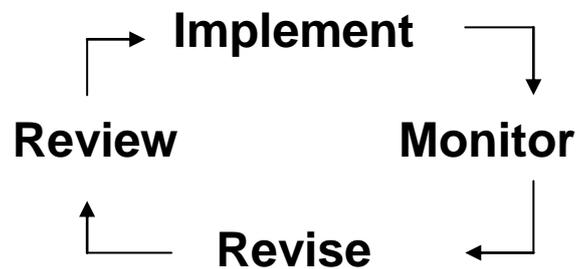




Northumberland National Park

Climate Change Adaptation Report

2012 – 2017



The Risk Assessment

First Edition

1.0 Foreword

The English National Parks contain valuable ecosystems, including forests, peat lands and open water, all of which may be vulnerable to climate change. We are already taking action to ensure that those managing these areas are aware of the impacts of climate change and how the habitats can become more resilient. Northumberland National Park in particular is a landscape rich in biodiversity. 11% is designed as Sites of Special Scientific Interest, and we are currently meeting Government targets for their condition. It also has a rich cultural heritage, with 228 listed buildings and 424 Scheduled Ancient Monuments, with some of the most extensive and well preserved archaeological landscapes in the UK.



Contemporary wisdom is clear about the likely impacts of climate change – warmer, wetter winters, hotter drier summers, sea level rises and more severe weather events including heat waves, storms, intense rainfall and drought.¹ Local authorities are at the front line in dealing with the impacts from climate change – not only for their own services, but also (along with other local partners) as leaders in their local communities. As special purpose local authorities, National Park Authorities share these responsibilities.

The Adaptation Reporting Power was introduced to help ensure all persons or bodies with a function of a public nature and statutory duties take appropriate action to adapt to the future impact of climate change. Adaptation is a process that needs to be built into our normal planning and risk management procedures, whether in business, government or elsewhere. That way we can make sustainable adaptation decisions at the right time, to maximise benefits and minimise costs. As a body with a key responsibility for one of England's finest landscapes, Northumberland National Park Authority is pleased to produce this Adaptation Report on a voluntary basis.

The local people of Northumberland National Park are only too aware of the potential consequences of severe weather. The flash flooding that took place across the Breamish Valley during 2008 devastated the local community. This led to the creation of the Cheviot Futures partnership, which aims to try and prevent similar occurrences in future. The forthcoming *Strategic National Framework on Community Resilience* highlights the importance of emergency service planning with instances like this.² It is underpinned by the need for co-operation, between government agencies, landowners, communities, and businesses, with partners sharing responsibility for taking the necessary actions.

With the co-operation of our partners, Northumberland National Park Authority is determined to minimise the risks of climate change, and maximise the opportunities, as we move towards a greener society. Strategic forward planning is required; we all need to take action now to prepare for likely changes in years to come.

John Riddle
Chairman
Northumberland National Park Authority

¹ Stern, J., et al. (2006) *Stern Review: The Economics of Climate Change*, HM Treasury: London.

² Cabinet Office, (2011) *Draft Strategic Framework on Community Resilience*, Consultation Document, Cabinet Office: London.

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2.0 Executive Summary

The impacts of climate change will affect the economy, infrastructure society and the environment. Northumberland National Park Authority volunteered to report to Government on the current and predicted impacts on climate change, detailing the risks and opportunities that are posed until 2080. The UK Climate Projections (UKCP09) provided climate information to inform the adaptation planning process.

Qualitative and quantitative information was gathered from scientists, specialists and practitioners, although it should be noted that not all individuals were in agreement about the potential consequences of climate change. Despite this uncertainty, the Authority sought to create a roadmap for adaptation actions that is as informed as possible in the light of the expertise that is presently available.

The assessment was developed around the strategic priorities Northumberland National Park Management Plan (2009 to 2014), which are: a Welcoming Park; a Distinctive Place; a Living, Working Landscape, for Now and the Future; Thriving Communities; and a Valued Asset. Each factor was assessed in terms of its likelihood by time-scale (2020, 2050 or 2080) with a consequence commentary, actions that can help to mitigate or eliminate the risks, and the indicative stakeholders responsible for taking those actions.

The Climate Change Adaptation Report identified the high priority changes, those that are predicted to take place before 2020 and where the consequences of inaction would be severe. The three key areas of risk were found to be: locally critical infrastructure; agriculture, livestock and game management; and habitats and ecosystems. The actions to manage the risks have been linked to the Management Plan Action Plan. This means that our approach to climate change adaptation is already embedded in the existing work of the Authority, as it will continue to be in years to come.

However, climate change adaptation is by no means straight-forward. There are foreseeable obstacles to overcome. There are economic barriers, because adaptation will require funding. There are ecological and physical barriers since planning a landscape approach to adaptation is a challenging task itself. There are technical barriers since Northumberland National Park is a protected area that requires sensitive management at all times, where development can only be permitted if it is appropriate. Finally, there are societal barriers to overcome. There is a rich and valuable Northumbrian cultural heritage that the Authority and its partners can continue to learn from. For example, generations of farmers and land managers can collectively bring a vast amount of practical knowledge to landscape management.

Work on climate change adaptation can only ever be a snap-shot in time, since the predictions of the impacts are estimates and societal knowledge and understanding is continually improving. This is built into our approach since the Authority and its partners will monitor and revise our work on climate change adaptation every five years. It is a fluid and flexible process that allows intervention and reaction to any unforeseen issues that emerge.

3.0 Functions Impacted by Climate Change

3.1 National Park Statutory Purposes and Duty

The purposes of National Park designation are set out in national legislation, first established in the 1949 National Parks and Access to the Countryside Act and amended by the 1995 Environment Act. The two statutory purposes are:

- To conserve and enhance the natural beauty, wildlife and cultural heritage of the National Park; and
- To promote opportunities for the understanding and enjoyment of the special qualities of (the) areas by the public.

The statutory purposes are underpinned in law by what is known as the ‘Sandford Principle’. This makes it clear that the first purpose should take precedence over the second in cases of irreconcilable conflict.

Northumberland National Park is a living and working landscape where the characteristic qualities are the result of the interaction of human activity and natural forces. It is in the interests of maintaining the close connections between local communities, economies and environmental conservation that the National Park Authorities have an additional statutory duty:

- In pursuing the purposes, the authorities should seek to foster the economic and social well-being of local communities within the National Park.

The delivery of the statutory purposes and duty contributes to the Government’s agreed vision for a diverse, healthy and resilient natural environment, and helps deliver the commitment of the United Kingdom to the European Landscape Convention, which came into force on 1st March 2007.

In 2010 a *Vision and Circular for the English National Parks and the Broads*³ was published. The Circular set out that in order to demonstrate early progress towards delivering the Vision, the Authorities and key partners needed to work together to focus on leading the way in adapting to, and mitigating climate change.

The Vision was reiterated in Defra’s 2011 *Uplands Policy Review*⁴, which endorsed the Vision and Circular as relevant statements of Government policy on National Parks. The Uplands Policy Review also highlighted Cheviot Futures, a partnership project already operating in Northumberland National Park as an example of best practice in climate change adaptation. Also published during 2011 was Defra’s *Climate Resilient Infrastructure: Preparing for a Changing Climate*⁵ document, which emphasised the need for a good evidence base from which to base the forthcoming *UK Climate Change Risk Assessment*.

Finally, the recently published *Natural Environment White Paper*⁶ offers a bold and ambitious statement, outlining the Government’s vision for the natural environment over the next 50 years. Whilst climate change adaptation is not a central theme to this White Paper, it does say that “...for climate change mitigation and adaptation [the] Government will play a leading role in delivering these outcomes and will take them forward in a way which is compatible with our other priorities.”

³ Department for Environment, Food and Rural Affairs (2010) *English National Parks and the Broads: UK Government Vision and Circular*, Defra: London.

⁴ Department for Environment, Food and Rural Affairs (2011) *Uplands Policy Review*, Defra: London.

⁵ HM Government (2011) *Climate Resilient Infrastructure: Preparing for a Changing Climate*, HMSO: London.

⁶ HM Government (2011) *The Natural Choice: Securing the Value of Nature*, HMSO: London, p18.

3.2 Northumberland National Park Management Plan, 2009-2014: Inspiring Landscapes, Thriving Communities

Since 2003 every National Park Authority has a duty to prepare a Management Plan as the framework for the delivery of the statutory purposes and duty and to review it at least every five years. The National Park Management Plan is the single most important document for the National Park, setting out the guiding principles, vision, objectives and actions for managing the National Park.

Although prepared by the Authority, the Management Plan is for everyone: residents, businesses, visitors, public bodies, all organisations, and individuals with a stake in the Northumberland National Park. The Management Plan seeks to guide the management of the National Park in a way that will help to achieve its statutory purposes and duty, improving the quality of life for those who live or work in the National Park or are visitors to it. Legislation requires other authorities and relevant public bodies to have regard to the National Park purposes when carrying out their work. Therefore, not only does it set the framework for the Authority's own policies and activities but it also shapes the plans, strategies, and actions of all other bodies operating within the National Park.

The Vision for Northumberland National Park for 2029 is ambitious, yet achievable, and was derived from workshops held with over 120 partners and key stakeholders during April 2008.

'Northumberland National Park will be a truly welcoming and distinctive place, easily accessible to all. Its inspiring and changing landscapes, characterised by open spaces, tranquillity, diverse habitats, geology and rich cultural heritage, will be widely recognised and valued. The living, working landscape will contribute positively to the well-being of the thriving and vibrant communities in and around Northumberland National Park.'

The Vision is embedded in five strategic aims and associated outcomes that will help guide the National Park and its communities towards a sustainable future. These strategic aims, which are in no particular order, are shown below.

A Welcoming Park

- People who come to the National Park feel they have had an exceptional experience in relating to the landscape and in finding peace, tranquillity and adventure and will have enjoyed their visit.
- The National Park will be accessible to a wider and diverse audience including people who live in, work in and visit the National Park.
- A more diverse range of learning opportunities will be available to help people understand, value and contribute to conserving, enhancing and enjoying the National Park's distinctive natural and cultural qualities.

A Distinctive Place

- A distinctive place that will maintain a sense of inspiration and tranquillity.
- The natural qualities and diverse habitats that characterise the changing landscapes will be safeguarded and enhanced.
- The rich historic environment and archaeological heritage will be understood, valued and cared for.
- There is a strong and recognisable sense of identity, which is born of the deep-rooted cultural heritage, yet balances this with a vibrant approach to the future.

A Living, Working Landscape for Now and the Future

- New and better approaches to sustainable land and water management have been tested, adopted and embedded.
- The National Park has made an important contribution to increasing understanding about, and demonstrating the practice of, sustainable development and responses to climate change.
- There is sustained and economically viable business growth in sectors which sensitively make use of the natural, historical and cultural qualities.

Thriving Communities

- The communities in and around the National Park will have a strong connection to, and appreciation of, the National Park and be fully engaged in shaping its future.
- Effective infrastructure (service, facilities, networks, etc.) will support socially and culturally active communities with a high quality of life and improved health and wellbeing.
- People will have opportunities to work in, live in and contribute to resilient communities in and around the National Park.

A Valued Asset

- The National Park is widely recognised for its environmental, social and economic contribution, particularly to North East England.
- The National Park has made a distinctive contribution to a broader network of protected areas.
- The value of the National Park as a place that is worth looking after is clearly demonstrated by the policies and actions of all who have an influence on the National Park.

This Adaptation Report makes the following distinctions:

- Northumberland National Park Authority (“the Authority”) is the principal management body for this protected area. It employs around 75 members of staff and its headquarters are based in Hexham, Northumberland. The implications of climate change for the organisation are considered in this Adaptation Report.
- Northumberland National Park is the protected area. It is the focus of the statutory duties and purposes of the place, therefore the implications of climate change for the place are considered in this Adaptation Report.
- Northumberland National Park is one of ten English National Parks. Each has a National Park Authority, and these Authorities work together through the English National Park Authorities Association.
- The Department for Environment, Food and Rural Affairs (Defra) is the government department responsible for environmental protection, food production and standards, agriculture, fisheries and rural communities in the UK.

3.3 The Special Qualities of Northumberland National Park

The exact future impacts of climate change are still unknown is the subject of ongoing scientific research. The special qualities of Northumberland National Park include its geology and landforms, its internationally important peat bogs and moorlands, and its nationally important grassland, hay meadows, rivers, burns flushes and fens. Its historical buildings and archaeological remains are also of national and international importance.

This varied heritage is important to the nation, as recognised by its National Park designation. The 1945 Dower Report led to the formation of National Parks in England and Wales, with John Dower setting out what National Parks in England and Wales should be like:

The distinctive landscapes and special qualities of Northumberland National Park are the product of many years of interaction between land and people. The daily decisions of those living in, working in or visiting the National Park continue to shape the quality, attractiveness and resilience of the environment, its settlements and its recreational infrastructure. The special qualities are recognised as:

A Distinctive Landscape Character

A key characteristic of the National Park is its openness, with landscapes and horizons free from significant human intrusions which contribute significantly to the high levels of tranquillity.

A Landscape Rich in Biodiversity and Geology

Extensive areas of the National Park have been designated for their international importance for nature conservation:

- 32 Sites of Special Scientific Interest (11% of the land area of Northumberland National Park), 5 for geological interest;
- 3 National Nature Reserves;
- 6 Special Areas of Conservation;
- 1 RAMSAR Site (international wetland designation);
- England's cleanest rivers; and
- Over 150 rare and significant species living here.

A Rich Cultural Heritage

Northumberland National Park contains:

- Hadrian's Wall UNESCO World Heritage Site (12,300 hectares);
- 1 Conservation Area (Kirknewton);
- 2 Parts of Registered Battlefields (Humbleton Hill and Otterburn);
- 1 Registered Park and Garden (Hesleyside);
- 424 Scheduled Ancient Monuments, equating to more than one per square mile, of which 63 are 'at risk' and 177 are 'at medium risk';
- 228 Listed Buildings (Grade I, II* and II); and
- 4,054 entries in the National Park's Historic Environment Record, including prehistoric hillforts, bastles, castles, and extremely well preserved examples of upland settlements and field systems from the Bronze Age to the present.

This, the most Northerly and remote part of England, has not been researched and studied to the same extent as the rest of the country and so many more important historical features remain unknown and unrecorded.

3.4 Stakeholder Analysis

Stakeholder analysis is the process of identifying those affected by climate change adaptation. The distinction has been made between the key stakeholders of the Authority and those of Northumberland National Park. It is appreciated that in some instances there is overlap. Stakeholder analysis has the goal of developing co-operation between the stakeholders and ultimately assuring successful outcomes for the Adaptation Report.

Northumberland National Park Authority

The Authority works in partnership with many organisations, delivering services for a range of customers. The key stakeholders of Northumberland National Park Authority were identified in the Management Plan (2009 to 2014) as follows:

- Natural England
- English Heritage
- Forestry Commission
- National Farmers Union
- Defence Infrastructure Organisation
- Northumberland Tourism Limited
- Country Land and Business Association
- Northumberland National Park and County Joint Local Access Forum
- Northumberland County Council
- Environment Agency

In 2009, One NorthEast was also identified as a key stakeholder. The Regional Development Agency has been excluded since their entire operation will cease as of 31 March 2012.

Northumberland National Park

There are a wide range of people involved in Northumberland National Park. The key stakeholders of Northumberland National Park, the place, are:

- Residents
- Landowners, property owners and developers
- Agriculture workers and farmers
- Water management organisations
- Forestry management organisations
- Community partnerships
- Parish councils
- Visitors and recreational users
- Businesses, both within and around the area
- Specialist interest groups

Stakeholder Management

All the stakeholders will have an interest in how climate change adaptation is implemented, and to varying extents, all will have a responsibility to ensure that the actions identified in the Adaptation Report are implemented.

4.0 Approach to Adaptation Planning and Risk Identification

4.1 Identifying Risk

Future climate impacts have been assessed drawing upon expertise from a variety of sources, including natural, regional and local studies and further analysis at a local level by local specialists and practitioners.

The vulnerability of the country to extreme was put into context by the 2008 *Pitt Review: Learning the Lessons for the 2007 Floods*.⁷ The floods that struck much of the country during June and July 2007 were extreme, affecting hundreds of thousands of people in England and Wales. It was the most serious inland flood since 1947 and the exceptional events that took place claimed the lives of 13 people, while approximately 48,000 households and nearly 7,300 businesses were flooded.

The North East England Climate Change Adaptation Study⁸ was published by the Climate Change Partnership in 2008. It provides a clear picture of the changes that are likely to take place in the future, what areas will be most affected, and what is required at present to prepare and adapt.

In 2009 *The Heat is On: The Strategic Framework for Climate Change Planning in Northumberland*⁹ was published by Northumberland Strategic Partnership. This highlighted the predicted increase in intensity and frequency of severe weather events, notably storms, flooding caused by heavy rainfall and heat waves. This was followed in 2010 by the *Northumberland Economic Strategy*¹⁰, which aims to support businesses and communities to adapt to the impacts of climate change, while utilising the opportunities to develop new activities, which can act as a catalyst for the growth of business and economic development.

The Authority has subsequently worked with a series of stakeholders to further define and evaluate the potential of climate change, including:

- Environment Agency
- Forestry Commission
- Natural England
- Newcastle University
- Northumberland County Council
- Climate North East
- The Cheviot Futures Partnership

Cheviot Futures is a partnership of stakeholders primarily interested in working together on climate change adaptation. It includes representatives from the Northumberland Wildlife Trust, the Royal Society for the Protection of Birds, land management and the Ministry of Defence.

A series of climate change adaptation focus groups took place at the Authority, themed around:

- Business Continuity
- Access, Tourism and Recreation

⁷ Cabinet Office (2008) *The Pitt Review: Learning the Lessons from the 2007 Floods*, Cabinet Office: London.

⁸ The Climate Change Partnership (2008) *North East Climate Change Adaptation Study*, ClimateNE: Newcastle.

⁹ Speakman, L. (2009) *The Heat is On: The Strategic Framework for Climate Change Planning in Northumberland*, Northumberland Strategic Partnership: Morpeth.

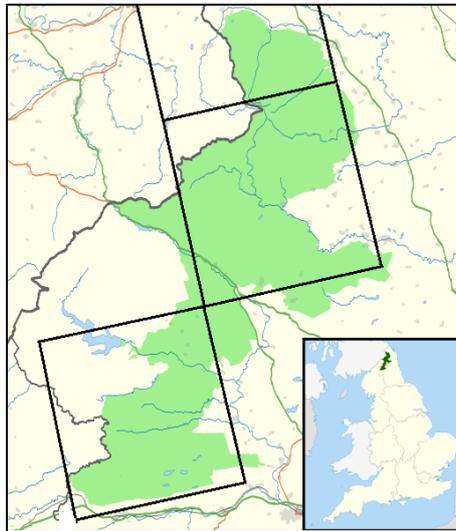
¹⁰ Northumberland County Council (2010) *Northumberland Economic Strategy*, NCC: Morpeth.

- Landscape
- Community, Culture and Economy
- The Historic Environment
- Farming and Land Management
- Biodiversity

The focus groups utilised expertise across the Authority from officers specialising in work on estate management; access; tourism; the ranger service; landscape management; community enterprise; archaeology; farming and rural enterprise; and ecology.

4.2 UK Climate Projections 2009

Newcastle University utilised UK Climate Projections 2009 (UKCP09) data for the three 25 kilometres square tiles that cover Northumberland National Park (Box Grid References: 886; 925; and 963). The tiles are located to the Northern, the Central and the Southern areas of Northumberland National Park and are precise enough to provide projections at a local level. For instance, the climate conditions are likely to be significantly different between the uplands of Northumberland National Park and the lowlands of Northumberland Coast Area of Outstanding Natural Beauty.



The UKCP09 data also shows differences between the Northern tile of Northumberland National Park, characterised by the Cheviots and Glendale, and the Southern tile of Northumberland National Park, characterised by Hadrian's Wall and the South Tyne area.

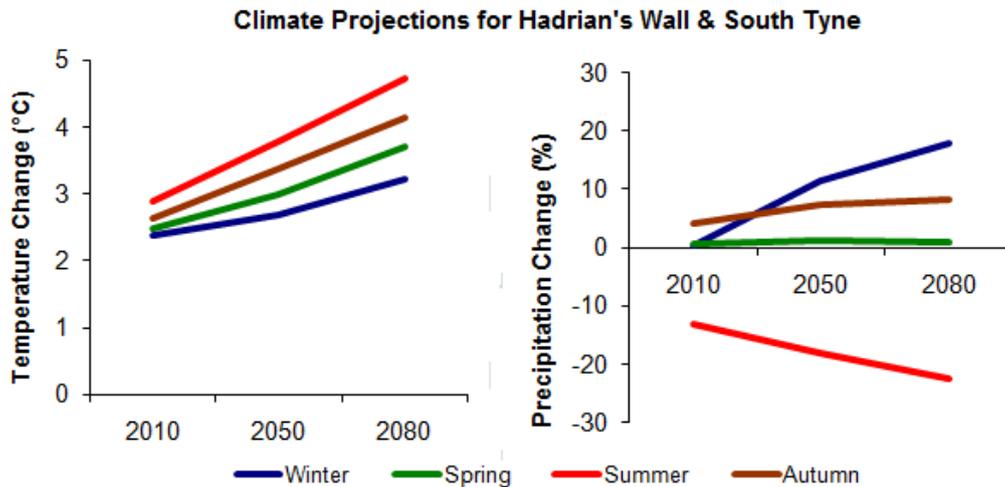
The projections offer a series of possible future climates up until 2080 based on three emissions scenarios (high, medium and low) and a range of probability levels, which reflect the uncertainties involved in climate science and future emissions.

The Authority has been advised by Newcastle University to plan for the **high emissions scenario**. The justification was that:

- It is best to cover all bases in the first instance;
- The carbon trading targets by 2010 for the medium emissions scenario were not been met; and
- The low emissions scenario presumed society would have completely switched to renewable energy by 2020. This is unlikely.

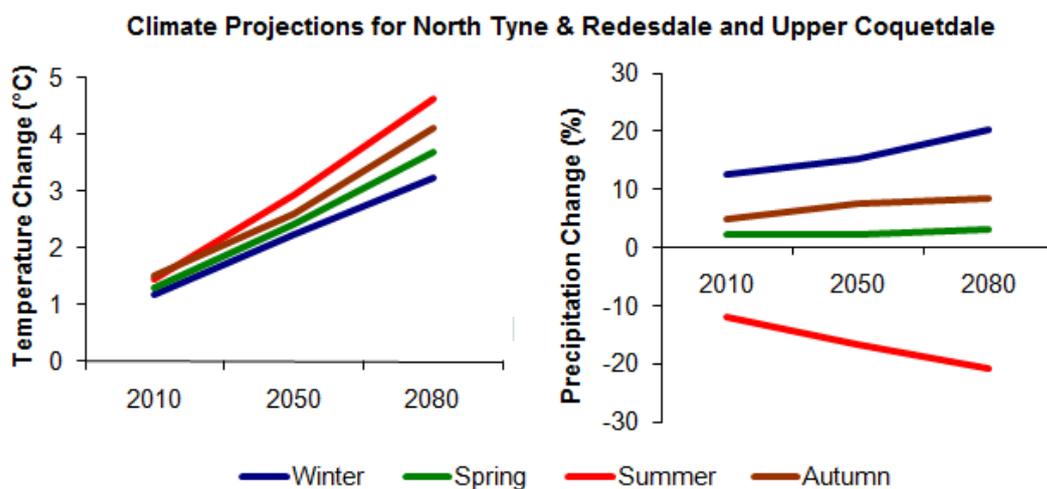
In addition, since the landscape of Northumberland National Park is regionally, nationally, and internationally important it is vital that the severity of the potential impacts of climate change are properly planned for from the outset. The Authority is aware that this must be kept in context and as new data becomes available and as our understanding of climate change increases, our planning for the future impacts of climate change will also improve.

UKCP09 Data



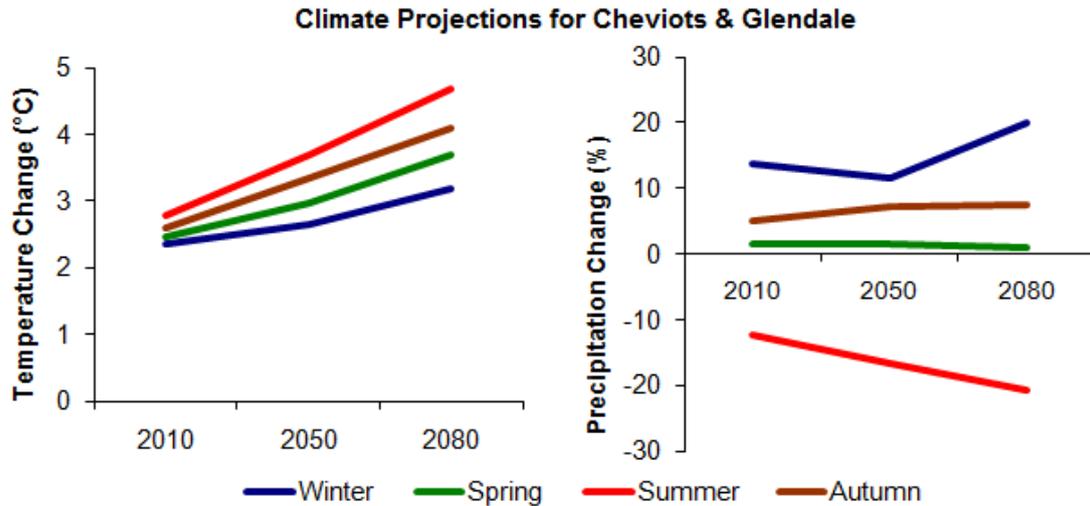
Source: UKCP09, Box Grid Ref: 925. Changes based on 1991 readings.

The graphs shown above detail climate projections for the Hadrian's Wall and South Tyne area. Under the high emissions scenario, summer temperature projections are forecast to rise by 4.7°C up to 2080. Meanwhile, over the same time period, summer precipitation could decrease by 22.4%, compared to a 17.8% increase in the winter months.



Source: UKCP09, Box Grid Ref: 925. Changes based on 1991 readings.

The graphs shown above detail climate projections for the North Tyne & Redesdale and the Upper Coquetdale areas. Under the high emissions scenario, summer temperature projections are forecast to rise by 4.6°C up to 2080. Meanwhile, over the same time period, summer precipitation could decrease by 20.8%, compared to a 20.2% increase in the winter months.



Source: UKCP09, Box Grid Ref: 886. Changes based on 1991 readings.

The graphs shown above detail climate projections for the Cheviots & Glendale area. Under the high emissions scenario, summer temperature projections are forecast to rise by 4.7°C up to 2080. Meanwhile, over the same time period, summer precipitation could decrease by 20.8%, compared to a 20.0% increase in the winter months.

4.3 Prioritising Risk

Sections 4.1 and 4.2 explained the approach the Authority has taken to the Adaptation Report, by engaging with scientists, specialists and practitioners. This is the Review area of the diagram below, and the Authority understands that our knowledge and understanding climate change is a continuous process, therefore quantitative and qualitative data will be used in future to continue to help inform and share our adaptation planning.



The monitoring process will take place every five years, and will inform the preparation and development of future the Management Plans of the Authority. The ability to effectively monitor success is not always a straight-forward process and further complicated if a monetary value is placed on the landscape. Defra attempted to calculate the economic value of National Parks¹¹, concluding that:

“It is often not possible to place on the benefits of National Park Authorities due to the nature of the work and the lack of quantified outputs.” (p17)

This is due to:

“The difficulties in establishing a clear baseline; the fact that monitoring is costly and therefore not always cost effective to implement; the complexity of the work that National Park Authorities carry out both with regards to environmental and social benefits where monitoring additionality can be complex and the subtle impacts that National Park Authorities

¹¹ Defra (2011) *National Parks: Assessment of Benefits – Working Paper*, Defra: London.

have that are difficult to quantify, for example their working with local groups to help them access relevant funding streams. In addition it can be argued that with regards to National Park Authorities it may be that the whole is greater than the sum of the parts and therefore using a methodology that segments the work of the National Park Authorities could underestimate their total impact on the National Parks.”(p118)

Some environmental benefits can be understood economically. The Valuing National Park Report used the following example:

- The benefits of planting 115 hectare of broadleaf woodland over 8 years include biodiversity, landscape and recreation benefits as well as a present value benefit from carbon sequestration of £2.3m.¹² (p61)

However in most instances, the value of the National Park is intrinsic, yet unquantifiable.

“The work of the National Park Authorities on the issue of climate change illustrates how the National Park Authorities can use their expertise, local knowledge, partnerships and other skills to tackle new issues on the ground, providing a test bed for new technologies and approaches and helping to educate the public.” (p121)

¹² 52 Assuming 14.375ha planted each year for 8 years and carbon valued at the central DECC estimate over 50 years.

5.0 The Risk Assessment

5.1 Explanatory Note

The following pages tabulate risks and opportunities assessments for the Northumberland National Park and Northumberland National Park Authority. The Authority acknowledges the likelihood of many of the risks occurring is unknown at present, and has therefore been worked out as a best estimation. The risks are set out under the strategic aims of the Northumberland National Park Management Plan because this captures the role of the Authority and the wider partners' objectives for the National Park.

No single organisation is going to bear the full costs of climate change adaptation. It is highly likely that, in keeping with its current practice, the Authority will work with partners to draw upon knowledge, expertise, and funding, to ensure that joint targets for climate change adaptation are met in the most effective and financially efficient way. When dealing with the impacts of climate change on a protected area the real costs are if habitats are lost with increasing temperatures or destroyed by severe weather occurrences. It is very difficult, if not impossible, to place a financial value on this happening, because the value of flora and fauna species is not quantifiable in this way. Needless to say, the value of a rich and diverse biodiversity is of utmost important to the Authority as the principal guardian for this protected area. Therefore it has not been possible to calculate the financial cost to the Authority.

The key to the columns in the tables is as follows:

Risk

This column explains the issue that is under consideration as concisely as possible. There is some overlap between the rows of the tables because climate change will have inter-related consequences. The risk is from affects of severe weather, i.e. hotter/drier summers and warmer/wetter winters.

Time-Scale

The time-scales are either: requiring action by 2020 (short term); requiring action by 2050 (mid-term); or requiring action by 2080 (long term). The Authority acknowledges that such a definition should be used as a guidance note only. The principal purpose is to separate out the high risk areas that require action in the short-term from those that may be experienced in either the mid or long term scenarios.

Likelihood by Timescale

This column uses the table below to define the likelihood level. There are three categories ranging from Unlikely to Almost Certain. The Authority acknowledges that many risks or opportunities do not have widespread expert consensus as to the degree of certainty, therefore this information should be treated as guidance at this time.

Likelihood	Definition
Unlikely	There is a low probability that the occurrence will take place.
Likely	There is a high probability that the occurrence will take place.
Almost Certain	There is a very high level of confidence that the occurrence will take place.

Consequence Commentary

The consequence commentary column attempts to put the risk into perspective, and where possible, draws the linkages to locally critical infrastructure.

Actions

The actions column attempts to explain what can be undertaken to adapt any given risk to climate change. Some actions are fairly obvious and straight-forward, whereas others will result from severe weather occurrences, which are difficult to plan for in a precise manner.

Indicative Monitoring

This column shows a list of organisations that have been identified as have an interest in the risk. The Authority acknowledges that this list is by no means comprehensive. Lead partners have not been identified a within each list since to varying degrees, the risks and opportunities are the responsibility of everyone.

Risk Rating

The risks have not been separated between those that affect the National Park and those that affect the National Park Authority. This is because the work of the latter is intrinsically linked to the former, and it is often difficult to separate the two. The Risk Rating is defined by the following categories.

Symbol	Explanation
	Potentially positive opportunities.
	Few identified threats, but they are generally manageable.
	A significant level of identified threats that will need sound management.
	Potentially catastrophic threats. Action required with very close management.

5.2 A Welcoming Park

To put people and their connections with the landscape at the heart of the National Park.

Risk	Time-Scale	Likelihood by Time-Scale	Consequence Commentary	Actions	Indicative Monitoring	Risk Rating
Damage to the Northumberland National Park Authority estates	2020	Likely	The Authority utilises eleven different sites in and around Northumberland National Park. The majority of them will need some adaptation work before 2050, likely to be undertaken as and when repairs and maintenance take place. The most vulnerable place is Ingram Visitor Centre, which has been susceptible to severe weather since 2008. Remedial work has already been undertaken adjacent to the River Breamish.	Extensive work would be required to adapt and safeguard all Authority sites.	Environment Agency, the Authority	
Deterioration of Rights of Way and Open Access	2020	Almost Certain	Footpath erosion is already a significant problem. A combination of tourism and hot summers and wet winters may accentuate occurrences of erosion. Winter may see flood damage to access routes. More sustainable routes are likely to be required in future.	Introduce harder wearing vegetation types. Slabs may need to be laid. Hierarchy of priority routes to be developed (e.g. the Hadrian's Wall Trail and the Pennine Way).	Highways Authority, the Authority, Community and Voluntary Groups	
Visitor numbers stretch beyond capacity and experiences suffer as a consequence	2050	Likely	Both summers and winters may see an increase in tourism and income generation. Market demand will affect supply. Insufficient numbers of beds and accommodation may see an increase in the number of campsites. The special qualities of Northumberland National Park must not be compromised. Changes in the range of activities available. Availability of fishing, hunting, horse-riding activities will depend on how well some animals adapt. Possible opportunity to introduce new sports.	Costs and opportunities will be primarily borne by private sector. Appropriate development locations determined by the Authority.	Private Sector, the Authority	
Increased demand on the Mountain Rescue service	2050	Likely	Summers and winters may see an increase in tourism. Increase in tourism may result in increased occurrences of dehydration and hypothermia. The greatest pressure is likely to come from more extreme weather events such as flooding or wildfire which would stretch teams more than the conventional work of individuals having problems.	Potential issues may be addressed by raising awareness. Joint planning and training with other emergency services. Continued support for the operation of the Northumberland National Park Mountain Rescue Service.	Northumberland National Park Mountain Rescue Service	

5.3 A Distinctive Place

To manage, conserve and enhance the distinctive natural and cultural qualities of the National Park.

Risk	Time-Scale	Likelihood by Time-Scale	Consequence Commentary	Actions	Indicative Monitoring	Risk Rating
Changes to geology and landforms	2050	Likely	Increased frequency of landslips, river course changes and scarring on the landscape, stripping of soils. Loss of soil and vegetation, siltation and other forms of pollution (e.g. run-off from farmland), bare landscapes, loss of special qualities. A serious risk but difficult to predict most vulnerable locations.	Use of stronger vegetation and sensible tree cover could increase resilience.	Natural England, the Authority	
Changes to the management of forestry	2020	Likely	Warmer and damper conditions generally favour tree growth whilst drought conditions can endanger some native species. Increased demand for wood fuel. Species choice needs to be suitable for the long term. Single species plantations are more susceptible to increased chance of tree disease. Opportunity for new wood products to develop. New employment opportunities.	Plant a good tree mix to strengthen disease resistance. Opportunities for wood as a product and in mitigation.	Forestry Commission, the Authority, Private Sector	 
Visual change to the landscape	2050	Likely	Change of land use to arable and biofuel, reduced size and increased number of estates, change in Ministry of Defence training needs. Visual change in landscape, increased use of farm sheds and some abandoned buildings.	Some potential issues may be addressed by raising awareness. The Authority can control some measures through its planning process.	Defence Infrastructure Organisation, National Farmers Union, the Authority.	
Deterioration of historical buildings	2050	Likely	Traditionally built buildings may survive warmer temperatures and be relatively unaffected (e.g. older buildings that have stood for hundreds of years). The level of vulnerability will depend on the location (e.g. if located in a flood plain). Important to understand how the buildings are used. Retaining the character could restrict the adaptation and mitigation options. Guttering and drainage could be damaged by flash floods. Opportunity to work with communities to decide how and where to place values.	Will depend on the stability of the foundations (e.g. bastles are fairly solid and therefore more robust). Possible preventative action through tree planting, flood barriers, improving rainwater drainage and collection, etc.	English Heritage, the Authority, Community and Voluntary Groups	 
Deterioration of historic settlements, landscapes, parks and gardens	2050	Unlikely	The Historic Village Atlas has already catalogued a number of areas of historical importance. Several pillboxes and way markers are of listed status. There is an expense to maintain them, and this could be lead to abandonment if costs are not met. Under-utilised venues may be converted into residential or commercial properties.	Record most vulnerable sites and consolidate with flood prevention measures.	English Heritage, the Authority, Community and Voluntary Groups	 
Deterioration of archaeological remains	2050	Likely	Particular risk of soil erosion along Hadrian's Wall, which is a tourism hot spot. Burning vegetation could also increase susceptibility to erosion at all archaeological sites. Remains could also be damaged by both rabbit burrowing (if population increases) and deep-rooted plants. If peat dries out, remains could be destroyed. Woodland planting and inappropriate development can affect the level of the water table and therefore archaeological remains.	Record most vulnerable sites and consolidate with flood prevention measures.	English Heritage, the Authority, Community and Voluntary Groups	 

5.4 A Living, Working Landscape for Now and the Future

To adapt to change by applying new approaches, together with traditional techniques.

Risk	Time-Scale	Likelihood by Time-Scale	Consequence Commentary	Actions	Indicative Monitoring	Risk Rating
Deterioration of soil quality	2050	Likely	Loss of vegetation with warmer conditions. Peat and podsols (leached soils) may dry out and there will be greater risk of wildfires. A change in temperature by a few degrees may lead to a move to arable farming, which will also be affected by market demand. With wetter conditions, there may be greater run-off in rivers (nutrient leaching), affecting fish populations and other wildlife. Water logged soils may lead to greater vegetation growth, although they could also become more acidic. Poaching by livestock may damage the soil structure. Loss of peat cover, lichen and mosses, bracken, etc.	Root crops, hedgerows, grass etc. must be kept in place so as not to disturb the soil structure. Some potential issues may be addressed by raising awareness.	Natural England, the Authority, Private Sector	
Changes to livestock and game management	2020	Likely	Traditional Northumberland sheep breeds do not thrive in hotter weather conditions and may be susceptible to disease. Extreme conditions may see increased occurrences of diseases (e.g. pneumonia and blue tongue), transferred by increasing insect populations (e.g. flies, ticks and mosquitoes). Animals may drown with severe floods. Game management typically includes wild grouse, pheasant, red leg partridge, fisheries and deer stalking. The industry is sensitive to the availability of food, breeding patterns in summer, parasites and the introduction of new predators. The number of shoot days may be affected. Fluctuating water flow levels, and increased water temperature, along with the amount of algae, could affect salmon.	Breeds of sheep, stock levels and farming practices may change depending on the availability of grazing land, fodder, water supplies, and shelter. An increase in the amount of sheep housing could be a necessity, which will affect planning.	National Farmers Union, Country Land and Business Association, Game and Wildlife Conservation Trust, the Authority, Private Sector	
Changes to crop management	2020	Likely	The types of crops may change as market demand for biofuels increases. Water logging and harvesting patterns may change.	Some potential issues may be addressed by raising awareness.	National Farmers Union, the Authority, Private Sector	
Changes to boundaries, trees, hedgerows and woodland	2020	Likely	Woodlands susceptible to diseases, fungal growths, etc. Tree planting has to be economically viable. Warmer weather may negatively impact on species mix of hedgerows. Intensification of agriculture may result in larger field sizes.	Some potential issues may be addressed by raising awareness.	The Authority, Natural England, Forestry Commission	
Reduction of water availability	2050	Likely	Local wells and aquifers may dry up. An increase in the number of springs and storage facilities for captured water (including ponds, which could also be used to stop wildfires), drying up of streams. Increased maintenance of pipe work and inefficient systems will need replacing. Quality of water may deteriorate if nitrates are leached into the resources.	Some potential issues may be addressed by raising awareness.	Environment Agency, Natural England, the Authority	

5.5 Thriving Communities

To ensure the thriving and vibrant communities have a strong sense of place and an economy grounded in the natural and cultural qualities of the National Park.

Risk	Time-Scale	Likelihood by Time-Scale	Consequence Commentary	Actions	Indicative Monitoring	Risk Rating
Changes to housing stock	2080	Likely	Traditional, well-made stone buildings will continue to be durable. Some buildings may get abandoned if flood risks are continually severe. If tourism increases, the demand for second homes may also increase. Retrofitted adaptation or mitigation (e.g. insulation) methods may become commonplace.	Monitoring of abandoned buildings. Ensure availability of local needs housing through planning process.	The Authority, Northumberland County Council, Community and Voluntary Groups, Private Sector	
Damage to locally critical infrastructure	2050	Likely	Flooding may be experienced all year round, but is particularly likely to occur in the winter months. It can affect residential and commercial properties and the use of local services to intervene and provide remedial work. It can damage such as roads and bridges, and devastate farmland. In extreme cases, it can cause death and bring diseases, especially if the water supplies become polluted. Flooding has the potential to destroy the special qualities of the National Park and pose a health hazard. The cost of the damage will depend on the severity of the instance. Roads susceptible to melting in hot conditions, damage by potholes in cold weather, and/or slippage in wet weather. If the price of fuel escalates, alternative sources of transport may become favourable. Car parking spaces will need to accommodate an increase in the number of visitors. Existing rural broadband insufficient. Postal delays during extreme weather conditions already being experienced. Some design specification may be compromised in order to ensure adaptation specification (e.g. bridges).	Prioritisation of key roads for emergency services. The Authority will control development in areas at risk from flooding through the planning process. The Authority will continue to support local community flood plans, business continuity planning, farm resilience planning, and catchment management approaches.	Defra, English Heritage, Environment Agency, Highways Authority, Northumberland Community Flood Partnership, the Authority, Northumberland County Council, Private Sector, Community and Voluntary Groups,	
Deterioration of local economy and community life	2050	Likely	Non-farming economy characterised by a large number of people home-working and seasonal employment. Includes many small and micro businesses. Community life is characterised by access to public houses, schools, village post offices, places of worship, retail outlets, special interest clubs and doctor's surgeries. All are inter-related and the balance can be affected by subtle changes to a single factor. Floods or a change in farming practices could affect shows and fairs. Insurance costs could increase.	Some potential issues may be addressed by raising awareness and encouraging business continuity and farm resilience planning. Must ensure that remedial work in rural areas does not take any longer than it would in urban areas. An alternative means of income may need to be found to keep the shows relevant.	Private Sector, Northumberland County Council, the Authority, Community and Voluntary Groups	
Increased uptake of renewable energy	2020	Almost Certain	Solar panels could become even more effective with hotter weather, and use of biomass for heating will also continue to increase. Opportunities to invest in renewable energy and grey-water recycling systems. Installations only where appropriate.	Building Design Guide encourages the use of renewable energy technologies. Awareness will continue to be raised.	The Authority, Northumberland County Council, Private Sector	

Visual impairment of outward-facing landscape	2020	Likely	Increased number of wind farms visible from Northumberland National Park. Will affect the look and feel of the protected area if it becomes an island surrounded by wind farms. Scottish policies across the border will come into consideration.	Continue to seek to influence partners to protect the special qualities of Northumberland National Park.	The Authority, Northumberland County Council, Community and Voluntary Groups	
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5.6 A Valued Asset

To ensure the National Park is valued as a local, regional and national asset, with influence beyond its boundaries that is worth looking after now and for generations to come.

Risk	Time-Scale	Likelihood by Time-Scale	Consequence Commentary	Actions	Indicative Monitoring	Risk Rating
Deterioration of internationally important peat bogs	2020	Likely	Bogs are sensitive to reduced rainfall conditions, particularly if the water levels are not replenished in winter with peat drying out (releasing carbon dioxide) and loss of bog species. Accidental fires may increase in dry conditions damaging the surface bog vegetation and destroying accumulated peat below the surface. Inappropriate grazing practices and artificial drainage ditches may exacerbate these issues and make bogs less able to cope with changing conditions. Peatland habitats are also prone to erosion through recreation, which can be exacerbated by heavy rainfall. Wetter conditions will favour bogs and they are unlikely to be affected by run-off or land slippages due to their locations.	Ensure that water levels remain as high as possible by blocking ditches and removing regenerating tree species. Ensure that burning management plans are in place avoiding sensitive bogs and fire plans are in place for surrounding moorland.	The Authority, Natural England	
Deterioration of internationally important moorlands	2020	Likely	Drier conditions make accidental fires more likely which could result in damaging or destroying moorland vegetation and peaty soils. Inappropriate grazing and burning (location, timing or not well controlled) of moorlands for sheep or grouse management may also cause permanent damage to the habitat and reduce the ability to respond to climate change. Patterns of intentional burning may change with longer, wetter periods (particularly in late winter/early spring) and make controlled burns harder to implement. There may be changes in resident and migratory species – e.g. flowering times may be brought forward with warmer winters causing a mismatch with pollinators and dependant species. There could be an increase in some species (e.g. mobile insects such as butterflies). Equally, diseases may also increase in type and frequency, particularly with occurrences of warmer winters.	Ensure moorlands are in good condition by preventing over-grazing – winter stock levels are particularly important. Ensure that moorlands have management plans for intentional burning, avoiding sensitive habitats. The frequency, timing, and heat levels are critical to good management. All moorlands should have fire plans developed to prevent fire spreading and to ensure that outbreaks are treated quickly and effectively.	Northumberland Fire Group, the Authority, Natural England	

Deterioration of nationally important grasslands and hay meadows	2020	Likely	Dry summers may reduce the growth in hay meadows and lead to pressure to apply nitrogen fertilizers to boost yields at the expense of the field diversity. The Whin Sill has a thin soil structure and will be affected by hotter, drier summers. Milder winters may see more invasive species encroaching on important grassland habitats.	Ensure that species-rich meadows do not have artificial fertilizers added and are shut-up for a period every year. Work with managers to source manure or other winter feed if yield levels drop in important hay fields. Ensure that areas of Whin grassland are well managed and are not over-grazed or affected by scrub encroachment.	The Authority, Natural England	
Deterioration of rivers and burns	2020	Likely	Water levels and water quality will be affected by flash flooding. Marginal vegetation may be altered and silt levels in rivers may increase due to increased run-off and soil erosion after periods of high rainfall. Increased temperatures and associated fall in oxygen may lead to changes in species distribution including loss of sensitive invertebrates, increase in invasive species and increase in algal growth. Existing high quality streams could be damaged and the shallow Roman Wall Loughs may become more turbid and nutrient enriched. Increase in stock pests and diseases may lead to increases in treatments/dipping and associated pollution incidents. Heavy rainfall periods may lead sewage treatment facilities and drains unable to cope leading to pollution incidents.	Prevent over-grazing of bankside vegetation and poaching by stock and manage wet woodlands and marginal vegetation to help prevent silt entering the system and loss of soil. Ensure stock treatment/dipping facilities are of good quality. Improve drainage and sewage treatment facilities to allow for increased rainfall events.	The Authority, Natural England, Environment Agency	
Deterioration of nationally important flushes and fens	2020	Likely	Prolonged dry periods could reduce ground water levels and the wetness of flushes and springs and therefore wetland species. Dry periods could reduce the availability of some invertebrate prey and feeding areas for wading birds. Traditional migratory birds may stay in Northumberland National Park if the winter conditions change and they can be accommodated. Alternatively, numbers may decline if migratory destinations are significantly altered elsewhere by climate change.	Ensuring fens, flushes and springs are in good condition – not over-grazed, poached or polluted will help them respond to changing conditions. Create scrapes, open ditches (in the correct locations) and permanent wet areas to provide feeding locations for wading birds.	The Authority, Natural England, Royal Society for the Protection of Birds	

6.0 Actions Proposed to Address Risks

6.1 High Priority Risks

The high priority risks are those where there is a significant (or greater) level of threats by 2020. These can be classified into three separate areas.

- Locally critical infrastructure. A new report has highlighted the urgent need to adapt the UK's infrastructure to the effects of climate change commissioned by Defra the report examines the risks the UK faces from rising temperatures and flooding.¹³
- Agriculture, livestock and game management. Climate change is likely to affect: the habitats of game and wildlife species; population levels of game and wildlife species; land management practices.
- Habitats and ecosystems. Upland hay meadows are one of the rarest types of grassland in the UK. Recent estimates indicate that there are less than 1,100 hectares in the UK; 40% are situated in North East England.¹⁴

6.2 Implementing the Adaptation Actions

The Climate Change Adaptation Report is aligned to relevant actions in the Management Plan Action Plan. This is annually monitored, reviewed and updated by the Management Plan partnership (see Section 1.4). The agreed lead organisation(s) for each action is also identified.

Outcome 1.1 People who come to the National Park will feel they have had an exceptional experience in relating to the landscape and in finding peace, tranquillity and adventure and will have enjoyed their visit	
<ul style="list-style-type: none"> • Survey the condition of 15% of the Public Rights of Way network to inform the preparation of the annual maintenance/improvement programme by: <ul style="list-style-type: none"> ○ Engaging ten volunteers in surveying 10% of the Public Rights of Way network; and ○ Completing national benchmarking surveys on 5% of the Public Rights of Way network 	Northumberland National Park Authority
<ul style="list-style-type: none"> • Prepare and oversee implementation of an annual programme of works on National Trails by: <ul style="list-style-type: none"> ○ Maintaining sections of flagged path and boardwalk (totalling 250 metres) at seven sites along the border ridge on the Pennine Way; ○ Improving the route at Brocolitia on the Hadrian's Wall National Trail by re-locating the existing flagged path onto a better line; and ○ Developing with partners a suitable regime of future maintenance for National Trails 	Northumberland National Park Authority
Outcome 1.3 A more diverse range of learning opportunities will be available to help people understand, value and contribute to conserving, enhancing and enjoying the National Park's distinctive natural and cultural qualities	
<ul style="list-style-type: none"> • Assist 4 new schools to work towards 'eco school' status using the National Park as the key learning resource 	Northumberland National Park Authority
<ul style="list-style-type: none"> • Review Skills and Training funding environment, Identify and secure resources if funding meets the Authority's objectives, including supporting a collaborative bid by Rural Development Initiatives to the Regional Growth Fund for training scheme for new entrants to the Forestry and Farming industries 	Northumberland National Park Authority

¹³ Secretary for State for Environment, Food and Rural Affairs (2011) *Climate Resilient Infrastructure: Preparing for a Changing Climate*, HM Government, London.

¹⁴ Harley, M., Buchanan, K., Berry, P., and Hodgson N., (2009) *Climate Change and Biodiversity in North East England*, ClimateNE, Newcastle upon Tyne.

Outcome 2.1 A distinctive place that will maintain a sense of inspiration and tranquillity	
<ul style="list-style-type: none"> The outcomes and objectives of the Management Plan are fully embedded into the emerging Local Development Framework for Northumberland County Council. Issues and Options consultation expected to be undertaken late 2011 	Northumberland County Council
<ul style="list-style-type: none"> Continue to monitor use of the rights of way network by motorised vehicles. Develop management techniques through the Authority and Northumbria Police Land Managers' Liaison Group to minimise damage on sensitive routes. Expand the scope of the group to be National Park wide 	Northumbria Police, Northumberland National Park Authority
<ul style="list-style-type: none"> The outcomes and objectives of the Management Plan are fully embedded in the Integrated Rural Management Plan for the Otterburn Ranges 	Defence Infrastructure Organisation
<ul style="list-style-type: none"> Ensure that the Coquet Valley remains protected from inappropriate development by using the Otterburn Training Area Landscape Character Assessment, wider Northumberland National Park Landscape Character Assessment and tranquillity mapping to direct development 	Defence Infrastructure Organisation
Outcome 2.2 The natural qualities and diverse habitats that characterise the changing landscapes will be safeguarded and enhanced	
<ul style="list-style-type: none"> Ensure Countryside Stewardship Scheme agreements ending in 2011 go into Entry Level Stewardship or Higher Level Stewardship 	Natural England, Northumberland National Park Authority
<ul style="list-style-type: none"> Deliver twelve new and add value to 10 existing Higher Level Stewardship schemes 	Natural England, Northumberland National Park Authority
<ul style="list-style-type: none"> Ensure three farms on the Otterburn Training Area go into appropriate environmental stewardship schemes 	Defence Infrastructure Organisation, Natural England, Northumberland National Park Authority
<ul style="list-style-type: none"> Develop a monitoring framework for Higher Level Stewardship to assess the success of positive management 	Natural England, Northumberland National Park Authority
<ul style="list-style-type: none"> Complete the required condition assessments and indicator of success visits for Sites of Special Scientific Interest 	Natural England
<ul style="list-style-type: none"> Provide grant aid to: support the creation of more than 100 hectares of new native woodland and to encourage the restructuring of even aged conifer plantations 	Forestry Commission
<ul style="list-style-type: none"> Woodlands with Authority agreements (Section 39 woods). Complete five Management Statements; engage ten volunteers to survey twenty sites; and complete maintenance work on eight sites 	Northumberland National Park Authority
<ul style="list-style-type: none"> Work with partners to develop a Landscape Biodiversity project. Produce an 'opportunities map' and scope potential funding sources 	Natural England, Northumberland Wildlife Trust, Northumberland National Park Authority
<ul style="list-style-type: none"> Target Higher Level Stewardship agreements to support enhancement works within the Whin Sill grassland on Hadrian's Wall 	Natural England
<ul style="list-style-type: none"> Deliver 20 Biodiversity Action Plan actions including: <ul style="list-style-type: none"> Monitoring upland heath at two sites; Surveying twenty hay meadows; Improving two mire sites by ditch blocking and/ or conifer removal; Undertaking heather seeding on at least one site; 	Northumberland National Park Authority

<ul style="list-style-type: none"> ○ Involving two communities to survey potential and known bat roosts at two sites; and ○ Completing bird surveys at five target sites 	
<ul style="list-style-type: none"> • Work with partners to further develop the Black Grouse recovery project including viability analysis modelling 	Northumberland National Park Authority
Outcome 2.3 The rich historic environment and archaeological heritage will be understood, valued and cared for	
<ul style="list-style-type: none"> • Work with communities and partners develop a Historic Environment Action Plan which identifies the priorities for the historic environment and programme for implementation 	Northumberland National Park Authority, English Heritage
<ul style="list-style-type: none"> • Undertake consolidation works at two farms on Hadrian's Wall, Hotbank and Cawfield 	Natural England
<ul style="list-style-type: none"> • Assess sites coming into Higher Level Stewardship for historic environment improvement opportunities 	Natural England, English Heritage, Northumberland National Park Authority
<ul style="list-style-type: none"> • Finalise the draft Conservation Area Appraisal and Management Plan for the Kirknewton Conservation Area 	Northumberland National Park Authority
<ul style="list-style-type: none"> • Deliver the Heritage at Risk Project and appoint Heritage at Risk Officer to: establish Heritage at Risk register; train voluntary rangers to deliver condition surveys and practical conservation; raise awareness of Heritage at Risk in the National Park; and begin conservation of priority heritage assets 	Northumberland National Park Authority, English Heritage
<ul style="list-style-type: none"> • Ensure all historic sites within the National Park Authority's care have an up to date condition assessment 	Northumberland National Park Authority
<ul style="list-style-type: none"> • Develop mitigation measures to ensure that "monuments at risk" on the Otterburn Training Area are addressed via the OTA Cultural Heritage Working Group 	Defence Infrastructure Organisation
<ul style="list-style-type: none"> • Update and implement management plans for all scheduled ancient monuments on Forestry Commission land 	Forestry Commission
Outcome 3.1 New and better approaches to sustainable land and water management have been tested, adopted and embedded	
<ul style="list-style-type: none"> • Forestry Commission Forest Design Plans for 3 state owned forests in the National Park revised to take account of the threat from tree diseases 	Forestry Commission
<ul style="list-style-type: none"> • Maintain certification to UK Woodland Assurance Standard through independent audit 	Forestry Commission
<ul style="list-style-type: none"> • Ensure that long term forest management plans are in place in both public or privately owned forests 	Forestry Commission
<ul style="list-style-type: none"> • Develop agreements to create 10ha of native woodland and fence 5ha of existing woodland 	Northumberland National Park Authority, Forestry Commission
<ul style="list-style-type: none"> • Work with landowners, the Authority and Natural England to help improve the ecological status of target ancient woodlands providing advice and grant support 	Forestry Commission
<ul style="list-style-type: none"> • As part of the 'Silt Reduction Project' implement better land management practices, including practical measures, to reduce runoff silt from entering the river system, and indirectly reducing diffuse pollution 	Environment Agency
<ul style="list-style-type: none"> • Higher Level Stewardship schemes to increase resilience to flooding and reduce pollution 	Natural England
<ul style="list-style-type: none"> • Deliver the Water Framework Directive programme of investigations and actions 	Environment Agency
<ul style="list-style-type: none"> • Deliver of capital works identified in Higher Level Stewardship agreements set up in 2010/11 along the River Rede 	Natural England, Tyne Rivers Trust

<ul style="list-style-type: none"> • Ensure compliance with Forests and Water Guidelines on the public forest estate and through woodland grant schemes 	Forestry Commission
<ul style="list-style-type: none"> • Work with Northumberland Community Flooding Partnership and the Tyne Rivers Trust to develop improvements to both the physical and ecological quality of the Haltwhistle Burn, from the source at Greenlee Lough down to the Tyne 	Northumberland National Park Authority
<ul style="list-style-type: none"> • Work with the Northumberland Community Flood Partnership to develop new approaches to the prevention, management and aftermath of floods by supporting the development of flood alleviation measures by one community flood group 	Northumberland National Park Authority
<ul style="list-style-type: none"> • Agree and adopt management plan for Greenlee Lough. Work with Natural England and the Environment Agency to agree water quality monitoring frequency and locations and implement measures to improve water quality 	Northumberland National Park Authority, Natural England, Environment Agency
Outcome 3.2 The National Park has made an important contribution to increasing understanding about, and demonstrating the practice of, sustainable development and responses to climate change	
<ul style="list-style-type: none"> • Deliver Year 1 activities of Phase 2 of the Cheviot Futures Climate Change Adaptation project: <ul style="list-style-type: none"> ○ Developing ten farm resilience plans identifying natural hazards and mitigation actions; ○ Implementing eight pilot resilience schemes; ○ Establishing a new lake at Linhope for use in fighting future wildfires; ○ Delivering two Wildfire training events in conjunction with Northumberland Fire and Rescue Service; ○ Installing a weather station and webcam at the Breamish Valley enabling information to be gathered on a catchment scale; and ○ Testing the Land Management Carbon Plan methodology on two farms in the National Park 	Northumberland National Park Authority
<ul style="list-style-type: none"> • Work with the Northumberland Fire Group to develop new approaches to the prevention and control of wildfires: <ul style="list-style-type: none"> ○ Incorporating a preventative burning regime into one Higher Level Stewardship Agreement; and ○ Engaging with three estates in the Park to develop collaborative burning programmes 	Northumberland National Park Authority
<ul style="list-style-type: none"> • Undertake further research to inform carbon sequestration capacity in the National Park including ascertaining the depth of peat at key locations across the National Park to further quantify the amount of carbon locked up in these soils 	Northumberland National Park Authority
<ul style="list-style-type: none"> • Promote the role of woodland planting and management in tackling climate change; in particular encourage uptake of the Woodland Carbon Code for woodland planting schemes that compensate for unavoidable carbon emissions 	Forestry Commission
<ul style="list-style-type: none"> • Develop a Climate Change Adaptation Plan to identify what the Authority and its partners will be doing to adapt to the opportunities and threats presented by climate change 	Northumberland National Park Authority
<ul style="list-style-type: none"> • Promote the production of wood fuel from undermanaged woodlands by, for example, offering grant aid 	Northumberland National Park Authority
Outcome 4.1 The communities in and around the National Park will have a strong connection to, and appreciation of, the National Park and be fully engaged in shaping its future	
<ul style="list-style-type: none"> • Work with Parish Councils, Action Area groups, County Council groupings, and the Northumberland Uplands Local Action Group to identify key local issues for residents 	Northumberland National Park Authority
Outcome 4.2 Effective infrastructure (services, facilities, networks etc.) will support socially and culturally active communities with a high quality of life and improved health and wellbeing	

<ul style="list-style-type: none">• Meet with six estates to raise awareness of sustainable development and climate change by December 2011	Northumberland National Park Authority, Energy Saving Trust, Northumberland Warm Zone
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7.0 Uncertainties and Assumptions

7.1 Working with Uncertainty

Climate change is sometimes presented in simple black and white terms: one either believes in it or not. This approach has been described as a false dichotomy.¹⁵ For instance, modern day weather prediction is inherently uncertain: if the atmosphere is in a chaotic state, the best advice the weather forecasters can provide are probabilities of different outcomes. As Professor Tim Palmer from Oxford University says, “We do not have to believe that our house will burn down in the coming year to take out insurance.” Similarly we do not have to believe that dangerous climate change will occur to start adapting. A great level of progress has been made in recent years to reduce the level of uncertainty in the field of climate change. However, three principal sources of uncertainty remain:

- Unknown future levels of emissions;
- Unknown natural climatic variability; and
- Imperfect representations in climate models.

UKCP09 presents probabilities of different future climates. These probabilities are created by weighting future climate projections on how well they represent the past climate, so they can be seen as the relative degree to which each climate outcome is supported by the evidence available. There are two types of probability; subjective and objective – UKCP09 is an example of subjective probability. This means that the data provided in Section 2 are estimates based on the available information and strength of evidence (similar to horse-racing odds or taking out insurance). The probabilistic climate projections are based on the best available information but there are still uncertainties. These depend on the climate model used, climate observations, the modelling method and assumptions, and choices made during the modelling procedure.¹⁶

UKCP09 data has been used as a basis to consult with experts on the likely impacts of climate change. The approach the Authority has adopted is to use the UKCP09 projections as a basis to allow experts to provide their analysis as to the likely impacts of climate change. Their views have been provided on the knowledge that societal understanding of climate change will improve over time, and such interpretation and analysis can likewise be updated.

A significant uncertainty to the operation of the Authority is the level of funding received from Defra. Some adaptation measures will require more investment than others, and some in the short term (2020), rather than the mid (2050) or long term (2080). A further level of uncertainty surrounds the partnership approach that the Authority is particularly adept at and the ability of partners to deliver. The most significant assumption is that the UKCP09 data is relatively accurate. It is this information that will underpin the programme of activity.

¹⁵ Palmer, T. (2010) *Climate Change Uncertainty Is No Reason for Inaction Since We Can't Rule Out Risk*, [Online]. Available at: <http://www.guardian.co.uk/environment/cif-green/2010/mar/22/climate-change-uncertainty> [22 March 2010].

¹⁶ UKCP09 (2010) *What Is Meant By Probability In The UKCP09 Probabilistic Projections?*, [Online]. Available at: <http://ukclimateprojections.defra.gov.uk/content/view/1205/531> [17 January 2011].

8.0 Barriers to Adaptation and Interdependencies

8.1 Overcoming the Obstacles

Defra has outlined some of the barriers to adaptation¹⁷:

- Market failures. These include lack of information or awareness of climate impacts, misaligned incentives and the public good nature of some adaptation measures.
- Behavioural barriers. Adaptation decisions can be complex, and involve dealing with long time horizons and uncertainty. This can lead to inertia and procrastination in preparing for the future climate.
- Adaptive capacity. Some may lack the ability to respond to climate change because of financial or other constraints.
- Natural capacity. Natural systems might be unable to adapt because of the natural pace of their adaptive capacity, their resilience to frequent stresses, and the surrounding environment.

The Authority considers there to be five main barriers to the implementation of its adaptation programme. In no particular order, these are:

Economic

These barriers entail an awareness of the adaptation that is required, but a lack of funding in order to undertake it. It also includes partnership working where the economic commitments may fall across more than one organisation.

Ecological

The majority of the impacts are likely to be felt first on the fringe of the habitat, which is where the monitoring procedures will draw awareness to the impacts taking place. However, adapting a habitat to better cope with the effects of climate change is a difficult task. Indeed, the extent to which it is possible to adapt is also difficult to ascertain.

Physical

Northumberland National Park is the single most remote part of England.¹⁸ It covers over 100,000 hectares (405 square miles) therefore there are tremendous physical challenges that will have to be overcome on a landscape-scale for the protected area to fully adapt to climate change.

Technical

Most technical barriers to adaptation are likely to be linked to restrictive legislation, prepared when climate change was not a prominent subject. These pieces of legislation will need to be identified and reviewed so that the 'red tape' restrictions are removed. All adaptations will nevertheless still need to be appropriate for the protected area.

Societal

The societal approach to climate change is fundamental to the success of the adaptation programme. This means that the Authority will need to carefully understand the ethical aspects of any given project, sources of local knowledge, and to be sensitive to the cultures and attitudes of local people. There are a shared set of common principles between the Authority and all the stakeholders mentioned in 1d and 2a. These principles revolve around the maintenance and welfare of the protected area.

¹⁷ Defra (2010) *Government's Role: Economics of Adaptation*, [Online], Available at: <http://archive.defra.gov.uk/environment/climate/adaptation/government-role.htm> [1 February 2010].

¹⁸ Northumberland National Park Authority (2009) *Management Plan: Inspiring Landscapes, Thriving Communities, 2009-2014*, NNPA.

9.0 Monitoring and Evaluation

9.1 Monitoring the Programme of Activities

The tables in Section 5.0 outline the indicative organisations responsible for monitoring the early signs of the consequences of climate change, where Section 6.0 identifies those organisations that are already committed to the Annual Management Plan Action Plan. It is their responsibility to alert others so action can be taken as and when required. In addition, the Authority will also utilise its Voluntary Rangers and wider community of local volunteers, who can also monitor the consequences of climate change and alert the Authority. The work of the Community Flood Partnership and Fire Group will also engage a wider constituency of people able to monitor and advise on changes.

9.2 Future Proofing

The Management Plan is a strategic document. Its implementation is assisted by Annual Action Plans agreed with partners. The specific adaptation actions that are required will be included in future Action Plans. The Management Plan is updated every five years and it is therefore flexible enough to include regular updates between 2011 and 2080. The Authority also produces a three-year Business Plan. If urgent adaptation is required, this can be incorporated into the Business Plan.

The Authority is a very forward-looking organisation, typified by hard working highly skilled individuals. In 2007 the Authority signed the Nottingham Declaration on Climate Change. In 2008 the Authority became a key partner of the Cheviots Futures project. In 2009 the Authority launched its Low Carbon National Park initiative. This is was a three-year venture designed to:

- Raise awareness about both climate change mitigation and adaptation;
- Test new ideas and technology that will help to lower the carbon footprint of the protected area;
- Focus the Authority's resources, both human and financial, to take action on climate change; and
- Work with partners to help deliver the whole initiative.

Northumberland National Park Authority Performance Assessment 2010

The National Park Authority Performance Assessment (NPAPA) is designed to help each National Park Authority understand its strengths and weaknesses, and so contributing to the continuous improvement process. The NPAPA for the Authority took place between 15th and 19th November 2010.¹⁹ Many partners, stakeholders and staff representatives were invited to talk to the assessors about the Authority. The assessment team consisted of five people from a wide range of backgrounds.

The independent assessment made some strong findings.

“Environmental issues are being addressed in a structured way. The Authority’s Climate Change Action Plan connects firmly to the principles of the Northumberland “Heat is On” plan. There is good support for activity through the Authority’s Low Carbon National Park programme that provides a robust focus on green jobs, low carbon farming, low carbon tourism, low carbon communities and renewable energy. The Authority is also working with partners to deliver increased carbon dioxide capture by enhancing and conserving peat habitats and by increasing the amount of new native broadleaf planted”

¹⁹ Lloyd, K. (2011) *Northumberland National Park Authority: Performance Assessment Report*, Solace Enterprises, Pontefract.

“Climate change issues feature well in community work. Authority initiatives on external environmental and climate change issues are widely recognised and well regarded and the Authority is seen as a leader in the development of new initiatives such as hydro schemes. Partners also feel there is good work being undertaken with communities on climate change through the Action Area teams who assist with climate change initiatives and who provide support to help reduce the carbon footprint of community buildings.”

“Partners would welcome an enhanced climate change role for the Authority. The performance in delivering Climate Change solutions suggests to partners that the Authority’s role could be extended to include them acting as the central point of information for all sectors of the community.”

The Authority’s work on climate change was classified under the ‘Achievement of Outcomes: Wider Sustainable Development’ Key Line of Enquiry. With regards to this area, the maximum possible score was awarded with the independent assessors concluding that the Authority is:

“An organisation that significantly exceeds minimum requirements [and] performs excellently.”

The production and publication of our first Climate Change Adaptation Report has harnessed the energy and enthusiasm of the staff in a work area that the Authority is already making significant progress.

Northumberland National Park Authority wishes to thank the following partner organisations.



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The information contained in this Adaptation Report is knowingly correct at the time of publication.
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