads to increased costs of supplementary feeding	Encourage adaptation responses and land use practices that support or benefit the special qualities of the Protected Area.	
	Warmer, wetter winters	increase of pests and diseases that may affect livestock	increased costs for veterinary bills and medication	Support livestock farming and grazing activity so they are viable and profitable in the long term	
		increase in overwintering of cattle outdoors	may lead to reduced costs and increased viability of farming		
	Increased seasonal rainfall	waterlogging of land	reduction in area of land available for grazing , inability to get machinery on land	Improve resilience through increasing the capacity to capture and store water on-farm.	
			can lead to animal welfare issues		
			increase in polluting run off from farmland into rivers	Promote soil conservation measures especially in areas that are prone to erosion or may be more susceptible to drought conditions.	

	Land management responses to the impacts of climatic change	Changes in grazing patterns and stocking rates may occur	Land may be become abandoned and habitat management is impacted	Encourage land management practices that maintain the structural and microbial condition of soils and maximise its ability to store water and nutrients. Create more woodland strips, scrub and hedgerows, and agro-forestry to provide shade and shelter
		Livestock exposed to extrmeme weather	Shelter required to protect livestock from extreme heat, wind and rain	
	warmer/wetter winters and hotter, drier Summers	Increase in need for pesticides and fertilisers (inputs) to ensure crop viability	negative impact on insect populations	
Forestry	Hotter, drier summers	loss of native and other species that are susceptible to drought	opportunity for new species to be planted	Research on which tree species may be most impacted by changes in climatic conditions.
	Warmer, wetter winters	Increase in favourable conditions for pests and diseases	increase loss of trees, and loss of vigour of growth of remaining trees	Plan ahead in terms of planting species that may be more resilient to prevailing climatic conditions in the medium/long term.
		Improved forest productivity	increased capacity for sequestration by trees and soils	Encourage best practice woodland management techniques to adapt to changing climatic conditions.
	Higher temperatures	Effects of drought on traditional orchards, managed or plantation woodland (D)	Tree loss and reduced crop yields due to water stress	Encourage woodland management that provides the best range of ecosystem service benefits including enhancing biodiversity, natural flood management, air quality, carbon sequestration and renewable energy potential.
	Increase in incidence and severity of seasonal storm event	Plantations may suffer tree loss and wind throw	Loss of trees from damage and wind throw caused by seasonal storms.	Work with forestry partners land managers to increase woodland cover and enhance the capacity for carbon storage and sequestration at landscape scale.
Land Use Change	Land management responses to the impacts of climate change and climatic conditions	Socio-economic impacts upon land management such as increased oil prices, drive for food and energy security and changes in global markets.	De-intensification of agriculture and change in use of some areas that are no longer economically viable for agricultural or game management use.	
			Opportunities for enhancing or creating new habitat or rewilding of areas no longer required for game management or agricultural use.	work with landmanagers and stakeholders to agree how local employment can be protected to continue necessary tasks on moorland, eg fire wardening, predator control
			Impacts on landscape character and on iconic or distinctive views within and from the Protected Landscape.	
	Planning or development responses to climatic change	Major infrastructure development such as road, rail, water or power transmission.	Impacts on landscape character and on iconic or distinctive views within and from the Protected Landscape.	Ensure the planning process takes account of the new requirement to 'Seek to Further'.
				Ensure all relevant bodies are aware of their duties under Sc245 of the LURA Act (2023).
			Potential effect on expansive views and open skylines from incongruous features or development.	Take a landscape-led approach to planning to ensure iconic or distinctive views are protected.
			Introduction of technology and new infrastructure will impact on the character and historic feel of the landscape.	Ensure that the Protected Landscapes are effectively considered and represented in national and regional planning discussions i.e. Regional and Local Area Energy Plans (RAEP/LAEP's)
		Increase in large-scale green infrastructure solutions, natural flood management and sustainable drainage systems.	Potential for positive impact on landscape and ecosystem function though these assets may still change or alter the extant landscape character.	Prepare for and accommodate landscape change.
				Develop green infrastructure plans and nature-based solutions to help build resilience to climate change at a landscape scale.

		sustainable drainage systems.		Restore supporting Ecosystem functions that deliver societal co-benefits.
		Influence on the type, style and/or pattern of development as a mitigation response to climate change impacts	Potential for long-term change in the style, pattern or location of built development may alter existing settlement patterns and character.	Take a landscape-led approach to planning to ensure landscape or built character and iconic or distinctive views are protected.
Surface and groundwater.	Hotter drier summers.	Increased intensity or duration of drought events may impact upon surface and groundwater levels and quality (ID)	Failure of water bodies and ground water to meet existing quality standards in terms of chemical and biological status. Impact on biodiversity	Work with farm cluster groups, catchment partnerships and sector groups to improve the ecological/chemical status of rivers and watercourses.
			Localised or regional effects on water supplies may require water companies to review their supply plans.	Promote the use of the new NE guidance on landscape-led development of new reservoirs and water infrastructure.
			Impact upon the landscape from additional water infrastructure such as pipelines and reservoirs.	
		Higher air & water temperatures lower dissolved oxygen levels and increase the concentration of pollutants (D)	Failure of water bodies and ground water to meet existing quality standards in terms of chemical and biological status. Impact on biodiversity	Encourage good soil and land management practices that maintain and improve water infiltration and reduces water run-off and diffuse pollution.
				Maintain flows to streams and rivers so that good chemical and environmental status is maintained.
				Create buffer strips around source protection zones and water courses to reduce excessive nutrient and sediment input into water bodies.
				Promote catchment level approaches and examine potential for natural flood storage and habitat creation which reduces pollution run-off during extreme weather events.
				Promote uptake of high precision or low-input farming techniques so that the application of nitrate fertilisers does not result in excess nutrients passing into the aquifers at key times of recharge (Autumn/Winter)
				Encourage conservation measures such as contour ploughing, buffer strips, improving soil structure or changes in land management such as transition from arable to long-term grass lays or cover crops.
		Higher air & water temperatures combined with increased nutrient pollution	Threats to ecosystem and public health from pollution and microbial contamination of water.	
		Need for greater investment in water infrastructure to maintain the quality of the public water	Increased costs for ensuring quality and safety of the public water supply	
	Warmer wetter winters	Greater intensity of storm events may exceed the designed capacity of waste-water or storm drainage infrastructure (D)	Increased incidence and severity of flooding could overwhelm or damage existing water and drainage infrastructure.	
		Increased storm water run-off washing sediments and other contaminants into drinking	Drinking water sources requiring additional treatment to meet existing quality standards in terms of chemical and biological status.	

		Increase in soil erosion on steep slopes and cultivated land as a result of increased surface run-off (D)	Soil erosion and increased sedimentation and turbidity in rivers and surface waters.	
Landscape Character and related special qualities				
Landscape character and features	Hotter, Drier Summers	Land use change as the result of changes to climatic conditions.	Reversion to natural grasslands, scrub or other land use change may introduce new patterns and textures into the landscape	This may be within the scope of acceptable change for some landscape types. Grasslands that are priority habitats or species-rich will need to be buffered and resilience built at a landscape scale where possible.
			Carefully sited increased woodland planting or cover will have a positive impact on the visual character and pattern of the landscape.	Develop and use woodland opportunity mapping to support local level planning and as a starting point for discussions with landowner and farmers. Promote tree planting schemes in locations that have less impact on the areas landscape character, e.g. valley sides rather than valley bottoms. Impact is mitigated by the positive benefits of tree planting for the landscape and for climate change Target woodland planting in areas where it enhances landscape character Consider how successional planting can be supported through woodland grant schemes or project delivery. Research on suitability and climate resilience of tree species for future schemes
			Impact upon wide open, expansive, characteristic or iconic views.	Target woodland planting in areas where it enhances landscape character
			Impact on Historic Landscapes and loss of veteran or landscape trees due to heat stress, disease or more severe storms will have an impact on landscape character, visual amenity and the cultural heriatge of the landscape	Research on suitability and climate resilience of tree species for future schemes. Ensure standard tres are planted in hedgerows to provide conitnuity wihth exisiting landscape features
	Warmer wetter winters	Change of land use due to climatic changes and seasonal cycles	Changes in the variety and contrast of the landscape from changed agricultural practices in response to an extended growing season	Support and promotion of agri-environment scheme options which are sympathetic to existing landscape character (grazing)
		Re-instatement of historical boundaries	Opportunity to bring back boundaries which were previously lost	Use previously collected opportunity mapping and continue to encourage planting of hedgerows to build nature connectivity and restore historical land use pattern
Community and Economy – Local Economy, health, tourism, community life, community resilience.				
Local Economy	Hotter drier summers	Business opportunities driven by increased visitor numbers and spend within the rural economy.	More opportunities for local and small businesses and a stronger local tourism economy especially food, drink and accommodation.	Ensure local communities and businesses can access benefits from low carbon and renewable energy generation.
				Support energy projects that build resilience and flexibility at local grid level so that communities are less impacted by grid outages.
	Increase in storm events	increase impact of bad weather on visitor spend and business economy	disruption to services, impact on property and land, costs and availability of insurance	Ensure emergency planning considers the needs of rural communities within the protected areas. Adopt natural solutions to flooding and make space for water where possible
			Improved tourism business economy	

Tourism and Recreation	Hotter drier summers	Increase in visitor numbers	Honeypot sites may become overwhelmed and unable to cope with increased numbers	Encourage dispersal of visitors via local marketing and promotion of new opportunities
			adverse impact of numbers on fragile/sensitive habitats and species	
Rights of Way	Hotter drier summers	drier vegetation, woodland and peat	Increased risk of wildfires on some open access areas.	Work with landowners/organisations to make sure wildfire monitoring and warning systems are in place
	warmer, wetter winters	increased growing season	overgrowth of paths and rights of way requiring more maintenance	Ensure that open access areas have wildfire management plans in place and staff are trained with the necessary equipment and emergency procedures.
		waterlogged ground	paths become impassable	Consider adaptive management practices that can ensure rights of way and access routes are more resilient.
			increased risk of landslides and rockfalls	Where paths are vulnerable or high risk work with the Highways Authorities and amenity groups to identify viable diversion routes and realignments that can ensure Right of Way remain useable in the long-term.
	Increase in storm events	Greater incidence of flash flooding	bridges and other access furniture lost or damaged	
			damage or loss of riverside paths	
Community resilience	Hotter drier summers	Longer hours of sunshine	Lower relieance on National Grid, more local solar generation	promote reponsible water usage and water management systems e.g. rainwater harvesting
		Water shortages	water rationing	Ensure emergency planning considers the needs of rural communities within the protected areas.
	Wetter winters	increased likelihood and severity of flooding	Adverse affect on health and wellbeing, particularly for vulnerable groups. Risk of being cut off	
			Impacts on provision of local services - transport, power etc	Ensure emergency planning considers the needs of rural communities within the protected areas.
			Damage to properties, knock on effects on insurance costs and repairs	Support community based food production e.g allotments
		Climate conditions effects on farming/food production	food shortages and increased food prices	Encourage an increase in tree planting to provide ecosystem service benefits within towns and villages. Promote the value of trees, parks and other Green Infrastructure in terms of health and climate resilience.
Public Health	Hot Summer Temperatures	exposure to extreme heat or excessive sun.	Increase in heat stress and related illnesses and health impacts for vulnerable groups and communities.	Work with local public health authorities to help them develop health impact assessments for climate change.
		Increased temperatures	increase in vector borne diseases	Ensure emergency planning considers the needs of rural communities within the protected areas.
			local health services overwhelmed by demand	
	Increased severity and occurence of extreme weather events	Impact of floodings and high winds on communities	direct physical injuries	Opportunity to extend the scope of volunteer capacity within Parishes and local groups to enhance community resilience to potential climate change impacts.
			Impacts on provision of local services - health, transport, power etc	
			impacts on mental health and wellbeing form stress of coping with extreme events	