Malvern Hills National Landscape

sustainability west midlands

Climate Change Adaptation Plan for the Malvern Hills National Landscape 2025

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Project Manager: Morgan Roberts (SWM)

Report Author: Morgan Roberts (SWM)

Project Contributors: Alan Carr (SWM) Louis March-Smith (SWM), Paul Esrich (MHNLP), numerous stakeholders and consultees who contributed to the development of the Plan.

Quality assured by: Alan Carr (SWM)

Disclaimer: This report represents the independent advice commissioned from Sustainability West Midlands and partners and not necessarily that of the funders.

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About Sustainability West Midlands

Sustainability West Midlands (SWM) was established in 2002 as an independent, not-for-profit company and our purpose is to help the West Midlands become more sustainable, greener and fairer for all.

Our vision is that the West Midlands is leading in contributing to the national target of Net Zero greenhouse gas emissions by 2050 whilst addressing health inequality and driving inclusive growth. We monitor the West Midlands Sustainability 2030 Roadmap which acts as a framework that all organisations based or operating in the region can use to help them make changes to their activities in the knowledge that they will contribute to wider regional ambition.

SWM's support our members and other local stakeholders in the public, private and third sectors to implement these changes by enabling them to demonstrate innovation and leadership and provide opportunities to collaborate and celebrate success.

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Contents

Glossary

Refer to this table for all acronyms used in this document.

Table 1. Acronyms used throughout this document.

Acronym	Organisation/meaning	Theme
AHDB	Agriculture and Horticulture Development Board	Agriculture/Landowners
CAT	Centre for Alternative Technology	University
CLA	Country Land and Business Association	Agriculture/Landowners
COG	Colwall Orchard group	Community and Voluntary Organisation
DC	District Councils	Local Authority
DC Planning	District Council's Planning teams	Local Authority
DEFRA	Department for Environment, Food and Rural Affairs	Government Department
EA	Environment Agency	Public body
EHT	Earth Heritage Trust	Third Sector
FC	Forestry Commission	Public body
FiPLF	Farming in Protected Landscapes Fund	Fund
GCC	Gloucestershire County Council	Local Authority
HC	Herefordshire Council	Local Authority
HE	Historic England	Public body
HLF	Heritage Lottery Fund	Fund
HWFRS	Hereford & Worcester Fire and Rescue Service	Emergency Responders
LA	Local Authorities	Local Authority
LA Comms	Local Authority Communications teams	Local Authority
LA PH	Local Authority Public Heath teams	Local Authority
LEP	Local Enterprise Partnership	Business Support Organisation
LNRS	Local Nature Recovery Strategy	Strategy
LRF	Local Resilience Forum	Emergency Responders
MHNL	Malvern Hills National Landscape	National Landscape
MHNLP	Malvern Hills National Landscape Partnership (sometimes referred to as 'the Partnership' or the 'NL team')	Public body
MHT	Malvern Hills Trust	Land management organisation

Acronym	Organisation/meaning	Theme
NE	Natural England	Public body
NFU	National Farmers Union	Agriculture/Landowners
NHS	National Health Service	Public body
NL	National Landscape	National Landscape
NT	National Trust	Third sector
STW	Severn Trent Water	Water Company
UoW	University of Worcester	University
WBRC	Worcestershire Biological Records Centre	Biological Records Centre
WCC	Worcestershire County Council	Local Authority
WTs	Wildlife Trusts (including Herefordshire, Worcestershire, and Gloucestershire)	Third sector

Figure 1. View of the Malvern Hills National Landscape from Eastnor © JamesLaurie via Canva

Executive Summary

The Malvern Hills National Landscape (MHNL) faces increasing pressure from climate change, with more frequent and severe storms and floods, a higher likelihood of water scarcity, and more intense and prolonged heatwaves all potentially threatening its unique and sensitive characteristics. To address these challenges, a comprehensive understanding of the risks and opportunities from climate change specific to the MHNL is needed, along with a plan for how to adapt the landscape and its communities, infrastructure and businesses to this increasingly volatile and extreme climate.

Many different organisations and interests that together make up the MHNL Partnership (MHNLP) have a key role to play in managing these challenges. As part of DEFRA's Third National Adaptation Programme (NAP3), the Partnership is required to adopt a climate change adaptation plan and to incorporate it into future Management Plans by 2028. This report is the first of these adaptation plans, through which the MHNLP hopes to bring together those who work, live in, and enjoy the MHNL to take action to ensure that its nature, people and place are prepared for the impacts of climate change. In doing so it aims to help preserve the features of the MHNL that make it so special.

Section 2 of this report provides some background and sets out the purpose of this work. Section 3 provides some examples of impacts on the area in recent years to demonstrate the sort of effects we are increasingly likely to see and analyses how the climate is likely to change in the MHNL up to the end of the century. The results show that we are likely to see hotter, drier summers and milder, wetter winters in the MHNL. As well as these general trends, we will see the number of days with extreme heat increasing, and an increase in short and long-term droughts.

The report then assesses the vulnerability to climate change of the natural, built and historic environment as well as principal land uses such as farming and forestry. This comes in the form of a Annex 2: Detailed Risk and opportunity assessment found in Annex 2, split into the four themes of nature, climate, people and place with risks scored based on likelihood and impact of occurrence over the short, medium and long term. A summary of these impacts can be found in Section 4.

Section 5 of the report provides a series of actions that should be considered for implementation by identified relevant local stakeholders within the MHNL:

- members of the community and visitors to the NL;
- land managers, farmers and foresters;
- those who work in tourism, recreation, or with the built or historic environment, and
- the MHNL Partnership itself.

Section 5 includes sub-sections for difference audiences that provide context on how addressing climate change relates to that audience and contains recommendations on how best to apply adaptation actions to different circumstances, recognising the need to balance adaptation with other priorities such as business, conservation and food production. At the end of each subsection is a table laying out the adaptation actions that could be carried out to help organisations and communities prepare for and respond to the risks associated with a changing climate. These actions include indications of the amount of resource that may be needed, other partners that could help deliver or fund actions and how long these actions may take. The advice is to start small and speak with the MHNL Partnership if further support or information is needed.

Summary of adaptation actions

For communities within the MHNL and visitors, adaptation actions in Section 5.1 mostly focus on understanding and considering the different landscape types and habitats in the MHNL and their unique risks from climate change. This means that any actions taken by those spending time in the NL, whether that be carrying out conservation activities for the natural, geological or historical environment or simply enjoying the area, also improve its resilience rather than exacerbating the impacts of climate change.

For land managers, farmers and foresters, understanding the landscape is key to adapting to climate change. Section 5.3 helps to identify the key features, habitats and species on land, assesses their vulnerability and selects areas for effective adaptation. It also offers recommendations for land management and agricultural practices to boost resilience, along with guidance on balancing climate adaptation with other land use priorities such as food production and nature recovery.

Section 5.5 offers recommendations for approaching adaptation of the historic environment in a way that conserves and enhances it. It suggests a step-by-step approach to adaptation, starting with improved maintenance, followed by land management around historic features, adjusting behaviours and processes, and only then, if necessary, considering hard infrastructure and building upgrades. This section also provides guidance on maintaining access to recreational sites by understanding and addressing climate change risks to paths and access points.

Finally, recommendations are laid out for the MHNLP in Section 5.7. The aim is for the MHNLP to act as a central coordinating body to provide support and strategic direction, hold partners to account and ensure the actions get taken forward, including:

- maintaining momentum from the engagement carried out during this project and scaling this up to engage more groups;
- carrying out further activities to identify and assign resource (financial and otherwise) to actions, re-assessing the prioritisation of actions throughout the plan and
- establishing outcomes and measures of success to be able to monitor progress whilst maintaining flexibility, appreciating that needs may change as climate change takes hold.

Driving this adaptation plan forwards

Recognising that climate change adaptation is by no means the only priority for those stakeholders named in this plan, Section 5.9 highlights opportunities for co-benefits, including carbon sequestration, nature recovery, improved agricultural productivity and building a stronger pride of place.

Finally, Annex 1: Strategic alignment explores how adaptation actions can align with and strengthen existing priorities in the MHNL Management Plan, as well as regional and national objectives such as the upcoming Local Nature Recovery Strategies. The landscape will change no matter what, so the options are to be a part of shaping that change or to do nothing and risk watching it change beyond people's control or wishes. This adaptation plan allows all those with an interest in the MHNL to prioritise, focus and coordinate efforts so people can continue to enjoy everything the area offers now and for generations to come.

1 Introduction to MHNL

A National Landscape (NL) is the everyday name for what is set out in legislation as an Area of Outstanding Natural Beauty (AONB). National Landscapes, along with National Parks, are designated under the 1949 National Parks and Access to the Countryside Act. The Malvern Hills National Landscape (MHNL) is an area of 105km^2 spanning Worcestershire, Herefordshire and Gloucestershire.

The protected landscape was designated because of its outstanding natural beauty, which legislation and regulation states should be conserved and enhanced. 'Natural beauty' is not just the look of the landscape, but includes landform and geology, plants and animals, landscape features and the rich history of human settlement over the centuries. This therefore includes the influences of agriculture and the built environment. A National Landscape Partnership exists locally to take a lead on the conservation and enhancement of the area.

Throughout this document, specific species, habitats, landscape features and other key qualities of the MHNL listed above are referred to, with specific guidance from the MHNL and partners on how to address these specific and sometimes unique challenges.

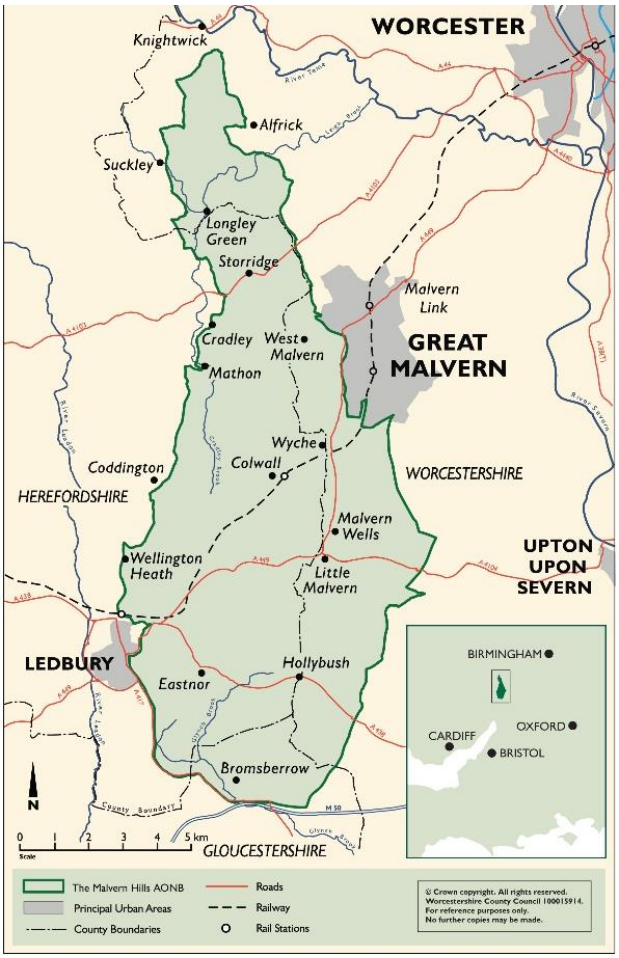

Figure 2 (Right). Map of the MHNL (border shown by green line). Key villages and towns labelled for reference.

A full list of these special qualities is laid out in the Management Plan 2025 and include:

A distinct and varied landscape; the Malvern Hills is a distinctive, narrow, north-south ridge of ancient rock that is visible from the Severn Vale and from the rolling hills and valleys to the west, and contains:

- A wide variety of landscape types in a relatively small area. Assessments of the area's landscape character identify ten distinct landscape types. Woodland and grassland in varying mixes are the most prevalent.

- A distinctive and varied geology, with a variety of different rock types including granites, diorites, volcanic lavas, limestones, sandstones, mudstones, shales and Ice Age deposits. This gives rise to the unique array of landscapes and natural habitats.

- A distinctive combination of landscape elements that include orchards, parklands, ridgelines, ponds, quarries, hedgerows and watercourses.

- An historic landscape of ancient unenclosed commons, varied field boundary patterns and designed parks and gardens.

- Distinctive villagescapes, including conservation areas, listed buildings, vernacular building styles and local features (such as specimen tree planting) that define a 'spirit of place' in the settlements.

Important natural and historical environments:
- An unspoiled 'natural' environment supporting a wide variety of wildlife, many of which are nationally recognised priority habitats and species and are nationally rare.

- A rich and distinctive historic environment including Bronze Age burial grounds, Iron Age hill forts, moated sites and industrial architecture.

Access to nature and high quality of life:
- Thriving and active communities with a low deprivation index that reflects the area's prosperity and the availability of employment.

- Open access in many places over the hills and commons, providing opportunities for bracing walks with fine views.

2 Background to and purpose of this report

2.1 Why this report is required

The precious and sensitive characteristics of the MHNL set out in Section 1 could be put under significant pressure due to the impacts of climate change, through the potential for more incidents of severe flooding, extreme heatwaves and storms. As such, MHNL needs to respond to this pressure through a plan of action to ensure the landscape and its characteristics can remain resilient in a more volatile and extreme climate.

As the MHNL Partnership (MHNLP) has a key role in helping to manage the pressures on the NL, it is appropriate that it is now required to adopt a climate change adaptation plan and embed this within future Management Plans by 2028 as per the ask of DEFRA through the Third National Adaptation Programme (NAP3).

Sustainability West Midlands (SWM) has been commissioned by the MHNL team to develop this Climate Change Adaptation Plan, aimed at providing a series of actions that should be considered for implementation to ensure that the National Landscape's natural environment, people, infrastructure, buildings and businesses are prepared for the impacts of climate change, including greater incidence and severity of flooding, a higher likelihood of water scarcity and more intense and prolonged heatwaves.

2.2 Aim of this report and what it includes

Aim: to ensure that the National Landscape's Nature, People, and Place are prepared for the impacts of climate change and, in doing so, help preserve the features of the NL that make it so special, as per the MHNL Partnership's purpose.

As set out in Policy CL2.3 in the MHNL Management Plan, this Plan:

- Analyses how the climate is likely to change in the MHNL up to the end of the century.
- Assesses the vulnerability of key assets and features of the landscape to the impacts of climate change.
- Considers sectoral impacts for principal land uses such as farming and forestry, as well as the natural, built and historic environment.
- Sets out a climate change risk assessment of the key risks and opportunities the MHNL is likely to face, split into the four themes in the MHNL Management Plan and scored based on likelihood and impact over the short, medium and long term.
- Provides a series of actions that should be considered for implementation by identified relevant local stakeholders within the MHNL.
- Analyses how the adaptation actions can help to strengthen existing priorities as given in the MHNL Management Plan 2025, and how actions from this adaptation plan could be integrated into the Management Plan's next iteration.

- Recommends the highest priority actions, focusing on next steps and initial quick wins, and includes suggestions for monitoring and evaluation processes.

The Adaptation Plan was developed through engagement with a wide range of MHNL stakeholders, and as such this plan is for everyone who has influence over, and benefits from, nature in the MHNL, including public and voluntary bodies, farmers and landowners, local businesses, residents and visitors.

On adoption, the Climate Change Adaptation Plan will be embedded within the next iteration of the Malvern Hills National Landscape Management Plan. In addition, it is also intended that this plan takes into consideration, and therefore fits within, the wider priorities and plans for the area that the MHNL resides in, including activities in Herefordshire Council, Worcestershire and Gloucestershire County Councils, and Forest of Dean and Malvern Hills District Councils, such as Herefordshire's adaptation plan and the upcoming Local Nature Recovery Strategies. Further alignment with relevant strategic documents can be found in Annex 1: Strategic alignment.

2.3 Key messages

This is a climate change adaptation plan

Note that this plan is about climate change adaptation (as opposed to mitigation, or greenhouse gas reduction). Section 5.7 talks about co-benefits, and the MHNLP recognises that other factors need to be taken into consideration with respect to land-use and other priorities. For the majority of the actions and recommendations in this plan, the focus is on helping people understand a range of options for climate change adaptation, and it is up to them to weigh up where, when, and to what extent these actions are appropriate in the context of the MHNLP's wider objectives.

The climate is changing, and so will the MHNL

Whilst the role of the MHNL Partnership is to maintain the character of the landscape for nature and for people, and although this plan goes to every effort to ensure that the MHNLP can continue to support and conserve the NL as it is now, we do have to accept that change is inevitable. Section 0 of this report demonstrates that we are already seeing changes to the landscape from extreme weather and a changing climate, and that these patterns are likely and may even accelerate in future.

Figure 3. Up on the Malvern Hills. © Jennifer Sanerkin via Canva

A strong understanding of the core purpose and values of the NL and a clear unified vision for what the NL is, and should be, will help to adapt to a future where aspects of the NL may look or feel different but still provide value to nature and people. Whilst appearance and landscape character are a large part of this, by understanding exactly what the benefits of the NL are to nature, climate, people and place in terms of *how* they provide joy,

quality of life, and pride of place, it is possible to identify the qualities that need to be preserved even as the landscape and habitats change over the decades.

> The Landscape will change no matter what, so we have to ask ourselves whether we want to be a part of shaping that, or do nothing and risk watching it change beyond our control or wishes.

Recognising resource constraints

It is important to note that the actions included in throughout this report are recommendations of adaptation activities best suited to the MHNL. There will be actions within these that there is currently no resource assigned to, and some may seem to have significant barriers currently to being achieved. It is crucial, however, that this plan is as comprehensive as possible, and without suggesting activities that are not possible immediately, many important recommendations would be excluded. Sections 5.7 and 5.8 outline the recommendation to explore financing options in more detail for these activities, and each action has an indicated resource intensity and urgency score to help plan and prioritise.

2.4 How to use this report

Section 5 of this plan provides specific guidance for different audiences so that they can be a part of the work that the MHNL Partnership needs to do to adapt to climate change.

This is in acknowledgement of the crucial role that all stakeholders that live in, work in, and who enjoy the MHNL can have in ensuring the area is resilient to a changing climate. We recognise that many people rely on the MHNL in some way, whether it be for income, food production, sense of community, or as a place to relax and enjoy all that this area has to offer. Many people see themselves as custodians of the MHNL, a place which needs careful management and respect in order for nature, climate, people and place to thrive together.

The MHNL Partnership's asks of you are as follows:

Skip to Section 5 if you:

- are a member of the community or a visitor to the NL:
- manage land, including farming and forestry, or
- work in tourism, recreation, or with the built or historic environment.

Read through the pages relevant to you in Section 5. This will provide you with:

- context on how addressing climate change relates to you;
- a list of recommendations from the MHNLP on how best to apply adaptation actions to your circumstances, including when and where adaptation may be most appropriate taking into considerations other priorities and
- a table with adaptation actions that you could carry out to help you, your business, community, and the wider MHNL prepare for and respond to the risks associated with a changing climate.

These actions include indications of the amount of resource that may be needed, other partners that could help deliver or fund actions, and how long these actions may take. Start small and speak with the MHNL Partnership if you would like further support or information.

3 What climate change looks like in the MHNL

The purpose of this section is to provide an overview of the current climate and analyse how the climate may change in the MHNL in the short, medium, and long-term future. Changes in climate can result in hazards including heatwaves, droughts, storms, heavy rainfall and subsequent flooding, and overall climatic variations, and so by building a picture of the change expected in the MHNL, we can better predict the likelihood and severity of impacts. As such, this analysis has been used to inform the climate change risk assessment and action plan. This, along with the engagement activities carried out and taking into consideration the special features of the National Landscape, helps to ensure the outputs of this report are specific and reflective of the local area.

3.1 How is the climate in MHNL already changing?

In the Malvern Hills area, a long-running local weather station provides data reflecting the nature and pace of change. The wettest year since recording began in 1889 is 1924 (1,083 mm) and the driest is 1921 (469 mm). Up to the very recent past, the data do not show a trend towards more or less rainfall.

However, temperature records show more definitive trends. The average annual temperature is now about 1.3°C higher than a hundred years ago. There has been a notably warm spell in recent years, reaching a peak in 2022, where new records were set in across the UK. In Malvern, a temperature of 37.1°C was reached in July, (1.3°C above the previous record set in August 1990), and the mean temperature for the whole year was 12.02°C (0.36°C above the previous record, also set in 1990). Some examples of how these numbers translate into real-world impacts in or near to the MHNL are outlined below.

Case study: Wildfire on the Malvern Hills, July 2018

Disposable barbecue the cause of Malvern Hills wildfire with firefighters continuing battle at site

3rd July 2018

WORCESTER

Figure 4. Wildfire on Malvern Hills, July 2018 and
Figure 5. Wildfire on Malvern Hills, July 2018. ©Dave Throup Flickr

On 2 July 2018, a fire broke out on the Malvern Hills started by a disposable barbecue, exacerbated by the high temperatures and dry conditions leading up to the event. Five acres of land were burned on both 2 and 3 July. The location on the Hills was typical considering the dry acid grassland, which is particularly vulnerable to catching fire, but this location also made combatting the fire extremely difficult. Bringing water up to this height to put the fire out created a significant challenge, with the fire service needing ten pumps to put out the blaze.

Case study: July Floods of 2007

In 2007, Worcestershire, Herefordshire and Gloucestershire each broke new records for the wettest summer recorded. Homes, businesses and farms were inundated with water, some of which had never flooded before. There were incidences of schools and care homes being evacuated.

Figure 6. Flooding in Credenhill, Herefordshire in 2007 © Dave Throup Flickr

Flooding on roads meant some towns or villages were extremely difficult to get in or out of, such as Ledbury and Colwall, or cut off entirely. High volumes of traffic made it difficult for people to reach home, work, or to collect children, such as was experienced at a nursery in Malvern where teachers looked after children in their own homes as parents were delayed reaching them.

Other than direct flooding, disruption came in the form of the traffic disruption described, power outages, and half of Gloucestershire's population having their water cut off due to flooding of a water treatment centre.

Many of the watercourses at the north of the NL were decimated, with the inundation of water completely changing the shapes of the brooks in the long-term, impacting nature and the landscape character.

3.2 Future climate change projections in MHNL

Using the Met Office's UK Climate Projections service, future climate projections for the MHNL area show that average temperatures in the winter and in the summer are likely to continue to increase; we may see summers three degrees higher than the present day by the end of the next four decades, compared to the increase of one degree over the previous four. Future projections also show that, as in many areas of the UK, the NL is likely to experience wetter winters and drier summers. Whilst these changes may not be felt as soon as the changes in temperatures, in the long-term (projecting through to the 2080s), we can expect around 20% more precipitation in the winter months than we currently experience, but adversely in the summer we can expect anywhere from 20 to 40% less precipitation than present day.

Hotter, drier summers and warmer, wetter winters shown in the results below could result in more intense and unpredictable flooding, more frequent and severe heatwaves and droughts, and storms that are more extreme and damaging.

We are likely to see hotter, drier summers and milder, wetter winters in the MHNL.

To plan and deliver effective adaptation, the frequency and intensity of these events should be continuously reviewed as they occur to ensure adaptation measures are suitable for the actual changes experienced. These climate projections should be re-analysed regularly, ideally alongside every management plan review, and/or when the Met Office release a new suite of projections or updated data.

Table 2. Summary of the key changes that MHNL is likely to experience in the coming decades.

	Baseline (1981 – 2000)	Future if global temperatures rise by 3°C (likely by 2080s)	Difference between baseline and 2080s
Annual temperature	10.27°C	12.83°C	+2.56°C
Summer temperature	16.38°C	19.45°C	+3.07°C
Winter temperature	4.74°C	6.80°C	+2.06°C
Summer precipitation	1.64mm	1.22m	-26.1%
Winter precipitation	1.99mm	2.24mm	+12.5%
Days per year above 25°C	16.7	54.5	+37.8 days
Nights per year above 20°C	0	0.7	+0.7 days
Annual Growing Degree Days	1993	2755	+38.2%
Drought Severity Index	7.2	14.3	+98.6%

A full climate projections summary is available as a separate report, including breakdowns of the projections for temperature, precipitation, Annual Growing Degree Days (GDDs), and a Drought Severity Index.

4 MHNL climate risk assessment summary

This section summaries the risks and opportunities that are likely to arise as a result of the projected climate changes in MHNL outlined in Section 3.2, including reference to the exposure and vulnerability of some of the special features and key components of the MHNL management plan. The full climate change risk and opportunity assessment carried out for the MHNL area can be found in Annex 2: Detailed Risk and opportunity assessment. This has been used as an evidence base to develop appropriate actions that are detailed in Section 5.

The key findings of the risk assessment are as follows:

Hotter summers and milder winters

Figure 7. Fire service putting out a fire on the Malvern Hills, July 2018. ©Dave Throup Flickr

- Health: Hotter summers, as well as an increase in the frequency and intensity of heatwaves, are likely to cause an increase in heat-related illnesses (for people and for livestock) and increased hospital admissions or deaths, with individuals with existing vulnerabilities such as underlying health conditions suffering in particular.
- Infrastructure: Higher temperatures also put a strain on cooling systems and power grids, leading to higher energy costs and potential outages. There are likely to be increases in transport disruption due to, for example, overheating of railway infrastructure, and more damage to our roads which are not designed to cope with the temperatures we are beginning to see in the summers.
- Buildings: It is very important to note that the temperature projections provided are for external temperatures, and that people in residential properties or livestock in agricultural buildings are likely to experience much higher internal temperatures due to residual heat held in the thermal mass of the building. Whilst we may experience reduced heating needs in the winters as they become milder, consideration for whether our residential, commercial, and agricultural buildings are suited for higher temperatures can help reduce energy and financial costs as cooling demands in the summer increase.
- Nature: Some habitats and species rely on cold conditions and so may be disrupted by warmer winters, such as our native oak and other broadleaf trees which cannot germinate without a bout of cold weather, or pollinators such as bees who rely on specific climatic conditions at different stages in their life cycles. Additionally, fewer cold days and overall rising temperatures can lead to increased survival rates of pests and diseases, both for humans and for agriculture.
- Landscapes: Increasing temperatures and drought can result in higher likelihood of open fires and changes in vegetation patterns and agricultural land use, all of which may affect the visual appearance and character of the National Landscape, especially where these risks impacting key areas such as the dry acid grasslands on top of the

Malvern Hills (particularly vulnerable to open fires). The types of crops that are viable in the area will change concurrent with the conditions, a particular concern for traditional orchards, but also potentially an opportunity if these changes are embraced and planned for in a way that enhances the NL rather than damaging it.

Water: either too much, or not enough

- Enhanced drought risk: Elevated temperatures are likely to result in more frequent, intense, and/or prolonged periods of drought within the MHNL. People reliant on private water supplies of the NL, in particular throughout the Malvern Hills and Commons, will be particularly vulnerable to these instances, as will agriculture throughout the NL due to the water-intensive nature of the sector and the threats water scarcity poses to crop production, forestry and the welfare of livestock. Significant depletion of water resources can also cause significant and sometimes long-lasting damage to the natural environment as habitats such as wetlands and watercourses dry out. As groundwater is used to replace limited mains water supplies, there are risks of exacerbating these issues in natural habitats.

- Enhanced flood risk: The National Landscape is not, at present, an area widely prone to flooding from watercourses, given that rivers are limited in number throughout the NL boundary. However, extreme rainfall events can have an impact on the natural environment and landscape character of the NL, such as the floods in July 2007, when watercourses were completely inundated with water and their shape completely changed. Some towns and villages have been affected by flooding from rivers or surface water because of limited drainage. When this is combined with greater pressures on our drainage infrastructure alongside the increased frequency and intensity of rainfall, this risk is only likely to increase.

Figure 8. Flooding of a petrol station in Powick, 2007. ©Dave Throup Flickr

- Water quality: One of the main concerns around changes in rainfall patterns in the MHNL are likely to be related to waterlogging and the link with poorer water quality. Waterlogged land can make planting unviable or kill existing crops and wildlife/plants, and the quality of our water is at risk due to agricultural run-off of pesticides and fertilisers and an increase in turbidity from soil erosion. Increasing pressures on agriculture from climate change resulting in an increase in pesticide and fertiliser use only exacerbates this issue.

- Erosion: The dry acid grasslands at the top of the Malvern Hills are, by definition, vulnerable to erosion due to their upland location and free-draining soils overlying loose geological features such as acid rocks and sands. An increase in precipitation and heavy rainfall events could significantly accelerate erosion on these SSSIs and throughout uplands in the MHNL.

The full, detailed risk and opportunity assessment can be found in Annex 2: Detailed Risk and opportunity assessment.

5 What actions can be taken?

This section provides advice and potential actions that can be implemented by communities, farmers, landowners and businesses to help address some of the risks that climate change is likely to pose.

Many people rely on the MHNL in some way, whether it be for income, food production, a sense of community or as a place to relax and enjoy all that this area has to offer. Users should, therefore, see themselves as custodians of the MHNL, a place which needs careful management and respect in order for nature, climate, people and place to thrive together.

Acknowledging the crucial role that many people who live in, work in, and enjoy the MHNL can have in ensuring the area is resilient to a changing climate, this section has been produced to provide specific guidance for different audiences, so they can be a part of the work to adapt the MHNL to climate change.

Find the section below relevant to you, which will provide:

1. Context on how addressing climate change relates to you;
2. A list of recommendations on how best to apply adaptation actions to your circumstances, including when and where adaptation may be most appropriate taking into consideration other priorities and
3. A table with adaptation actions that could be implemented to help individuals, businesses, communities and the wider MHNL prepare for and respond to the risks associated with a changing climate.

Regarding the table of adaptation actions, the box below describes what these include.

The table of adaptation actions includes the following information (described by the order of the columns, left to right):

- the action number;
- a brief description of the action;
- further information about each action and the justification for its inclusion;
- relevant local stakeholders who could support or lead on its implementation (acronyms are included in the glossary at the start of this document);
- bodies that could potentially fund the implementation of the action;
- whether the action should be (either due to urgency or its simplicity) implemented in the short (within the next two years), medium (two-10 years) or long (>10 years) term and
- whether implementing this action is expected to be intense from a resourcing and cost perspective, from Low (L), Medium (M) to High (H).

We have prioritised each action as shown below. The separate methodology report provides details on how these actions were prioritised:

VH-I	Very High and Immediate
VH	Very High
H	High
M	Medium

It is acknowledged that many landowners are already carrying out many of these activities. Continuing these actions and ensuring stakeholders share progress and best practice with other landowners and the MHNLP can help unify and accelerate adaptation in the MHNL.

Remember - this plan is about adaptation. Section 5.7 talks about co-benefits, and the MHNLP recognises that other factors need to be taken into consideration with respect to land-use. For the majority of the actions and recommendations in this plan, the focus is on helping people understand a range of options for climate change adaptation, and it is up to stakeholders to weigh up where, when, and to what extent these actions are appropriate.

5.1 Advice and actions for members of the local community

Annex 2: Detailed Risk and opportunity assessment relates to climate change in the MHNL; this can be used to help understand your risks, or to develop your own risk assessment for a specific community or organisation within the MHNL. If you are part of a community or voluntary organisation that would like to continue/start supporting nature preservation or enhancement within the MHNL, use this adaptation plan to gain ideas on effective activities to help manage these risks and to understand the types of habitats in your area that may need support the most.

5.1.1 Advice #1: Ensure any work you do with nature is the Right Action, in the Right Place

It is important to recognise that not all actions to help enhance nature may be appropriate in your area. For example, in the MHNL, generally prioritising informed land management over 'rewilding' important habitats will be more effective for nature, people, and place. See the 'Right Tree, Right Place, Right Reason' campaign as an example to help you understand this, and speak to local experts, community groups, or the MHNLP if you are planning on carrying out any nature-related projects to ensure these have the maximum impact.

5.1.2 Advice #2: Know your landscape types and habitats

Areas and features that are most likely to benefit from support, depending on the area, could be:

- ancient woodlands or trees; planting schemes could help create a buffer for these habitats from floods and high winds;
- traditional orchards that may be expensive and labour intensive to maintain for owners could benefit from volunteer support in managing or harvesting (see Colwall Orchard Group case study at the end of this section);
- wetlands, wet woodlands, rivers and brooks are extremely important ecosystems for flood and water management, and so restoration and conservation of these sites can have a big impact on flood risk, water quality and local climate regulation and
- spaces around farmland; by working with local farmers and landowners to improve the nature in and around farmland, some of the impacts that agriculture can have on the natural environment can be mitigated. This can be done in a way that also helps adapt to the impacts of climate change on the farms, the natural environment and communities.

5.1.3 Advice #3: Education and awareness raising

Another important thing you can do as a member of the MHNL community is to understand the impacts your individual actions could have on the resilience of the environment around you and to help raise awareness of this with others. This includes:

- the outdoor fire risk associated with things like outdoor barbecues, especially during a heatwave;
- the impact your water consumption has on water scarcity and water quality in rivers, and how to save water and
- checking your wastewater is being treated correctly.
- Where and how you travel through the National Landscape:
    - have you visited some of the less popular sites in the MHNL? This could reduce the impact of footfall on key sites like the Malvern Hills ridge area, which is particularly vulnerable to erosion.
    - do you use a bike/electric bike or similar in the MHNL? Make sure you are using paths that are designed for/able to accommodate these types of vehicles and take care when using sites before, during or after severe weather, as your actions in combination with rain or drought could damage man-made and natural paths. You could consider avoiding certain routes at these times.

5.1.4 Advice #4: Use citizen science

Consider setting up or getting involved in citizen science programmes that could routinely monitor areas for pests and diseases, new species colonisations, water quality, and other climate impacts. Work carried out on one of the geological sites by a Geological Site Volunteer group (see the MHNL Nature Recovery Plan for more details) is a great example of working with local communities. You can also peruse the Wildlife Trust's examples of Citizen Science Projects for inspiration and this guide on Citizen Science best practice from the UK Centre for Ecology and Hydrology.

Case study: Volunteer groups supporting the MHNL

Figure 9. (Right) Children from the Downs School, Colwall, collecting Apples and
Figure 10. (Left) Volunteers in Dingle Quarry ©MHNLP

Figure 10 shows geological site restoration. Local geology clubs and a volunteer group, working with the MHNLP and Earth Heritage Trust, have restored multiple Sites of Special Scientific Interest (SSSIs) or Local Geological Sites whose conditions were declining. Almost fifty geological sites showing local unique geology special to the MHNL have been

substantially improved and made accessible for researchers and the public since 2014, with an investment of over 300 volunteer days so far.

Figure 9 shows Colwall Orchard Group (COG). The group owns two community orchards which showcase good land management for wildlife and community use. In partnership with the MHNL, the Group is also creating and restoring traditional orchards and advising orchard owners on enhancing the future health and condition of their orchards.

5.2 Action plan for local community members

Error! Not a valid bookmark self-reference. below provides a list of potential actions, including those above, that you might consider carrying out or supporting the MHNLP to deliver to increase the resilience of the MHNL.

Table 3. Action plan for local community members.

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
1.	Advocate for climate adaptations in new footpaths and active travel routes.	When feeding into any planning application reviews for work in the MHNL, advocate for the accessibility of active travel routes and footpaths. Ensure that climate change risks are considered within this. Active travel routes in particular need to be sheltered from the worst impacts of extreme weather, otherwise residents and visitors may be discouraged from using them. Examples of more resilient routes could include shaded seating in the summer and water fountains, green infrastructure including trees and hedgerows that are hardier in high winds, and adequate drainage to help reduce flooding or water pooling and altering use of surfacing materials.	DCs; LAs; Living Streets; Sustrans	DCs; LAs	Short-term, ongoing	L	H
2.	Ensure any nature restoration work is conducted using the principle of the Right Action in the Right Place.	If you are part of a community group or are an individual who wants to support the MHNL or the environment more generally, it is important to recognise that not all actions to help restore nature may be appropriate in your area. For example, in the MHNL, generally prioritising land management over rewilding of important habitats will be more effective for nature, people and place. See the 'Right Tree, Right Place, Right Reason' campaign as an example to help you understand this, and speak to local experts, community groups, or the MHNLP if you are planning on carrying out any nature-related projects to ensure these have the maximum impact.	Individuals, communities, CVSOs	-	Ongoing	L/M	VH-I

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
3.	Develop awareness of the impact of individual actions on the resilience of the environment around us.	An important thing you can do as an individual, resident or visitor to the MHNL is to understand the impact your actions could have on the resilience of the environment around you and to help raise awareness of this with others. See the guidance in Section 5.1 of this plan for more information on this including your impact on fire risk, water security and the natural environment when visiting.	Individuals, communities	-	Ongoing	L	H
4.	Support the development of small, localised renewable energy systems.	The national grid may experience more service disruption and electrical outages as a result of more extreme weather. In the move to renewable energy as part of decarbonisation, smaller-scale, localised energy systems can help increase the resilience of communities' energy supplies and help to manage increasing populations without impacting the character of the area e.g., mini wind turbines, solar panels in small patches, underground heat networks etc.	MHNLP, LAs, DCs	-	Ongoing	L	H
5.	Set up or utilise existing community-led groups to routinely monitor areas for pests and diseases, new species colonisations, water quality, and other climate impacts.	Utilising community groups and volunteers will encourage local people to help protect and adapt their nearby green spaces, and monitoring on a more routine basis will ensure diseases are picked up early. Where resourcing is limited within public bodies for monitoring impacts on key species, habitats, and features of the MHNL, local people can be a huge asset. For example, the TreeAlert system could be used for more systematic logging of observed impacts. Citizen science projects can be used for inspiration and guidance on setting up projects. Work carried out on one of the geological sites by a Geological Site Volunteer group (see MHNL Nature Recovery Plan) is a great example of working with local communities. See the Wildlife Trust's examples of Citizen Science Projects for inspiration and this	MHNLP, Farmers and Landowners, CVSOs, WBRC, EHT	STW, EA	Medium-term	L/M	VH

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
		guide on Citizen Science best practice from the UK Centre for Ecology & Hydrology.					
6.	Set up or utilise existing community-led groups to help maintain traditional orchards.	Traditional orchards are a key part of the MHNL's character. However, they can be expensive, time consuming and labour intensive to manage, and so they may be at risk of being lost which has implications for the landscape but also for biodiversity and adaptation. Projects such as those carried out by the Colwall Orchard Group should be seen as best practice and considered elsewhere in the NL to help engage people with nature and their sense of place whilst also helping keep these sites alive.	MHNLP, CVSOs, EHT	HE, WTs	Medium-term	M	M
7.	Collaborate to deliver water saving initiatives through community engagement.	Water saving initiatives are an extremely important part of addressing resource scarcity. There is significant opportunity for residents and businesses to reduce their water usage to reduce pressure on supplies and strain on wastewater infrastructure, as well as providing benefits in cost savings and reaching sustainability targets for the region. The MHNL Partnership should work with water companies, the EA, and Local Authorities to help increase reach of any water efficiency programmes to communities and businesses.	Farmers and Landowners, Residents, STW	-	Ongoing	L	H
8.	Work with councils and conservation groups to ensure that retrofit can be carried out on historic buildings to ensure they are protected from	Property level adaptation is essential given that larger scale projects take a long time to implement and cannot necessarily benefit everyone. To take pressure off responding agencies, enabling householders to make their own property adaptations will ensure more people are protected from the worst impacts of climate change. Use guidance from Historic England and engage with local authorities and local heritage/conservation groups to ensure that any upgrades are in keeping with the	LAs, DCs, HE, NT	HE, Heritage Lottery Fund	Ongoing	M	H

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
	climate change, whilst still reflecting historic character.	historic environment. The MHNL's influence on the planning approval process should reflect the need to adapt to climate change whilst still maintaining historic character.					
9.	Use nature recovery projects to embed adaptation.	There is a huge opportunity to use the Local Nature Recovery Strategies which are currently under development by Local Authorities to allow nature to become a significant part of the adaptation solution by ensuring that new nature creation/ enhancement programmes, and better habitat connectivity, can help to reduce the impacts from climate change, as well as how protected landscapes (e.g. SSSI, SPA and SACs) may be affected by climate change. Working more closely with the LAs in the region through the LNRS can also enable a more joined-up approach for nature-based projects, unlock potential funding for these activities, and help track measurable outcomes of adaptation as an 'ecosystem service'. Use other biodiversity/ ecological focused strategies such as the MHNL Nature Recovery Strategy and the MHNL Ecosystem Service Report to help identify hotspots for nature-based solutions that support adaptation as well as all the other priorities in these strategies.	HC, WCC, GCC	HC, WCC, GCC, DEFRA (through LNRS)	Short-term	M	VH

5.3 Advice and actions for land managers

All of the advice in this section is applicable to people who own land of any size and for any purpose, be that for farming, recreation and tourism, or anything else. Key landowners engaged throughout this project and that this advice relates to include Eastnor Estate, Bromesberrow Estate and the Malvern Hills Trust.

Summary of actions for farmers and landowners:

- ☑ Work out what habitats, species and land uses you have on your land.
- ☑ Use the information in this plan to work out where on your site is most vulnerable and where provides opportunity for adaptation and other co-benefits like biodiversity.
- ☑ Collate this information to feed into a climate risk assessment and adaptation plan using Weathering the Storm for Agriculture and this action plan.
- ☑ Use the recommendations on agricultural and land management practices to ensure your business is as resilient as possible.
- ☑ Speak to your neighbours and local farmer/landowner networks to identify opportunities for collaboration.
- ☑ If you would like to discuss your options for adaptation with someone, contact the MHNL Partnership or other organisations such as the NFU, CLA, EA, FC or NE.

5.3.1 Advice #1: Co-benefits and competing priorities; identifying the best use for your land

Use the guidance in this plan to inform you of adaptation options and opportunities for your land. Uses of your land may include food production, nature conservation or recreation. The sense of place that your land provides may also be significant to you and the wider community, particularly if your land includes any of the special features of the NL (see Section 1).

While the MHNLP acknowledges that climate adaptation is not likely to be considered the main priority for modifying your land, the activities you undertake on your land do not have to contradict climate change adaptation; in fact, adaptation may sometimes be essential to ensure that these key activities can continue. There are also many adaptation actions which will provide co-benefits for things like nature restoration. The MHNLP recommends weighing up what you feel the best use of your land is and identifying where adaptation activities can support this. See Section 5.9 of this plan for more on identifying opportunities for co-benefits.

5.3.2 Advice #2: Support the key habitats and species on your land

The MHNL has identified a list of priority habitats and species within the MHNL that are either on the UK Biodiversity Action Plan (BAP) list or are important at a local level due to their uniqueness or contribution to factors such as sense of place in the MHNL. When considering climate change adaptation measures, it is not only important, but can be useful, for you to take into account these habitats and species because there is guidance and support available for protecting these habitats and species that can help drive your

adaptation activities. Ascertain whether the area of land you manage includes any of the key habitats and species outlined below so you can feed this information into your risk assessing and adaptation planning.

Table 4. List of habitats and species that contribute to the MHNL special features.

Key Habitats	Key Species
Lowland mixed deciduous woodland	Noble Chafer
Lowland dry acid grassland	Yellowhammer
Lowland calcareous grassland	Bullfinch
Lowland meadows	Skylark
Traditional Orchards	Song Thrush
Wood pasture and parkland	Adder
Veteran trees	Great Crested Newt
Rivers and streams	Dormouse
Hedgerows and hedgerow trees	Bats (Greater Horseshoe; Lesser Horseshoe; Barbastelle; Leisler's; Serotines)
Ponds	Black Polar
Wet woodland	Willow warbler
	Barn Owl
	Peregrine Falcon
	Polecat

Consider: Do you have any of these key habitats or species on your area of land?

5.3.3 Advice #3: Identify which aspects of your land are most vulnerable to climate change

This section identifies and summarises some of the vulnerabilities climate change poses to key habitats and species in the MHNL. Use this to help understand the unique risks in your area.

- Woodlands - many woodlands in the NL are relatively small and narrow and can often be found on the slopes or ridgetops on higher ground. As such, these woodlands can be particularly susceptible to wind and to the effects of intense sun, as well as extreme fluctuations in water content of the soil, all of which impact the health of the trees, the likelihood of trees falling over, and the types of species that survive. Deciduous woodland which is ancient in origin is a complex and highly evolved ecosystem which may be particularly susceptible to damage. Where woodland is under-managed or not managed at all, it is particularly vulnerable to the impacts of pests and diseases and could be more impacted by wildfires or flooding.

- Trees - many native tree species including oak and other broadleaf trees cannot germinate without a spell of cold weather, the reduction of which could have a

detrimental impact on our native trees in the landscapes such as within parklands and fields and in broadleaved woodlands.

- Wet woodland and wetlands - these are at risk of changing dramatically with current species suited to these wet conditions struggling and dying as a result of higher temperatures and lower water levels. These habitats can also suffer as a result of poor water quality which can be exacerbated by flooding and by low water levels in droughts.

- Water courses - there are a range of habitats that rely on specific water flow and levels in our brooks and streams, with key species including the native White-Clawed Crayfish and the Great Crested Newt dependent on these environments. Some stretches of the area's water courses are already prone to low flows, resulting in damage to riverine habitat, concentration of pollutants and less water for abstraction. Over-abstraction can have a compound detrimental impact.

- Geology - the unique and distinct rocks and geological features on the hills and in quarries throughout the MHNL are at particular risk of slipping following heavy rainfall events and when the ground is saturated. These are key habitats for a range of plant and animal species and create a distinct quality for the NL.

- Wildflower meadows and grasslands - these can be rich in biodiversity owing to their botanical diversity and the insect and other life forms they support. They could be at risk from wet summer weather delaying hay cutting, or forcing an earlier hay cut before flowering and seeding takes place. They are also at risk from general changing climatic conditions altering the species that are likely to thrive in these places. The most sensitive species which are least tolerant of changing conditions are likely to fare worst.

- Acid and calcareous grasslands - these are a significant part of the local landscape, supporting the wider conservation interest of the habitats (often as SSSIs), and some graziers partially depend on these spaces for their income. The biggest risks to these special grasslands in the MHNL are likely to be soil erosion (especially because they are often found on the tops or slopes of the Hills), changes in management practices and open fires. The grasslands distinct to much of the Malvern Hills have previously been at risk from encroachment where Sycamore and Ash were spreading over the open hills with scrub and bramble. This is now declining but needs active management.

Figure 11. Sheep in the MHNL ©Jennifer Sanerkin via Canva

- Water scarcity - getting water to livestock, especially higher up in the hills and uplands of the MHNL can be challenging, and this is exacerbated when water supplies are low during periods of drought. This also has serious implications for wildfires on the hills.

Increasing water storage capacity should therefore be a particular priority, especially in areas that could be difficult to reach for transporting water.

- Arable farming near a watercourse - careful consideration should be made of the risks to water quality from agricultural run-off and soil erosion, a risk that is likely to increase in frequency and intensity due to more frequent and intense rainfall episodes. Where possible, get involved in the Catchment Sensitive Farming initiative which helps farmers to protect water bodies and the environment.

5.3.4 Advice #4: Where on your land are there opportunities for adaptation?

As well as understanding the most vulnerable sites, habitats and species on your land, you can also use this information to identify the areas that might provide the biggest benefit for you and for nature if you were to improve them through adaptation. For example:

- On hills and slopes, grasslands that are north facing will be more protected from changes to drought and sun exposure and so should be expanded where possible to replace sites that are more likely to suffer.

- The Malvern Hills and other hills in the NL are vulnerable to fire risk, and grazing on the Malvern Hills has helped reduce this risk by creating breaks in vegetation, so should be continued wherever possible. If you decide to stop or reduce grazing, talk to the MHNL Partnership so that they can explore other ways to manage fire risk in the area.

- View this report that talks about how woodland management to support nature can increase timber yield, a potential revenue stream with increasing demands for wood fuel.

- Rivers, brooks, and wet woodlands are an extremely important part of our ecosystems, and when effectively managed, restored, or expanded, they have enormous opportunity to hold more water and reduce the impacts of flooding on your land and downstream throughout the MHNL and beyond.

- An opportunity assessment has been carried out to identify Natural Flood Management measures that could help slow water flow during heavy rain in the MHNL. See MHNL website for this report. Measures recommended include establishing grass bunds to temporarily slow/store water, installing water storage ponds on the floodplain, and assessing the feasibility of leaky dams in the streams and brooks.

5.3.5 Advice #5: Plan land management/adaptation actions for these habitats and species

You should now have a list of key habitats and species on your land and have started to build an understanding of which of these are vulnerable and/or provide opportunities for adaptation. The MHNLP recommends feeding this information into your adaptation activities by using the guidance for adaptation planning and delivery outlined below.

Note that much of this guidance is applicable more generally than just to the key habitats/species/land types mentioned and so should be considered by anyone hoping to increase the resilience of their land to extreme weather.

The MHNLP recommends the following activities for understanding your risks and adaptation options as a landowner or manager:

1. Use Weathering the Storm for Agriculture, a free guide that takes you through completing your own climate change risk assessment and adaptation plan (in less than a day).
2. Use the risk and opportunity assessment in 'Annex 2: Detailed Risk and opportunity assessment' of this document to help you understand your risks from climate change and/or to develop your own risk assessment.
3. Read through the recommendations for agricultural practices in the MHNL from the MHNLP below.
4. Read through the action table (Table 5) at the end of this section for a summary of adaptation actions for farmers and landowners.
5. Use Natural England's Climate Change Adaptation Manual to understand the risks to specific habitats and species where available to you, and consider the adaptation measures suggested.
6. Have a look at the case studies below showing examples of adaptation in action in the MHNL and similar settings.

Resource: Natural England Climate Change Adaptation Manual

Natural England have developed a Climate Change Adaptation Manual that provides free to use, online guides to understand the risks to, and adaptation techniques for, different habitats and species in England, as well as general guides for green infrastructure, geology and geomorphology, and access and recreation.

Cross-reference the characteristics of your land with the key habitats and species in the MHNL and use the Manual to understand the risks to these specific areas where available.

The following landscape types found in MHNL are included in Natural England's Climate Change Adaptation Manual:

Hedgerows	Lowland mixed deciduous woodland	Rivers and streams	Wood pasture and parkland
Upland acid grassland/ Dry acid grassland	Lowland meadows	Wet woodland	Calcareous grassland

5.3.6 Advice #6: Recommendations for agricultural practices in the MHNL

The Malvern Hills National Landscape Nature Recovery Plan focuses on active management of the landscape, particularly for its semi-natural habitats. This means that active management (as opposed to rewilding) will most always be the best option for adaptation in line with preserving the MHNL. Advice #6 aims to highlight risks and opportunities related to climate change for the key types of agriculture or different land management practices that you may carry out or be considering and states the MHNLP's recommendations relating to these issues.

It is recommended to use this list to help guide decision making as a farmer or forester in the NL to ensure your business is resilient to climate change and that activities are not negatively impacting nature, people, or the landscape you live and work in.

It is very important that the MHNLP and other partners work with farmers in various ways to help improve agricultural productivity in a sustainable way. To understand what the MHNLP and others are doing to support farmers and landowners in the MHNLP, see Sections 5.7and 5.8.

Arable farming

Certain land types in the MHNL, such as on the slopes and hills, are particularly vulnerable to soil erosion, something that will be all the more common with increasing and heavier rainfall. Therefore, the choice of land use is crucial to help reduce this risk, as erosion has impacts on your soil nutrient levels and on the quality of water which our nature and our health relies on.

Figure 12. Hay in a field in the MHNL. ©Kevin George via Canva

- It is recommended that the planting of maize is avoided where possible, especially on slopes, as this crop is particularly good at disrupting soil making it more likely to wash away in heavy rain. It is often harvested at a time of year when rainfall is generally at its highest.

- If you are growing/considering arable crops on your land, for selling or for livestock feed, there are ways to minimise soil erosion. Actions recommended include using cover crops between harvests, timing harvests so soil is not exposed in the autumn or when heavy rain is due, or considering whole crop cereal as an alternative. Read the Sustainable Farming Initiative's advice on minimising soil erosion and run-off from maize.

- Speak to the NFU, the CLA or the MHNL Partnership team or other groups for advice on alternative crops that can benefit your farm's productivity and our nature and communities.

- The MHNL Partnership does not recommend the conversion of grassland into biomass crops if they add extraneous elements to the landscape that have significant effects on the habitats and landscape character.

Forests and woodlands

The MHNL recommends regular monitoring for the occurrence of tree pests and diseases in forests and woodlands. In particular, Chalara Ash Dieback, Horse Chestnut Bleeding Canker, Horse Chestnut Leaf Miner (exotic insect pest) and Acute Oak Decline are likely to

impact the mixed deciduous (broadleaf) woodlands characteristic of the MHNL. See the Forestry Commission's standard practice guide on adapting forest and woodland management for a changing climate for more details.

Best practice for managing disease is likely to be to fell trees that suffer from these diseases, although there are exceptions to this, for example, certain trees with Chalara Ash Dieback. Whilst replacing trees like for like may ensure the characteristic of the MHNL is maintained in the short term, there will be situations where replacing trees like for like is not an effective option; if the affected species is suffering too much from pests and diseases, drought, waterlogging, and other impacts of climate change, it may be not be suitable to try and plant the same again without implementing other measures to reduce their exposure or vulnerability.

There are many options for planting that are likely to be more resilient and increase the resilience of the woodland as a whole. The MHNL recommends that prioritisation should be made based on whether the planting option provides additional benefits aside from resilience to climate change, for example enhancing biodiversity, whilst still keeping the characteristic of the area. This could mean:

- planting more shrubs, which often have deep roots helping slow the flow of water in heavy rain or holding water in drought, and provide varying habitats and food sources for animals;
- planting trees of the same species that exist locally but sourced from areas with a climate more similar to what we are likely to see in the near future (e.g., from further south);
- planting trees from the same species with varying genetic diversity (see Black Poplar example below);
- planting trees from different species alongside each other (diversification) and
- replacing native trees with other native trees that are more resilient, such as replacing Oak with Lime, or trees from further south.

It is acknowledged that replacing native trees with new, sometimes non-native, species may sometimes be the best option. Speak to the MHNL Team and the Forestry Commission when planning to expand existing woodlands or create new ones to help find the best solutions for your land.

Many types of woodland are either under-managed or not managed at all, which makes them more vulnerable to climate change, a key issue considering that deciduous woodland makes up a significant proportion of the MHNL and its landscape character. Consider whether there are opportunities on your land for harvesting wood fuel, as this could bring more woodland into active management. Peruse this report that refers to how woodland management can support nature and increase timber yield.

Grasslands

It is acknowledged that there are increasing pressures on farmers using some grasslands for grazing. These pressures are from a range of factors, including many that climate change exacerbates, for example, rising costs for farmers, unsuitable conditions for livestock in storms or extreme heat and the erosion and/or flooding of these grasslands. These could risk driving farmers to move away from grazing livestock on these lands altogether.

- Grazing by livestock such as cattle and sheep contributes to the creation and maintenance of many important habitats and without it the health of many of these special places is at risk. Reduced grazing and increasing, unmanaged scrub can also increase the likelihood of wildfires in some areas.
- If you are considering stopping or reducing grazing, talk to the MHNL Partnership so they can explore other ways to manage fire risk in the area.
- Improving grassland, for example by liming and top dressing or by sowing a more diverse sward can be effective methods to improve the quality of the soil and land for grazing animals. Grasslands can be highly important for nature as well as providing a strong sense of place, so careful consideration is needed before applying land management techniques for soil health.

Traditional Orchards

Because many orchards contain older and sometimes veteran trees which may have taken many years to establish it is recommended that, as with other veteran trees and older woodlands, maintaining existing orchards should be prioritised over planting new ones.

It is recommended that, where feasible, Traditional Orchards within wider landscapes that have other uses and values should be kept even if not being harvested for financial gains, because of the benefits these habitats provide for a sense of place and for nature.

Water storage

Careful considerations must be made regarding the scale, siting and design of water storage features to ensure they fit well and make a valuable overall contribution to the National Landscape and to conserving and enhancing natural beauty. However, the need to conserve water as a result of climate change is now well-recognised.

Working together

Sometimes adaptation measures may not feel feasible on your farm alone. Also, the issues you have with flooding or water scarcity could be as a result of management elsewhere rather than on your own land, and conversely your land management practices could be impacting someone else. As such, working collaboratively can make adaptation measures more affordable, larger scale and effective, as well as building trust between landowners and communities. Work with existing farm clusters, speak to your neighbours and/or contact the MHNLP for support in making connections for adaptation.

Case study: Steep ground harvesting and landslide prevention

This case study comes from the Forestry Commission's website, where more details and other case studies on woodland management and adaptation can be found.

On steep slopes, windthrow and landslides are increasing in likelihood due to more frequent and severe storms as well as winter rainfall. A project in Glen Righ Forest in Scotland aimed to assess and address this risk by creating a well-connected broadleaf woodland corridor, stabilising the slope.

Tools including the ForestGALES tool and the Ecological Site Classification decision support tool (ESC) are used to firstly understand the wind risk to a forest and then to identify a list of appropriate species to cope with future projections. In the case of Glen Righ Forest, large conifer trees by a road were removed and replaced with broadleaf woodland, improving tree and slope stability. Small areas of the forest were used as trials before carrying out works by the road. Specialist training and equipment were required due to the steep ground, as well as measures to protect the public during and after felling including rock catch nets and fences. The biggest learnings from the project were of the importance of specialist training due to the extreme nature of the environment.

Case study: Planting Black Poplars at Castlemorton Common

Malvern Hills Trust planted young Black Poplar trees on Castlemorton Common with small genetic differences from the local population to provide better resistance against disease.

When trees are propagated from cuttings all trees will be clones of each other and are therefore at greater risk should they become infected with a disease. By introducing more genetic diversity in the species in the area, the population as a whole is more resilient.

Figure 13. Tree planting at Castlemorton Common © MHNLP

Figure 14. Black Poplar Tree © MHNLP

Case study: Meadow restoration works

Grasslands and meadows across the MHNL and beyond are important features of the NL and provide significant benefits to biodiversity, but some of these have been damaged or are at risk of being lost due to pressures including agricultural run-off, waterlogging, and changing climatic conditions reducing the rich diversity in plant species.

Figure 15. Knapp and Paper Mill Nature Reserve © snapvision via Canva

Worcestershire Wildlife Trust (WWT) have carried out meadow restoration works on grasslands across the whole of Worcestershire, and manage a number of significant grasslands in the MHNL including those at the Knapp and Paper Mill Nature Reserve.

Activities include altering timings of hay-cutting to reduce the likelihood of being disrupted or delayed by poor weather, managing to ensure mixed species which increases resilience from things like pests and diseases and selecting plant species appropriate for grasslands and hay meadows that also hold more water or have water filtration qualities to improve soil and water quality. These are common features of any well-managed

grassland or meadow, demonstrating these habitat's importance in climate resilience for the wider environment as well as for other co-benefits provided such as biodiversity and pride of place for residents and visitors alike. The WWT have produced a guide to help you manage or create your own grasslands.

Case study: Managing a woodland with acute oak decline: Bell Coppice

Whilst it is not yet clear whether Acute Oak Decline (AOD) has increased directly due to climate change, impacts from the increased stress brought on by a changing climate seems to be a factor and an increase in insect pests is likely to increase as temperatures rise. Factors that likely contribute to AOD include drought stress, lack of management and poor soil conditions. Identifying and managing risks associated with AOD is therefore an effective adaptation strategy as we anticipate an increase in pests and diseases with a changing climate.

Figure 16. Dead oak in a forest. ©Aleksander via Canva

One example of this being carried out already can be found on the Forestry Commission's website, regarding a family-owned woodland in the Midlands called Bell Coppice. Adaptation measures include planting a mix of new broadleaved trees expected to be more successful in a changing climate alongside creating a variation in the age of the trees in the area to try and slow AOD. With more proactive management AOD incidence was reduced in Bell Coppice leading to a greater economic return from felled trees that had not been impacted by AOD.

5.4 Action plan for land managers

Table 5 below provides a list of potential actions, including those above, that you might consider carrying out or supporting the MHNLP to deliver to increase the resilience of the MHNL.

Table 5. Action plan for land managers.

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
Actions on planning for adaptation							
10.	Use resources including this plan and Weathering the Storm for Agriculture to understand your risks and how to plan adaptation.	This plan considers a range of advice and guidance on planning for adaptation specific to the MHNL. Weathering the Storm for Agriculture is a free guide, designed for use by farmers and landowners across the country, which provides practical actions and solutions, taking you through completing your own climate change risk assessment and adaptation plan in less than a day. This should be promoted across the farming community in MHNLP. Other resources that may be of use include the Forestry Commission's ForestGALES tool for evaluating the wind risk for a site, and a tool entitled D-Risk to help understand your drought and abstraction risks.	Farmers and Landowners, NFU, MHNLP	-	Short-term	L/M	VH-I
11.	Sign up for the Environment Agency's Flood Warnings and the Met Office severe weather warnings.	This will allow landowners and farmers to prepare more effectively for flooding or severe weather events such as storms and heatwaves when they are likely to occur, minimising the potential costs as a result.	Farmers and Landowners, Businesses, Communities	-	Short-term	L	VH-I
12.	Ensure any work you do with nature is the Right Action, in the Right Place.	When appraising adaptation actions (particularly related to nature recovery) for your land, as a community group, or business, it is important to recognise that not all actions to help restore nature may be appropriate in your area. For example, in the MHNL, generally prioritising land management over rewilding will be more effective for nature, people, and place.	Farmers and Landowners	-	Ongoing	L/M	VH-I

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
		See the 'Right Tree, Right Place, Right Reason' campaign as an example to help you understand this, and speak to the MHNLP or other organisations such as the FC, NE or HE if you are planning on carrying out any nature-related projects to ensure these have the maximum impact.					
13.	Use existing spatial information for locations that should be prioritised for adaptation when planning projects.	The Local Nature Recovery Strategies (LNRSs) being developed by Local Authorities will include a list of identified habitats that should be restored, spatial information on species at risk in the region, and spatial opportunities for nature restoration and habitat expansion/creation that will also provide a range of other ecosystem services (including reducing flood risk, heat, erosion). This information must be used when identifying where nature-based solutions for adaptation should occur. They should be used by the MHNL Partnership to plan where to support strategically, but can also be used by landowners and people responsible for land management to see what nature projects would be best suited for their land. Community and voluntary organisations can use this information to help identify places for potential projects such as local tree planting schemes or nature conservation days, as well as using the LNRS to demonstrate the need for and benefits of nature-based projects in funding/planning applications. Contact the MHNL Partnership or the local council that has developed the LNRS to discuss how your community group can help conserve and enhance the MHNL.	MHNLP, LAs, CVSOs, Farmers and Landowners, Businesses	-	Short-term	L	VH
14.	Use nature recovery projects to embed adaptation.	There is a huge opportunity to use the Local Nature Recovery Strategies which are currently under development by Local Authorities to allow nature to become a significant part of the adaptation solution by ensuring that new nature creation/ enhancement programmes, and better habitat connectivity, can help to reduce the impacts from climate change, as well as how	HC, WCC, GCC	HC, WCC, GCC, DEFRA (through LNRS)	Short-term	M	VH

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
		protected landscapes (e.g. SSSI, SPA and SACs) may be affected by climate change. Working with HC, WCC, and GCC to use the LNRSs to understand priority habitats, species, and locations for nature recovery will assist the prioritisation of locations for nature-based adaptation as set out in this plan. Working more closely with the LAs in the region through the LNRS can also enable a more joined-up approach for nature-based projects, unlock potential funding for these activities, and help track measurable outcomes of adaptation as an 'ecosystem service'. Use other biodiversity/ ecological focused strategies such as the MHNL Nature Recovery Strategy and the MHNL Ecosystem Service Report to help identify hotspots for nature-based solutions that support adaptation as well as all the other priorities in these strategies.					
15.	Set up/join groups for farmers and landowners to share information and collaborate for climate change adaptation.	Existing formal and informal farmers networks in the MHNL should be used to set up systems for sharing information and resources on extreme weather and for longer-term emergency and adaptation planning. One key use of these networks should be to plan how to share water between farms during a drought, or how to plan an event with the fire service in the case of a fire. farmers and landowners should consider using LandApp to share their activities with the rest of the region for more joined up thinking and action.	MHNLP, NFU, CLA, Farmers and Landowners	NFU, EA, CLA, DEFRA	Medium-term	M/H	VH
16.	Ensure climate impacts are considered in maintenance and planning for tracks, footpaths and access points.	Paths and access points should be assessed for their likely resilience to climate change based on their past performance during extreme weather and how future climate change could affect them. Following this, the most strategic paths should be monitored and maintained, with management plans drawn up to identify appropriate adaptation actions. Paths that should be prioritised for intervention are those that either experience the highest footfall, provide access to essential local services,	Landowners, WWT, LAs, DCs, Tourist sites, Living Streets, Sustrans	-	Medium-term	M/H	H

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
17.	Ensure waste management, storage and treatment on private land is robust to withstand future climatic conditions.	provide a single point of access to a specific site, and/or are accessible routes for a wider range of users. See Natural England's Adaptation Manual on Access and Recreation for more specific adaptation examples for paths and rights of way. Whilst waste handling is the responsibility of the Local authorities, there will be private landowners, land managers and tourism organisations that have to store significant amounts of waste, most significantly green waste from land management and farming. Through any engagement with these groups, ensure that information is disseminated on handling waste to prevent pollution in extreme weather such as this guidance from the Environment Agency.	Farmers and Landowners, LAs, DCs, EA	-	Short-term	L/M	H
18.	Work with the Forestry Commission to evaluate the feasibility of woodland expansion or connectivity on your sites.	Once you have identified potential locations for woodland planting, expansion or connectivity on your land using spatial mapping, the Forestry Commission are able to support you to understand the feasibility of planting on your sites and advise on specifics such as which species to use where. The NL Team may also be able to assist.	FC, Farmers and Landowners	FC	Short-term	M/H	M
19.	Consider the impacts on climate change resilience when selecting arable crops.	If you are an arable farmer, it is crucial to consider potential crops' impact on soil, as some crops or harvesting processes can increase the likelihood of soil erosion and run-off, a growing risk with increased frequency and intensity of rainfall. Read the MHNLP's recommendations regarding arable farming in Section 5.3.6 of this adaptation plan.	Farmers and Landowners	-	Short-term, ongoing	L/M	VH
20.	Consider new species suitable for a range of climates.	Identifying new species to help with land management and crop selection, especially for arable farming/livestock feed, is important in the context of climate change. Try to identify a range of new potential options rather than just one, so you are prepared for a range of scenarios that we may experience, including drought, poorer soil quality, flooding and higher	Farmers and Landowners	-	Short-term, ongoing	L/M	VH

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
		temperatures. Considering plants with different growing seasons will also be useful as the times of year that land management will be possible may decrease as disruptions from flooding or droughts become more frequent and severe. Also consider native species or species you already grow or manage, but from areas further south in the country that may therefore be more suited to rising temperatures.					
		Monitoring and prevention					
21.	Regularly monitor for and take preventative measures against invasive species, pests and diseases.	Even where your land is not currently suffering from pests or diseases, regular monitoring can allow for early intervention if issues appear. An example of prevention could be considering vaccination against potential future pests and diseases for livestock, including Bluetongue (which the NFU are currently planning in the MHNL area). See the recommendations from the MHNLP in Section Error! Reference source not found. of this adaptation plan on managing pests and diseases in forests and woodlands, in particular Chalara Ash Dieback, Horse Chestnut Bleeding Canker, Horse Chestnut Leaf Miner (exotic insect pest), and Acute Oak Decline, which are likely to impact mixed deciduous (broadleaf) woodlands. Volunteer and community groups can also support with monitoring for pests, diseases and invasive species. Organisations such as the MHNLP, the NFU and Natural England should consider what funding and support can be provided for preventative measures.	Farmers and Landowners	-	Short-term, ongoing	H	VH-I
		Water storage and management					
22.	Prioritise Natural Flood Management (NFM) strategies on your land.	NFM strategies mean introducing or improving natural processes to 'slow the flow' of flood water or to hold more water to prevent flooding downstream. These could include building leaky dams, restoring ditches and managing watercourse vegetation, grass bunds to temporarily slow/store water,	Farmers and Landowners, EA, MHNLP	EA, MHNLP, NE, FC, DEFRA	Medium-term, ongoing	L/M/H	VH-I

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
		planting vegetation and installing water storage ponds on the floodplain. Leave unfertilised rough grass margins to buffer watercourses. Retain and protect existing field ponds and wetlands, ensuring clean natural water supplies and periodic cutting back of overhanging trees.					
23.	Restore water courses and wetland habitats.	Ensure that existing watercourses and wetland habitats on your land are restored and maintained so they are healthy. See the Wildfowl and Wetlands Trust website for more on how to do this.	Farmers and Landowners, EA, MHNLP	EA, MHNLP, NE, FC, DEFRA	Medium-term, ongoing	M	VH
24.	Improve storage and use of excess winter rainfall on agricultural land.	Better storage and use of excess winter rainfall and other methods to maximise sustainable use of water resources (e.g. rainwater harvesting and on-farm reservoirs) should be carried out across the MHNL, particularly on agricultural land and, where, possible, nature reserves. This helps to manage heavy rainfall, prevent flooding, and mitigate against water scarcity. Measures can include natural water storage such as ponds, but also infrastructure so that excess water is held away from your land during the winter and can be used when there is less rain in the summer. Winter storage of water can benefit local wildlife, for example by reducing the need for abstraction from water courses.	Farmers and Landowners, EA, MHNLP, DC Planning	EA, MHNLP, NE, FC, DEFRA	Medium-term	M	VH
25.	Set up water storage and systems to maintain wetlands during droughts.	If smaller watercourses, wetlands, or wet woodlands dry out during droughts, this can have severe impacts on the species within these habitats. By storing excess water during particularly wet periods within the year, perhaps in other nearby sites that are not wetland habitats, landowners and managers may be able to pump water into these environments during dry seasons (see action 26 below). WWT already do this on one of their nature reserves.	Farmers and Landowners, EA, MHNLP, DC Planning	EA, MHNLP, NE, FC, DEFRA	Medium-term	M/H	VH

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
26.	Manually add water into wetlands and wet woodlands (as a last resort).	If a scenario arises where water levels become too low, manually adding water can be a short-term measure to ensure these habitats are maintained. Other actions addressing soil erosion and reducing chemical use can also help improve water quality.	Farmers and Landowners, EA, MHNLP, WTs	-	Short-term	L/M	H
27.	Consider creating reedbeds for water filtration.	Reedbeds filter water from settlements, roads and farmland before it reaches a watercourse to improve water quality. This can be particularly effective near potential wastewater or sewage treatment plants, such as the work Anglian Water in the East of England are carrying out. Other considerations such as impacts on local habitats will need to be taken into account, and engagement with the MHNLP, STW, and EA would be beneficial when considering this.	Landowners, EA, MHNLP, WTs	EA, MHNLP, DEFRA	Long-term	M/H	M
28.	Consider joining the mains water supply where entirely reliant on private supplies.	Whilst private water sources such as boreholes and springs reduce reliance on larger infrastructure systems for a key resource, in increasing temperatures we are likely to see more of these private water sources running low or completely drying up at times. Mains water supplies do not need to replace private water sources, but the MHNL recommends that farmers and landowners strongly consider connecting up to the mains to reduce the likelihood of running out of water in a period of drought.	Farmers and Landowners, STW	-	Short-term	L/M	VH
29.	Ensure land management minimises water pollution.	Often driven by rainfall and how land is managed, agricultural diffuse pollution occurs when nutrients, pesticides, faecal bacteria, chemicals and fine sediments are lost from the land into local water courses and groundwater. Run-off not only impacts the natural environment, but also removes valuable nutrients for your farm, reducing agricultural productivity. Factors that can increase the likelihood of water pollution from agriculture include spreading fertilisers and pesticides at the wrong time (e.g., before heavy rain) or too close to a	Farmers and Landowners, MHNLP, NFU, CLA	EA, MHNLP, NFU, CLA, DEFRA	Medium-term, ongoing	L/M/H	VH-I

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
		watercourse, cultivating too close to a watercourse and/or without an adequate buffer strip to prevent soil loss or field runoff reaching watercourses, and slurry or dung entering water bodies or courses. Adaptation actions to minimise water pollution other than addressing soil erosion (action 30) can include ensuring sedimentation has not occurred at gravel and water banks that may be used by invertebrates and fish and planting nutrient-loving plants; nature restoration that takes into consideration nutrient loving plants can reduce water pollution levels (such as work taking place in Herefordshire). Initiatives such as Catchment Sensitive Farming can also help farmers to protect water bodies and the environment.					
30.	Take action to minimise soil erosion.	Certain land types in the MHNL, such as slopes and on the hills, are particularly vulnerable to soil erosion, something that will become more common with increasing rainfall. Therefore, the choice of land use is crucial to help reduce this risk, which has impacts on your soil nutrient levels, and on the quality of our water which can harm our nature and our health. See the Forestry Commission's website for guidance on managing soil erosion. Examples of measures include creating unfertilised buffer strips on farmland to slow or prevent run-off reaching watercourses, considering the crops used in arable land, using cover crops between harvests and planting herbal lays, which is something that the Bromesberrow Estate have been carrying out on their sandy soils which are particularly prone to erosion.	Farmers and Landowners	-	Medium-term	M	VH-I
Land management							
31.	Continue management of pastures and grasslands.	Grazing by livestock such as cattle and sheep can help to create and maintain grassland habitats found across the MHNL, including the dry acid grasslands that form the SSSIs on the Malvern Hills. Grazing is therefore key to maintaining these	Farmers and Landowners	DEFRA, MHNLP, MHT, NE	Ongoing	L/M	VH-I

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
		areas and also helps minimise fire risk by creating breaks in vegetation, therefore management should be continued wherever possible. Dry acid grasslands are particularly vulnerable to wildfires, but grazing for management should be considered for all grasslands and pastures. If you decide to stop or reduce grazing, talk to the MHNL Partnership so they can explore other ways to manage fire risk in the area.					
32.	Plant and maintain scrub on grasslands for shading and habitats for wildlife.	Adding scrub to grassland can provide shading for wildlife in hot temperatures and during times of strong sun exposure, but without proper management this scrub can increase the likelihood and severity of wildfires especially in areas with much visitor pressure. On hills and slopes, grasslands that are north facing will be more protected from changes from drought and sun exposure and so should be expanded where possible to replace sites that are more vulnerable to fire risk.	Farmers and Landowners	DEFRA, MHNLP, MHT, NE	Medium-term, ongoing	L/M	VH
33.	Use nature-based solutions to reduce fire risk on grasslands and other high-risk areas.	As a priority, measures should be carried out on sites most at risk of wildfire, which will include grasslands, particularly on hills and slopes where groundwater may be lower, and sites near to railway tracks or infrastructure that could increase fire risk. More information can be found in the Forestry Commission's guidance on wildfire planning, and the FC's report on wildfire case studies and reflections.	Farmers and Landowners	EA, MHNLP	Medium-term	H	H
34.	Fence off hedgerows and trees.	Fence off hedgerows and trees from livestock and deer especially at times of the year where these are most vulnerable (e.g. during periods of heavy rain or drought), especially when they are young.	Farmers and Landowners	-	Short-term	L	H
35.	Diversify planting.	Diversity (i.e. using a range of species) in future planting schemes for woodlands, orchards, hedgerows, meadows and grasslands can help increase resilience to the impacts of climate change. For example, selecting deeper rooted plants that are	Farmers and Landowners	-	Short-term	M	H

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
36.	Link new planting to existing habitats.	less vulnerable to soil erosion and drought. Planting genetically diverse plants in one area increases resilience to pests and diseases that may spread quickly otherwise (see the case study on Black Poplar trees, Section 5.3). This could include planting a new stretch of woodland that links two existing woodlands or planting new hedgerows around existing hedgerows or veteran trees. This can increase the likelihood of survival of the new plants, and also in the long-term create habitats with a range of ages of plants in the same space which supports wildlife as well as resilience. This also contributes to better connectivity of habitats (see action 37).	Farmers and Landowners, Councils, MHNLP, FC, WTs	Councils, MHNLP, FC, WTs	Medium-term	M	H
37.	Connect up existing habitats.	Changes in climate may restrict the distribution of important habitats and keep wildlife populations apart, limiting their chance to breed. Reducing fragmentation of habitats with a network of wildlife corridors will be especially important as a changing climate may reduce food and water availability. Corridors allow wildlife to move and migrate as the climate changes.	Farmers and Landowners, LAs, MHNLP, FC, WTs	Councils, MHNLP, FC, WTs	Long-term	H	H
38.	Alter land management times with changing seasons.	For example, alter hay cutting and grazing to align with changes in flowering dates in lowland meadows.	Farmers and Landowners	-	Short-term, ongoing	L	VH
39.	Maintain existing trees as a priority over planting new.	Long-established trees provide key habitats, carbon sequestration, and sense of place in the NL and so should be maintained, though planting the next generation of trees is also important. This is the case for veteran trees in field boundaries, parks, and woodlands, as well as Traditional Orchards. Maintenance includes using restorative pruning for old trees and restocking with traditional varieties, creating windbreaks for vulnerable trees such as those in Traditional Orchards, for example by encouraging mistletoe removal to support mature	Farmers and Landowners	-	Short-term, ongoing	L	VH

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
		trees from wind, and ensuring that mature and veteran trees are maintained, for example through coppicing, to help reduce the likelihood they will fall over in extreme weather and therefore improving the safety of those visiting the MHNL and maintaining the character of the parks and woodlands.					
40.	Use alternatives for hard surfaces used on streets and paths to reduce surface water flooding.	To reduce surface water flooding or water pooling on hard surfaces such as paths, consider permeable paving options, nature-based solutions such as hedgerows alongside a road to slow flow or hold water, and regularly maintain drainage such as ditches and culverts.	Landowners, WWT, LAs, DCs, Tourist sites	LAs, DCs	Medium-term	M	H
41.	Use nature-based solutions to reduce the strain on hard infrastructure from increasing climate pressures.	Nature based solutions have the opportunity to reduce the strain on hard infrastructure such as sewage treatment and drainage systems. When identifying priority areas for adaptation or nature restoration, consider whether a project can also improve the resilience of hard infrastructure. For example, planting hedgerows and shrubs can act as a buffer from wind, rain/flooding, and high temperatures for energy infrastructure. See Anglian Water's work using reed beds as an example of reducing the strain on sewage treatment plants in Norfolk.	MHNLP, LAs, Farmers and Landowners, Businesses, Utilities	Utilities	Medium-term	H	H
42.	Ensure local tree planting programmes contribute to climate adaptation objectives.	New tree planting schemes such as the Severn Treescapes initiative often have the primary aims of meeting Net Zero targets or biodiversity benefits in mind, but by planting the right trees in the right place, all future schemes could also have positive impacts on helping alleviate the impacts of climate change too, e.g. by helping to reduce flood risk, providing shade for visitors and livestock, and act as a buffer for existing woodlands. Ensuring that new trees are likely to be resilient to a future climate is also important. These principles need to also be embedded into any tree strategies and programmes of work in/impacting the MHNL.	Farmers and Landowners, CVSOs, MHNLP, FC	Existing initiatives	Short-term, ongoing	L	H

5.5 Advice for tourism businesses and the historic/built environment sector

5.5.1 Advice #1: Adapting heritage

When developing an adaptation plan for heritage buildings, historic buildings and monuments, every effort should be made to preserve the character of an asset and its surroundings. These are special parts of the MHNL, providing much of its sense of place. This section includes advice and information on managing the risks from climate change to these types of sites, as well as the MHNLP's specific recommendations on carrying out adaptation in a way that still preserves the historic environment as much as possible.

Figure 17. Eastnor Village. ©Kodachrome25 via Canva

Firstly, the MHNLP suggests that potential adaptation actions should be reviewed to assess their potential for harm to the historic environment and appropriate arrangements set up to ensure that harm is considered and either avoided or minimised. In general (although there may be some differences from site to site), the MHNL Partnership recommends that the order of activities for adapting the historic environment should be:

1. Carry out essential maintenance works on a structure and its immediate surroundings to ensure that it is up to standard. When considering financing options for these works, essential maintenance activities may be considered as climate change adaptation by the MHNL Partnership.

2. Ensure that land management and nature-based solutions can positively impact the structure. These may include improving drainage systems, planting or restoring habitats that can hold water or slow the flow of water during heavy rainfall and planting and maintaining trees and shrubs for shading and windbreaks for visitors and the buildings. Another measure is ensuring that trees near a heritage asset are maintained or, if necessary, are removed, to prevent them damaging a building in high winds.

3. Consider behaviour change and process alterations to protect an asset. This may include restricting visitor access to a site that is particularly vulnerable to erosion before, during and after an extreme event such as a storm or heavy rain, where footfall can exacerbate the impacts of erosion. The MHNL Partnership acknowledges the difficult balance required to ensure that protection of these sites does not restrict people from accessing and enjoying them, and so will support, where appropriate, decisions to restrict access to a site temporarily for conservation purposes. A longer-term strategy may need to be developed by partners involved in supporting and maintaining these

assets to decide when and how these restrictions may be used for periods of time of more than a few days.

4. As a last resort, consider hard infrastructure/built environment upgrades or alterations to a building or asset. All other options must be explored before this is considered. See Historic England and the National Trust's advice for adapting historical assets and the wider historical environment.

Resources for considering impacts on Historic Environment in adaptation planning include:

- The SHINE (Selected Heritage Inventory for Natural England) dataset that was designed to support delivery of Stewardship schemes by identifying heritage assets manageable or potentially impacted through the scheme actions.
- This project in Somerset by the National Trust is an excellent example of the consideration of the historic environment during design stages of adaptation measures and is a model of best practice.
- County Historic Environment Records can help to inform proposals for all projects, including those needing adaptations.

5.5.2 Advice #2: Maintaining access

Accessibility of the MHNL and its key assets are reliant on our road and public transport infrastructure, our footpaths including the accessible Miles without Stiles routes and on the information and interpretation resources that the MHNL Partnership and others provide its residents and visitors. Not only are many of these things threatened by the impacts of a changing climate, but they also contain potential opportunities for communicating the risks from climate change to the residents and visitors of the MHNL and engaging them in adaptation activities to create a more resilient environment for everyone.

Actions to ensure access to recreational sites can be maintained include the following.

- Make sure you know which of your footpaths and access points are most at risk of erosion or damage from weather as part of short-term maintenance and long-term planning for management of these paths. Flooding and bank erosion recently damaged a footpath at one of the Worcestershire Wildlife Trust's nature reserves in the NL, so this is a genuine concern.
- Monitor the impact heavier loads such as electric bikes and horses are having on tracks/access points.
- Maintenance and management plans should prioritise those paths most at risk from climate impacts combined with paths that:
    - experience the most footfall;
    - provide access to essential services (e.g., train stations or healthcare facilities);

Figure 18. Gates at a footpath in the MHNL. ©Kodachrome25 via Canva

- are the only point of access to a significant site (such as a green space or heritage site) and
- are existing accessible routes (e.g., wheelchair accessible).

As well as the actions included in this plan, Natural England's Adaptation Manual has a section on 'Access and Recreation'. This could be useful for exploring more specific adaptation examples for rights of way, paths, and recreational access. For more general advice on adapting tourism sites and recreation, visit the National Trust and Historic England websites.

5.6 Action Plan for tourism businesses and the historic/built environment sector

Table 6 below provides a list of potential actions, including those above, that you might consider carrying out or supporting the MHNLP to deliver to increase the resilience of the MHNL.

Table 6. Action plan for Tourism businesses and the historic/built environment sector.

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
43.	Ensure any work you do with nature is the Right Action, in the Right Place.	When appraising adaptation actions (particularly related to nature recovery) for your land, as a community group, or business, it is important to recognise that not all actions to help restore nature may be appropriate in your area. For example, in the MHNL, generally prioritising land management over rewilding will be more effective for nature, people, and place. See the 'Right Tree, Right Place, Right Reason' campaign as an example to help you understand this, and speak to the MHNLP or other organisations such as the FC, NE or HE if you are planning on carrying out any nature-related projects to ensure these have the maximum impact.	Farmers and Landowners, CVSOs, MHNLP, FC	-	Ongoing	L/M	VH-I
44.	Use nature recovery projects to embed adaptation.	There is a huge opportunity to use the Local Nature Recovery Strategies which are currently under development by Local Authorities to allow nature to become a significant part of the adaptation solution by ensuring that new nature creation/ enhancement programmes, and better habitat connectivity, can help to reduce the impacts from climate change, as well as how protected landscapes (e.g. SSSI, SPA and SACs) may be affected by climate change. Working with HC, WCC, and GCC to use the LNRSs to understand priority habitats, species and locations for nature recovery will assist the prioritisation of locations for nature-based adaptation as set out in this plan. Working more closely with the LAs in the region through the LNRS can also enable a more joined-up approach for nature-based projects, unlock potential funding for these activities, and help track	HC, WCC, GCC	HC, WCC, GCC, DEFRA (through LNRS)	Short-term	M	VH

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
		measurable outcomes of adaptation as an 'ecosystem service'. Use other biodiversity/ ecological focused strategies such as the MHNL Nature Recovery Strategy and the MHNL Ecosystem Service Report to help identify hotspots for nature-based solutions that support adaptation as well as all the other priorities in these strategies.					
45.	Ensure local tree planting programmes contribute to climate adaptation objectives.	New tree planting schemes such as the Severn Treescapes initiative often have the primary aims of meeting Net Zero targets or bringing biodiversity benefits. By planting the right trees in the right place all future schemes could also have positive impacts on helping alleviate the impacts of climate change too, e.g. by helping to reduce flood risk, providing shade for visitors and livestock, and act as a buffer for existing woodlands. Ensuring that new trees are likely to be resilient to a future climate is also important. These principles need to also be embedded into any tree strategies and programmes of work in/impacting the MHNL.	Farmers and Landowners, CVSOs, MHNLP, FC	Existing initiatives	Short-term, ongoing	L	H
46.	Support the development of small, localised renewable energy systems.	The national grid may experience more service disruption and electrical outages as a result of more extreme weather. In the move to renewable energy as part of decarbonisation, smaller-scale, localised energy systems can help increase the resilience of communities' energy supplies and help to manage increasing populations without impacting the character of the area e.g., mini wind turbines, solar panels in small patches, underground heat networks etc.	MHNLP, LAs, DCs	-	Ongoing	L	H
47.	Collaborate to deliver water saving initiatives through business and	Water saving initiatives are an extremely important part of addressing resource scarcity. There is significant opportunity for residents and businesses to reduce their water usage to reduce pressure on supplies and strain on wastewater infrastructure, as well as providing benefits in cost savings and reaching	Farmers and Landowners, Residents, STW, MHNLP, EA, LAs	-	Ongoing	L	H

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
	community engagement.	sustainability targets for the region. Local businesses and tourist sites could have a significant influence on employees, residents and visitors alike on their water consumption. The MHNL Partnership should work with water companies, the EA and Local Authorities to help increase the reach of any water efficiency programmes aimed at communities and businesses.					
48.	Sign up for the Environment Agency's Flood Warnings and the Met Office severe weather warnings.	This will allow businesses, especially those in flood vulnerable areas, to prepare more effectively for flooding when it is likely to occur, minimising the potential costs as a result. Being aware of severe weather and flood warnings will also allow businesses, particularly those in tourism and recreation, to communicate these risks and potential disruptions to visitors and staff as quickly as possible.	Tourism businesses, businesses	-	Short-term, ongoing	L	VH-I
49.	Ensure climate impacts are considered in maintenance and planning for tracks, footpaths, and access points.	Paths and access points should be assessed for their likely resilience to climate change based on their past performance during extreme weather and how future climate change could affect them. Following this, the most strategic paths should be monitored and maintained, with management plans drawn up to identify appropriate adaptation actions. Paths that should be prioritised for intervention are those that either experience the highest footfall, provide access to essential local services, provide a single point of access to a specific site and/or are accessible routes for a wider range of users. See Natural England's Adaptation Manual on Access and Recreation for more specific adaptation examples for paths and rights of way.	Landowners, WWT, LAs, DCs, Tourist sites, Living Streets, Sustrans	-	Medium-term	M/H	H
50.	Prioritise adaptation with nature-based solutions that will reduce the need for hard infrastructure/	When adapting the built environment, one way to ensure that the impact on landscape character is minimised is to focus on nature-based solutions that minimise the need for hard infrastructure interventions, particularly in the villages situated within the MHNL. Examples include sustainable urban drainage systems and	MHNLP, LAs, DCs, EA, CVSOs, Farmers and Landowners	-	Ongoing	M	VH

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
	infrastructure strengthening.	an increase in trees for shading purposes. When carrying out any green/blue infrastructure projects such as tree planting, ensuring that the projects also address the impacts of climate change can help generate maximum benefits and reduce the need for hard infrastructure. There will be scenarios where hard infrastructure strengthening is required to ensure services such as our roads, our water and our electricity supplies are resilient to climate change.					
51.	Use alternatives for hard surfaces used on streets and paths to reduce surface water flooding.	To reduce surface water flooding or water pooling on hard surfaces such as paths, consider permeable paving options, nature-based solutions such as hedgerows alongside a road to slow flow or hold water, and regularly maintain drainage such as ditches and culverts. Sustainable drainage systems are drainage solutions that provide an alternative to the direct channelling of surface water through networks of pipes and sewers to nearby watercourses. Provision for SuDS and the national standards required for their design, construction, maintenance and operation is included in the Flood and Water Management Act 2010 and can be found here.	Landowners, WWT, LAs, DCs, Tourist sites	LAs, DCs	Medium-term	M	H
52.	Work with councils and conservation groups to ensure that retrofit can be carried out on historic buildings to ensure they are protected from climate change, whilst still reflecting historic character.	Property level adaptation is essential given that larger scale projects take a long time to implement and cannot necessarily benefit everyone. To take pressure off responding agencies, enabling householders to make their own property adaptations will ensure more people are protected from the worst impacts of climate change. Use guidance from Historic England and engage with local authorities and local heritage/conservation groups to ensure that any upgrades are in keeping with the historic environment. The MHNL's influence on the planning approval process should reflect the need to adapt to climate change whilst still maintaining historic character.	LAs, DCs, HE, NT	HE, HLF	Ongoing	M	H

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
53.	Use existing resources for adaptation planning for heritage sites and the historic environment.	The National Trust already provides climate change adaptation guidance, and there is a range of advice provided by Historic England, both looking at the risks to the historic environment and advising how to increase their resilience to climate change without altering the character of the landscape.	MHNLP, HE, NT, WWT, Historic and heritage site owners	HLF, HE, NT	Short-term, ongoing	L	VH-I
54.	Develop climate change risk assessments and adaptation plans for buildings that are frequently used by the public.	The MHNL Partnership will not be able to facilitate climate change risk assessments and adaptation plans for every significant building in the area. Once the designated assets have been assessed, focus can be turned to significant buildings such as visitor centres, key tourist assets and villages that define the key characteristics of the NL. Prioritising these could be done by considering which of these buildings/villages are used the most by residents and visitors and therefore provide the most value to the NL.	MHNLP, Tourist/Recreation/Heritage site owners	MHNLP, HE, NT, HLF	Medium-term	H	H
55.	Conduct risk assessments for individual heritage sites, listed buildings, and scheduled monuments and propose adaptation options for those most at risk.	The MHNL has a range of heritage assets, scheduled monuments, and listed buildings, bringing economic and environmental benefits to the area. Many of these properties and landscapes are likely to be at high risk from the impacts of climate change. A first step will be to prioritise which assets are at greatest risk and outline options to deal with these. Adaptation plans should be produced for those most vulnerable, a process which could be aligned with Historic England's approach to adaptation and that could use guidance such as that produced by the National Trust.	HE, WWT, HWT, NT	HE, HWT, WWT, NT, HLF	Medium-term	H	H
56.	Prioritise adaptation measures that preserve the character of the historic	The historic environment is a special part of the MHNL, providing much of its sense of place as well as a large part of the economy. Understanding the historic environment may highlight opportunities that may be mutually beneficial to climate change adaptation and to the conservation or enhancement of the	MHNLP, HE, NT, WWT, Historic and heritage site owners	HLF, HE, NT	Short-term, ongoing	M	VH-I

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
	environment, only using hard infrastructure interventions where absolutely necessary.	historic environment. An example includes the creation of permanent grassland on or adjacent to the heritage assets, protecting them from cultivation impacts, erosive actions or enhancing their setting. This understanding will also highlight conflicts between adaptation delivery and the conservation of the historic environment. See the recommendations in Section 5.5 for more advice and information on managing the risks from climate change to these types of sites, as well as the MHNLP's specific recommendations on carrying out adaptation in a way that still preserves the historic environment as much as possible.					

5.7 Advice and actions for MHNLP

5.7.1 Advice #1: MHNLP as the coordinator

As this section of the report demonstrates, ensuring MHNL can cope with the likely impacts of a changing climate is the responsibility of multiple stakeholders. However, MHNLP could act in the role of the central coordinating body to hold partners to account and ensure the actions get taken forward. Most of the actions in Section 5.8 are categorised as 'strategic actions,' without which it may be harder to implement the other, more 'on-the-ground' actions. These should be a priority when MHNLP embarks on implementing this plan.

5.7.2 Advice #2: Maintain engagement with stakeholders

Throughout the development of the Action Plan we have undertaken various rounds of stakeholder engagement and connections and relationships have been established and built upon. We can be confident in stating that this Plan has been co-created, as without stakeholder input the action plan would likely have looked very different, less location-specific and not reflective of existing local activity.

In their role as a coordinating body the MHNL Partnership should build on this extensive engagement quickly. MHNLP cannot, and should not, implement these actions alone, and by striking while the iron is hot with regards to maintaining stakeholder engagement, this would emphasise that point.

It is hugely important that the MHNLP and other partners work with farmers and landowners (see section 5.4) in various ways to help improve agricultural productivity in a sustainable way. By doing so partners can help ensure the success of farming and forestry in the NL, meaning intensification of agriculture is not necessary, as this has implications for soil and water quality, the natural environment, carbon emissions and the landscape character as well as resilience to climate change.

Figure 19. Bluebell wood in West Malvern © Jennifer Sanerkin via Canva

As the key messages in Section 2.3 explain, it is inevitable that there will be some level of change to the appearance and land-use in the MHNL. SWM recommends that the MHNL Partnership begins a programme to consult all partners and stakeholders that use or interact with the NL to ensure these changes are considered in the context of the core purpose and values of the NL. Acknowledging that NL Partnerships have responsibilities for helping to maintaining the NL, the MHNLP and other partners with influence may also choose to work with central Government to carefully adjust the requirements of the NLs.

Giving more power to local structures such as the NL Partnerships, who are made up of people with local knowledge and expertise, could allow these organisations to make their

own decisions on which physical qualities of the NLs can be maintained and to what extent. This could bring about a greater flexibility regarding which adaptation options MHNLP can realistically implement. SWM would fully support these efforts in engaging with Government.

5.7.3 Advice #3: Identify priorities

We have provided our perspective on how each action should be prioritised for implementation in the action plan, from 'Medium' to 'Very high and immediate'. There will always be an element of 'informed subjectivity' about the prioritisation rating, and it may be that MHNLP and its partners feel that some of the lower priority actions could/ should be accelerate, and vice-versa. In order to further refine the prioritisation of actions, it may be beneficial for the MHNL Partnership to undertake more in-depth analyses that was outside the scope of this project for the actions assigned to the Partnership and other similar organisations. These could include:

- undertaking a more accurate cost/benefit analysis of each action;
- analysing in more detail the extent of co-benefits each action may bring about, in line with MHNL's priorities and
- identifying how quickly resources can be mobilised to make implementation happen.

Following this, the first step is to agree a list of actions with partners that are going to be implemented by the MHNL Partnership in the first year, or where implementation will be commenced.

5.7.4 Advice #4: Integration

Wherever possible, adaptation measures should be integrated into activities already happening in the MHNL to maximise impact whilst minimising resource requirements. This would also ensure adaptation actions do not threaten to contradict Net Zero targets, or visa-versa. The same principle applies to other co-benefits such as natural environment improvement projects, including (but not limited to) those being set out in the Local Nature Recovery Strategy currently under development.

5.7.5 Advice #5: Identify financing options

Identifying financing options will be crucial to the successful implementation of some of the actions in this plan. Mapping of these opportunities and lobbying of central Government needs to take place hand-in-hand, to encourage appropriate investment. There also needs to be strategic use of public sector funds to lever in appropriate private sector investment, alongside engagement with banks and the insurance industry on how they can support this. With joined up working and collating existing activities already happening, as recommended in this plan, public sector funds can be used more efficiently where adaptation aims and objectives overlap. While it was outside this project's scope to detail these funding sources, SWM have some intelligence around funding streams and can assist with this initial identification upon request. We have also provided suggestions in the action plan around which bodies may be in a position to fund certain actions, based on their priorities and commitments.

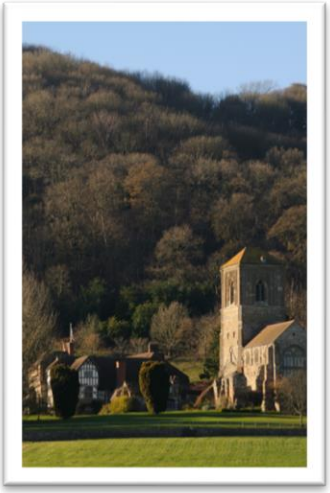

Figure 20. Little Malvern Priory. ©Leadinglights via Canva

5.7.6 Advice #6: Establishing outcomes and measures of success

Quantifying and measuring the success of implemented adaptation actions is challenging. Unlike Net Zero, where one can often state that 'by implementing this action we are likely to save X tonnes of CO_2 or £X,' stating similar quantified targets and goals is much more difficult for adaptation. Undertaking a cost/ benefit analysis of each action would provide some element of quantification and give backing to implementation but will, in itself, be a reasonably costly exercise. In the absence of this, it is still important to consider what the specific outcomes are for each action, drawing up visions of 'what success looks like', in order to make the case for implementation. Some of this may be qualitative but could be strengthened by emphasising the likely co-benefits and magnitude of impact.

5.7.7 Advice #7: Building in flexibility

Despite having an understanding on the likely climatic changes expected to occur in MHNL, it is impossible to be specific about exactly what is going to happen, where, and when, due to various elements of uncertainty. Not knowing exactly by when, and to what extent, we need to take action makes both implementation of adaptation actions and making the case for implementation more challenging.

It will therefore be important to build flexibility into adaptation actions, which can be achieved by taking an adaptation pathways approach when planning adaptation. This can prevent continuing activities that are no longer fit for purpose as scenarios change simply because the project has been predetermined.

Despite this uncertainty, we can say with confidence that doing something is better than doing nothing, as we know enough about the broad trends and impacts to know that the latter is not an option. 'No regret' options, such as protecting specific landscapes or rolling out nature-based solution projects, can still be effective with a degree of uncertainty in the system.

5.7.8 Advice #8: Monitoring and evaluation (M&E)

Developing a process for M&E that outlines how and when actions will be assessed and allows one to capture progress against each action is critical. A first step should be to develop a monitoring system or integrate adaptation actions into an already established monitoring system such as the Framework Indicators within the Management Plan, which allows for the capturing of progress against each action. A reporting mechanism should also be established to ensure progress and learnings are being communicated to partners and to other National Landscapes. Whilst not aimed at National Landscapes, the Local Partnerships Climate Adaptation Toolkit for Local Authorities (page 40+) provides more information on M&E and how this can be achieved.

5.8 Action plan for MHNLP

Table 7 below provides a list of the strategic actions that should be taken forward to enable this adaptation plan to be successfully implemented.

Table 7. Action plan for the MHNL Partnership

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
57.	Update this action plan annually and set up a monitoring framework.	This will ensure actions are kept relevant and are being delivered with success measures identified. One of the first actions that the MHNL Partnership should undertake is the development of a monitoring system that goes alongside this Plan to track progress. Adding core indicators for adaptation into the MHNL Management Plan would be a significant way to track and drive progress in this area.	MHNLP	-	Ongoing	L/M	VH-I
58.	Develop an approach to capturing data that can help to monitor the impact severe weather events have on the county.	This will help determine the impact of these weather events on people, services and from a financial point of view, allowing for better planning. A central bank of data sources would be beneficial to allow quantification of weather-related impacts and, over time, climate change impacts. Alternatively, it may be that the councils that sit within the MHNL boundary already have databases like this, therefore working more closely to feed into these and to access this information will reduce unnecessary duplication of effort. This action will need a strategic lead and coordination, and the LAs and/or the MHNLP may be best suited for this.	MHNLP, WCC, HC	-	Short-term, ongoing	L/M	VH
59.	Set up effective impact monitoring on the natural and historic environment to build the business	The MHNL Partnership have an important role to play in ensuring the impacts on the natural environment, farming and forestry are represented when addressing climate change. Where properties have not been damaged by an extreme weather event, but natural habitats and the historic environment have been, impact monitoring will be important for	MHNLP, EA, LAs, HE	-	Short-term, ongoing	L/M	H

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
	case for adaptation activities.	justifying and appraising adaptation and recovery works. This is a particular feature seen within areas with minimal properties such as in the MHNL. Work should be done to bring together teams and organisations who work with the natural and historic environment to better understand and measure the impacts that these incidents are having.					
60.	Continue to work with existing boards and working groups in the region that address climate change.	There is much work already being done in the region and beyond on climate change adaptation that the MHNL can both support and benefit from. Working cross-sector and cross-boundary on adaptation, including with the relevant councils, will ensure there is a recognition that climate risks and adaptation solutions do not stop at boundaries. The Wye Valley adaptation group is an example of best practice for this action, and it will be important to continue to be represented on boards such as the River Severn Catchment Based Approach group. Collaboration is especially relevant in relation to catchment-based schemes, to prevent maladaptation (e.g. flood protection in one area leading to worsening issues in another) and to share wider good practice and expertise. A live stakeholder spreadsheet (or other contact management system) should be developed and kept up to date.	MHNLP, all partner organisations mentioned in this plan	-	Ongoing	L/M	VH-I
61.	Ensure adaptation is considered within cross-sector and cross-boundary groups and activities that the MHNL Partnership is involved in.	This will ensure there is a recognition that climate risks and adaptation solutions do not stop at boundaries. This is especially relevant in relation to nature connectivity schemes through the new LNRSs coming into play at a county level, and to share wider good practice and expertise. This will include engagement with surrounding county and district councils and nearby significant natural sites and other NLs. Existing partnerships for cross-border issues such as for LNRS development can be built on for this. The MHNLP should also	MHNLP, to be identified through this action	-	Ongoing	L	VH-I

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
		ensure the NL is being utilised effectively in regional adaptation activities and nature recovery projects such as wildlife corridors.					
62.	Use the MHNL Partnerships' position to share adaptation knowledge and actions taking place in the region, and in other NLs and with other partners.	Once current activities have been mapped out and a database has been developed, consider how to share this information with others, including key landowners like the WWT and the large estates. The capacity of the MHNL Team is limited, and currently setting up new working groups or subcommittees is impractical. Instead, a twice-yearly or an annual event on climate change adaptation in the MHNL could be run in partnership with other key players such as the Local Authorities.	MHNLP	-	Medium-term	M	H
63.	Identify and learn from best practice examples of adaptation and collate a database of local projects.	Use the existing adaptation activities taking place in and around the MHNL, as well as in other NLs as best practice examples to learn from when delivering adaptation options such as those in this Plan. This can include examples of governance and collaboration, for example ways to ensure adaptation happens in a fair way, as well details of specific adaptation projects. Link in with the work WWT are doing to identify projects including adaptation in the region, and with any mapping of adaptation activities that the LAs such as HC have done.	MHNLP, to be identified through this action	-	Ongoing	L	M
64.	Identify financing options and funding sources suitable for adaptation option implementation.	Ultimately, funding will be required to take forward many of the actions outlined in this Plan. A more detailed investigation into the potential costs of the highest priority actions in this plan should be carried out as soon as possible. The MHNL Partnership should then identify financing options to take forward projects across the NL and research innovative approaches to implementation. Existing public and private funding options that currently focus on other themes can also be utilised where there is potential to integrate adaptation outcomes, e.g. Farming in Protected Landscapes, carbon markets, river catchment and	MHNLP	TBD	Short	M	VH-I

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
		nature restoration funds etc. It is also important to ensure that funding conditions for these other types of projects include evidence that their implementation will benefit climate adaptation.					
65.	Use new and existing funding mechanisms through the MHNL Partnership to drive adaptation.	Due to its local knowledge, the MHNL Partnership can enable public-sector funding to reach sectors that sometimes struggle to access it, such as privately-owned heritage assets or farmland. A great example of this is when the MHNL was responsible for allocating funding through the Farming in Protected Landscapes Grant. The MHNL Partnership should therefore aim to continue advocating for hyper-local funding allocation mechanisms that ensure money gets to where it is needed most.	MHNLP	TBD	Short-term	M	VH
66.	Disseminate information from local authorities, UKHSA, and others on how to stay safe in extreme weather.	The MHNL Partnership can play a role in educating local residents and businesses on how to stay safe in a changing climate. Local Authority websites and Local Resilience Forums such as those in West Mercia and the West Midlands often hold this advice and information, so the MHNL should link to these websites and use resources from these organisations to share through the MHNL's own engagement and communications channels. These include the LRFs advice for community and business resilience in extreme weather and the UKHSA adverse weather health action cards for operating in adverse weather conditions such as heatwaves.	LAs, DCs, LRF	-	Short-term, ongoing	L	VH
67.	Develop a communications and engagement strategy for adaptation in the MHNL.	A communications strategy will help create a clear voice on adaptation within the MHNL, so businesses and communities are hearing the same message around the aims and responsibilities of all organisations in the NL, managing expectations and building trust with the public. Clearer messaging will be more impactful and help show people that	MHNLP, LA Comms, LRF, CVSOs	-	Medium-term	M	VH

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
		adapting to climate change does not have to be in contradiction with maintaining the things that we know and love about the MHNL, but instead supports them. Existing guides and resources such as the cycling and walking guides for the area should have information on climate risk and adaptation integrated in. Resources for raising awareness of the risks to climate change, and of any adaptation projects to be delivered, should be produced and disseminated through existing communication channels for visitors, residents and businesses. Use the Britain Talks Climate report for guidance on communicating with different audiences with different backgrounds and values. CVSOs such as Transition Malvern Hills can also be reliable 'trusted messengers' and should be partnered with for communications and engagement with communities.					
68.	Develop an online space for climate risk and adaptation information on the MHNL website.	As part of developing communications and engagement resources for climate change adaptation, the MHNL website should be used as a 'one-stop shop' for anyone visiting, living or working in the MHNL. This can be the central location for information on the MHNL Partnership's work on adaptation and include this Plan. Many online sources of information already exist, and so the MHNL Partnership should focus mostly on linking people to other relevant sources of information. This includes LA websites, the EA's website (particularly pages focusing on flood risk and advice for farmers), the LRFs and advice from groups like NE, HE and the NT.	MHNLP	-	Medium-term	M/H	VH
69.	Use existing engagement with landowners and managers on nature recovery to educate	The MHNLP already engages with clusters of landowners and land managers to provide training, advice and support on nature recovery, including demonstration and training events being delivered on farms and estates to promote beneficial land management and promote uptake of sustainable farming.	MHNLP	-	Short-term	L	VH-I

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
	and plan for adaptation.	Ensure that education on climate risks and adaptation advice is embedded into these.					
70.	Establish a climate risk and adaptation engagement programme for farmers and land managers.	Farming represents a significant proportion of the MHNL. However, at present, there is limited coordinated support on climate adaptation for farmers, along with how LNRS, BNG, ELM and other mechanisms can contribute to adaptation. An engagement programme showing how farmers can effectively adapt their business activities (e.g. crop types etc.) to climate change and contribute positively to local land management will provide a good place to start, as well as investigating and sharing case studies of effective programmes and of farmers carrying out adaptation such as Natural Flood Management in the UK and internationally. Existing routes of engagement, such as the Agriculture and Horticulture Forum, The Association of Horticulture Development Board, the NFU's engagement and existing connections through MHNL Partnership can be used as trusted routes, as well as integrating adaptation into events and conversations focusing on other, but not unrelated topics.	NFU, CLA, AHDB, MHNLP, MHT, LAs	MHNLP, NFU, CLA, LAs	Medium-term	H	VH-I
71.	Embed climate adaptation into existing engagement with farmers and landowners.	Expand on existing relationships and activities that involve farmers and landowners to ensure that climate change risks and adaptation are being shared and supported. This could include being involved in WCC's events on nature friendly farming, the Catchment Sensitive Farming initiative, HC's work on carbon audits for farmers (ensuring adaptation is included in recommendations provided as a result of these), and any engagement with farmers for the LNRS development.	NFU, CLA, AHDB, MHNLP, MHT, LAs	-	Short-term, ongoing	M	VH-I
72.	Ensure as many people as possible sign up to the Environment	This will allow land managers and businesses, especially those in areas most vulnerable, to prepare more effectively for flooding, storms and heatwaves, minimising the potential costs as a result. Many landowners, businesses and residents may not	MHNLP, EA, CVSOs, LEP	-	Medium-term	L	M

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
	Agency's Flood Warnings and the Met Office severe weather warnings.	believe signing up to these alerts is useful for them if they are not situated next to a watercourse, but surface water flooding from heavy rain, which can often happen much more suddenly/with less warning, can happen anywhere. Raising awareness of this can help protect people and assets.					
73.	Advocate for an improved system for localised flood warnings for farmers and landowners.	Work with other key partners to advocate for an improved system for localised flood warnings for farmers and landowners. Often the EA postcode-based system for flood warnings is ineffective for large pieces of land; fields owned by the same landowner may come under different postcodes, so incidents can occur where either a farmer spends time and resources preparing for a flood (e.g., moving livestock) in an area that was unnecessary, or not believe that a flood was due on their site and then be affected. Hyper-local communication systems for sharing up-to-date information between farmers, landowners and authorities could also help deal with these risks and challenges.	MHNLP, EA, LAs, LRF	-	Medium-term	M	VH
74.	Advocate for improved drought and hot weather guidance for farmers and landowners.	There is currently a range of drought and extreme heat advice available for farmers and landowners, but a need has been identified when speaking with stakeholders around a central place to hold this advice, with clear step-by-step guidance to follow during an emergency situation. The MHNL Partnership are in a good position to bring partners together to such advice. There is some information in this Plan that aims to start filling this gap, but further work needs to be done to bring expert knowledge and information together and to disseminate this information.	MHNLP, EA, LAs, LRF	-	Medium-term	H	VH
75.	Develop climate change risk assessments and	With backing/ funding from and engagement with key partners, the MHNL Partnership should rollout a programme that provides farms with individual mini adaptation action plans that detail	MHNLP, NFU, CLA, Farmers	NFU, EA, CLA, DEFRA	Medium-term	H	H

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
	adaptation plans for individual farms.	the most cost- and 'climate-effective' measures to install on their farm to improve their resilience to a future climate, including water saving, shading, water storage etc. Prioritise those farms that have experienced a greater degree of failure in recent years due to extreme weather. Even without a scheme like this, farmers and landowners can use Weathering the Storm for Agriculture along with the guidance in this Plan to assess their own specific risks from climate change and site-level plans to address these.	and Landowners				
76.	Gain information on which farmers and landowners are reliant on private water supplies.	Identify those farmers who are on private water sources as they are most vulnerable to drought, and support them to get onto mains water supply as an option and prioritise them for communicating about shared water storage and sharing initiatives.	MHNLP, NFU, CLA	-	Short-term	L	M
77.	Undertake detailed future scenario modelling of flood (fluvial and surface water), drought and fire risk in the MHNL.	The impact climate change could have on rainfall intensity and frequency could have consequences on the area in terms of both flood and drought risk. Undertaking future scenario modelling of water course behaviour and surface water flooding potential against a range of future climate scenarios is key to this, and local partners have already begun some work on this. This and additional activity will help to obtain a clearer picture of future water management practices that may need to take place to reduce both flood and drought impacts, aligned with water usage data and analysis from STW to target areas for intervention. Tapping into the fire service's information on fire risk can also help to better understand the locations most at risk now and in the future for more strategic fire mitigation.	MHNLP, UoW, STW	UoW, STW	Medium-term	M	VH

No.	Action	Further information and justification	Relevant Local Stakeholders	Potential Funders	Timescales	Resource Intensity	Priority
78.	Raise awareness of wildfire risk and causes.	The majority of wildfires are started by people through ignition sources like disposable barbeques. Although land management can be used to reduce the impact and spread of fires, there is no clear guidance on the best approaches at present, and instead the focus is on addressing people's behaviours (for example, through the Forestry Commission's guidance on wildfire planning). CVSOs such as Transition Malvern Hills can also be reliable 'trusted messengers' so should be partnered with when spreading awareness with communities.	MHNLP, LRF, HWFRS, CVSOs	-	Short-term, ongoing	L/M	VH-I

5.9 Opportunities for co-benefits

When implementing adaptation options, it is important to consider whether that option will include co-benefits following its implementation. Co-benefits could include contributing to nature recovery, enhancing ecosystem services or improving water quality, for example, as well as contributing directly to alleviating climate impacts. Annex 1: Strategic alignment looks at how adaptation aligns with MHNL's existing strategies and activities and how adaptation can help deliver these strategies, and visa-versa.

Consider the questions in the box below to prompt consideration for the co-benefits that can support adaptation and vice-versa.

Questions to help select locations for adaptation that consider co-benefits:

- ? Is this project helping the resilience of the built environment without having to alter historic buildings or sites?
- ? Is this site a valuable carbon store that could be at risk?
- ? Does this site have national or local at-risk habitats or species that adaptation could support?
- ? Does this site include special features of the MHNL that are at risk?

Would adaptation at this site also help to…

- ? Improve agricultural productivity (e.g., through improving soil health)?
- ? Reduce agricultural run-off or other factors impacting water quality?
- ? Contribute to nature recovery or biodiversity enhancement?
- ? Bring communities and visitors together to celebrate the NL and provide pride of place and community?

It is also important to recognise the opportunities to ensure that other activities related to sustainability are resilient from the impacts of climate change. Two main examples that relate to the MHNL are as follows:

Sustainable growth - Focus on a local food system where food is made and bought locally. This sort of activity is often considered as part of the carbon reduction agenda/ sustainability agenda in general, but it can also increase the resilience of the food system. Ensuring food is made and bought locally can help communities preserve more traditional and lower intensity farming practices and reduce the emissions of food production. By driving the demand for local food and resources (particularly timber) in the MHNL this can also improve the financial stability of the agricultural businesses so long as the practices carried out by the agricultural sector in response are also conducive to a climate resilient future.

Carbon sequestration - When undertaking carbon sequestration projects it is important to make sure adaptation is being considered, as otherwise projects will be at risk. Use the ecosystem service natural capital report to see which landscapes are the most valuable carbon stores in the MHNL and prioritise adapting these. Use Herefordshire's work on carbon audits on farms to keep track of this.

Annex 1: Strategic alignment

As mentioned in Section 2, National Landscapes are required to embed climate change adaptation plans within future Management Plans by 2028 as per the National Adaptation Programme (NAP3). There are multiple existing strategies and opportunity maps for the MHNL detailing opportunities in the MHNL for ecosystem services such as biodiversity, water quality, and multiple adaptation services including local climate (temperature) regulation and flood management. Table 8 below is an outline of these to prompt consideration for adaptation within these existing activities and to vice-versa consider opportunities for co-benefits through these other priorities when planning potential adaptation projects.

Table 8. List of local strategies and resources and how they link to adaptation.

Strategy/Resource	Links with adaptation
Local Nature Recovery Strategy	The LNRSs currently being developed by Local Authorities will highlight spatial opportunities throughout the region, including the NL, for nature connectivity, expansion, restoration and buffering. These plans should include nature restoration that provides adaptation to climate change, and equally without adequate climate adaptation there is a risk that the delivery of the LNRS will be impaired. Keep up to date with the progress of these plans through the Worcestershire County and Herefordshire Council websites.
The Malvern Hills Nature Recovery Plan	This report provides guidance on land management practices that support nature within the NL, including highlighting the high value areas for nature connectivity and restoration. This guidance should be considered in conjunction with the adaptation guidance in this plan to ensure that land management is providing multiple benefits to the people and nature in the MHNL and beyond. See page 19 of the Nature Recovery Plan for an ecological network map.
Natural England opportunity statement for MHNL	Natural England's statement of environmental opportunity for the MHNL recommends the priorities for the MHNL for improving the natural environment. This shows the main approaches recommended for nature recovery (conserve and manage, improve access, protect the historic environment, plan for expansion of semi-natural habitat) and should be used when prioritising adaptation activities as well.
UK Biodiversity Action Plan (BAP) Priority Habitats	The UK BAP has a detailed sheet on each of the priority habitats, including many of those key to the MHNL, with information on what these habitats are and how they may be enhanced. See also the UK BAP Priority Species list. Read these if you want even more information that the NE summaries provide on what these habitats are.
State of Natural Capital Report	The Natural Capital Report produced for MHNL in 2021 shows the habitats and landscape types in the MHNL that have the most opportunity to provide 'ecosystem services', not only related to adaptation but also factors like food provision and biodiversity. The table on pages 61 to 63 can be used to help identify which habitats/features of the MHNL have the most potential for adaptation and weigh these up against other factors and co-benefits.

Annex 2: Detailed Risk and opportunity assessment

Introduction

This section details the risks and opportunities that climate change presents in the MHNL. Any stakeholder within the MHNL can use the assessment to help understand their risks from climate change and/or use this as a template to develop their own risk assessment.

Identifying the potential risks and opportunities to the MHNL

This consisted of reviewing existing risk assessments both nationally (the UK Climate Change Risk Assessment), for specific sectors (such as from Natural England or other National Landscapes), and locally (Herefordshire Adaptation Plan), as well as speaking with stakeholders within the MHNL about their own experiences on the ground. A risk assessment and adaptation plan template from the National Landscapes Association has been used along with SWM's own experience in writing adaptation plans to guide the structure of these sections.

Determining risk level

Likelihood is scored using a scale of 1 to 5 and impact is scored on a scale of -5 to 5, with minus numbers showing an opportunity and positive numbers showing risks (see

Table 10). These scores have been determined by a combination of UKCP18 climate projections (see Section 3.2) and information from local stakeholders based on experience of previous extreme weather events and the consequences of a changing climate being witnessed on the ground. The likelihood and impact scores are then multiplied together to give an overall risk score that is colour coded based on severity (green being an opportunity, and yellow to red showing low to high risk). Table 9 shows the definitions used for determining impact level of risks, and

Table 10 shows the RAG matrix used.

Table 9. Impact scoring

Number	Rating	Definition
5	Catastrophic	It would result in a huge negative impact to this feature, with immediate impacts lasting for several days/weeks and significant long-term impacts such as failure of businesses, destruction of homes or livelihoods, and damage to nature that will take months or years to repair.
4	Major	It would result in a significant negative impact to this feature, with immediate impacts lasting longer than a few days and/or some long-term impacts such as reducing business success that year or requiring intervention for nature recovery.
3	Moderate	It would result in a moderate negative impact to this feature, with immediate impacts lasting no more than a few days and minimal long-term impacts, for example the natural environment not needing intervention to recover, or business productivity for the year minimally impacted.

2	Minor	It would result in a small negative impact to this feature, such as disruption to business operations or residents for less than a day, with no long-term impacts.
1	Minimal	It would result in negligible negative impact to this feature.

Table 10. Red, Amber Green (RAG) Matrix showing the calculated risk scorings from likelihood and impact scores, colour coded by risk level.

Risk	5	Catastrophic	5	10	15	20	25
	4	Major	4	8	12	16	20
	3	Moderate	3	6	9	12	15
	2	Minor	2	4	6	8	10
	1	Slight	1	2	3	4	5
No Change	0	No Change	0	0	0	0	0
Opportunity	-1	Slight	-1	-2	-3	-4	-5
	-2	Minor	-2	-4	-6	-8	-10
	-3	Moderate	-3	-6	-9	-12	-15
	-4	Major	-4	-8	-12	-16	-20
	-5	Fantastic	-5	-10	-15	-20	-25
			Rare	Unlikely	Possible	Likely	Almost certain
			1	2	3	4	5
			Likelihood				

It should be noted that there are many risks from climate change that overlap and interact with each other, including many which are not within the MHNLP's remit to address and therefore are out of scope for this risk assessment. However, some risks that will impact the MHNL 'out of scope' have still been included as they will be important for many stakeholders to understand and prepare for, even where they are not within the Partnership's remit to address. Some risks for features such as infrastructure networks, education and International Dimensions risks (presented here in the UK Climate Change Risk Assessment, Chapter 8) have not been included in this assessment as, in the main, these risks are UK-wide or international and unlikely to be influenced greatly by local circumstance, activity and/or policy. There is also more detail provided in the Natural England Adaptation Manuals with respect to impacts to specific species key to the MHNL such as dry acid grasslands and hedgerows.

As detailed in the separate methodology report, we have used this risk assessment to structure the Action Plan and to develop the actions within it.

The Risk Assessment

Table 11. The Climate Change Risk Assessment.

Risk Receptor	Climate Change Factors	Nature of Impact	Short term (2030s)			Medium-term (2050s)			Long-term (2080s)		
			Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk
Nature											
Key habitats	Rising temperatures	Longer growing season meaning increased growth of wild habitats, leading to greater management requirements and an enhanced threat of abandonment.	4	2	8	5	2	10	5	3	15
Key habitats	Warmer winters	Fewer frost events may mean the winter chill requirements of certain species may not be met. Reduced bud, flower and fruit production will affect food resources for wildlife.	3	3	9	4	4	16	5	4	20
Key habitats	Drier summers	Drought resulting in increased mortality and die-back of certain species. Drought stress increases tree susceptibility to pests and diseases.	2	3	6	2	4	8	4	4	16
Key habitats	Wetter winters	Flooding and waterlogging of soils damaging soil structure and damaging or killing woody species.	2	3	6	2	4	8	3	4	12
Key habitats	Extreme weather	High winds could cause loss of mature and veteran hedgerow trees and trees in woodlands and forests.	4	4	16	4	4	16	5	4	20
Climate											
Carbon stores	Various	Risks to grasslands from extreme weather events, flooding and wildfires reducing their ability to store carbon.	3	3	9	4	3	12	5	3	15

Risk Receptor	Climate Change Factors	Nature of Impact	Short term (2030s)			Medium-term (2050s)			Long-term (2080s)		
			Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk
Carbon stores	Various	Risks to woodlands from extreme weather, flooding and wildfires reducing their ability to store carbon.	2	4	8	3	4	12	3	5	15
Carbon stores	Various	Risks to wet woodland from extreme weather, flooding, increasing temperatures and wildfires reducing their ability to store carbon.	3	5	15	4	5	20	5	5	25
Carbon emissions	Various	Footpaths and other active travel paths blocked, damaged or eroded, meaning reduced active travel impacting carbon emissions.	3	2	6	4	3	12	5	3	15
Water											
Clear water and Brooks	Various	Risks to water quality from increased agricultural run-off, soil and bank erosion increasing sedimentation and turbidity, and sewage overflows. This will have an impact on the 'clear water' and brooks key to the landscape character of the MHNL.	4	4	16	5	5	25	5	5	25
Brooks	Increasing temperatures and droughts	Risks to brooks key to landscape character from water scarcity and low flows in increased temperatures and droughts.	3	3	9	4	3	12	5	3	15
Springs and spouts	Increased precipitation and extreme weather	Erosion, exacerbated by climate change, of rocks and key geological features responsible for the distinct springs and spouts in the Malvern Hills.	3	4	12	4	5	20	5	5	25

Risk Receptor	Climate Change Factors	Nature of Impact	Short term (2030s)			Medium-term (2050s)			Long-term (2080s)		
			Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk
Springs and spouts	Increasing temperatures and droughts	Reduced rainfall resulting in less water impacting springs and spouts, which are key features of the MHNL.	2	4	8	3	5	15	3	5	15
People											
Health and wellbeing	Extreme weather	Extreme weather and acute incidences such as extreme temperatures, flooding, or high winds increasing the likelihood of injury to people's health. These people could be residents, employees of local businesses or visitors/tourists.	2	5	10	3	5	15	4	5	20
Health and wellbeing	Flooding and extreme weather	Flooding or damage to property in extreme weather and the financial impact on local residents from increasing cost of insurance, and decreasing value of properties/land, even if not directly affected.	1	4	4	2	5	10	3	5	15
Health and wellbeing	Hotter summers and milder winters	Opportunities for milder winters to reduce risk of rural communities being cut off by snow and ice and the positive impacts on health and wellbeing of communities.	2	-2	-4	2	-2	-4	2	-2	-4
Health and wellbeing	Various	Risks to water quality from increased agricultural run-off, soil and bank erosion increasing sedimentation and turbidity, and sewage overflows impacting people's health.	2	3	6	4	3	12	5	4	20
Health and wellbeing	Various	Longer-term disruption to utilities and resource availability and the increased cost of utilities impacting residents and communities.	3	3	9	3	4	12	5	5	25

Risk Receptor	Climate Change Factors	Nature of Impact	Short term (2030s)			Medium-term (2050s)			Long-term (2080s)		
			Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk
Emergency Services	Extreme weather	An increased likelihood of injury during extreme weather increasing demand for emergency services, putting a strain on the public sector.	2	5	10	3	5	15	4	5	20
Business	Rising temperatures and heatwaves	Impacts on health and wellbeing of employees of local businesses reducing business productivity.	3	3	9	4	3	12	4	3	12
Business	Extreme weather	Reputational and insurance impacts if employees of local businesses are negatively impacted by extreme weather whilst at work.	1	5	5	2	5	10	3	5	15
Business	Extreme weather	Reputational and insurance impacts from incidents where tourists and visitors get hurt due to extreme weather or climate related damages to infrastructure such as footpaths and buildings. This is a particular risk around heritage sites such as the ridge and hills, where erosion is a particular concern resulting in falling debris or slipping paths.	2	4	8	3	5	15	3	5	15
Business	Various	Disruption to public transport and active travel routes and the knock-on impact on emissions of travel.	4	2	8	4	3	12	4	4	16

Risk Receptor	Climate Change Factors	Nature of Impact	Short term (2030s)			Medium-term (2050s)			Long-term (2080s)		
			Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk
Business	Various	Damage to infrastructure causing disruption to utilities and the impacts on residents and communities (particularly people working from home or vulnerable people, especially during winter).	3	2	6	4	3	12	5	3	15
Business	Various	Longer-term disruption to utilities and resource availability and the increased cost of utilities impacting businesses (including farmers and landowners and tech-based businesses).	2	3	6	3	4	12	5	5	25
Business	Flooding and extreme weather	Flooding or damage to property in extreme weather and the loss of livelihood and mental health impacts from experience extreme events.	1	4	4	3	4	12	4	4	16
Business	Various	Reduced agricultural productivity causing financial instability for farmers.	3	4	12	4	5	20	5	5	25
Business	Various	Disruption to public transport and road infrastructure and the knock-on impact on business productivity, supply chain, and visitor numbers, particularly for tourism.	4	3	12	4	4	16	5	4	20
Communities	Various	Damage to infrastructure causing disruption to utilities and the economic impact on businesses.	3	2	6	4	3	12	5	3	15
Communities	Flooding and extreme weather	Flooding or damage to property in extreme weather and the economic impact on businesses affected directly (costs of repairs and time closed during repairs).	1	4	4	3	5	15	4	5	20

Risk Receptor	Climate Change Factors	Nature of Impact	Short term (2030s)			Medium-term (2050s)			Long-term (2080s)		
			Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk
Communities	Various	Longer-term disruption to utilities and resource availability meaning scarcity of resources, particularly water, impacting agricultural productivity.	2	4	8	3	4	12	4	5	20
Communities	Flooding and extreme weather	Flooding or damage to property in extreme weather and the financial impact on local residents from damage to properties and land.	1	4	4	2	5	10	3	5	15
Farming and Forestry	Various	Longer-term disruption to utilities and resource availability meaning scarcity of resources, particularly water, impacting health of communities.	2	3	6	2	3	6	3	4	12
Farming and Forestry	Various – international	Economic instability nationally and internationally causing risks to business and public sector supply chains due to changing climate outside of the MHNL/UK.	2	4	8	3	4	12	5	4	20
Farming and Forestry	Various – international	Reduced agricultural productivity internationally providing opportunities for agriculture and forestry from rising demand for local produce as global food security reduces.	2	-3	-6	2	-2	-4	2	-2	-4
Economy	Flooding and extreme weather	Flooding or damage to property in extreme weather and the economic impact on businesses from rising insurance costs even if not impacted directly.	1	4	4	2	4	8	3	4	12

Risk Receptor	Climate Change Factors	Nature of Impact	Short term (2030s)			Medium-term (2050s)			Long-term (2080s)		
			Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk
Economy	Hotter summers	Increases in energy demand in summer for cooling in higher temperatures	2	3	6	4	3	12	5	3	15
Economy	Milder winters	Reduction in energy demand and costs for businesses and residents over winter due to milder temperatures reducing heating needs	2	-3	-6	3	-3	-9	4	-3	-12
Economy	Various	Pressure on infrastructure from increasing populations from migration from urban environments as they become less habitable in a changing climate and as a consequence raising the cost of living.	1	2	2	2	3	6	3	4	12
Economy	Flooding and extreme weather	Rural communities cut off by floods and the consequent impacts on health and wellbeing of the local community.	2	4	8	3	4	12	4	4	16
Economy	Various – international	Economic instability nationally and internationally causing risks to business and public sector access to finance, investment and insurance.	2	4	8	3	4	12	5	4	20
Recreation and Access	Hotter summers and milder winters	Warmer temperatures increasing people's time outdoors meaning opportunities for increased tourism in increasing temperatures.	3	-2	-6	2	-2	-4	1	-2	-2

Risk Receptor	Climate Change Factors	Nature of Impact	Short term (2030s)			Medium-term (2050s)			Long-term (2080s)		
			Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk
Recreation and Access	Various	Footpaths and other active travel paths blocked, damaged or eroded meaning reduced access to and use of heritage sites.	3	4	12	4	5	20	5	5	25
Recreation and Access	Various	Footpaths and other active travel paths blocked, damaged, or eroded meaning reduced access to and use of nature.	3	3	9	4	4	16	4	4	16
Recreation and Access	Various	Footpaths and other active travel paths blocked, damaged, or eroded meaning reduced accessibility of tourism.	3	5	15	4	5	20	5	5	25
Recreation and Access	Flooding and extreme weather	Flooding or damage to property in extreme weather meaning reduced access to recreation/information/tourism if visitor centres are closed short or long-term due to extreme weather.	2	3	6	4	3	12	5	3	15
Place – Built and historic environment											
Built Environment	Various	Damage to the built environment, particularly historic buildings (listed and non-listed) from subsidence as temperatures and soil water content fluctuations increase.	3	5	15	4	5	20	5	5	25

Risk Receptor	Climate Change Factors	Nature of Impact	Short term (2030s)			Medium-term (2050s)			Long-term (2080s)		
			Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk
Built Environment	Flooding and extreme weather	Distinctive villagescapes at the border of the NL in the MHDC area are at a high risk of flooding, which not only has implications for health and wellbeing and the financial impacts on communities, but also on the landscape character.	4	3	12	5	3	15	5	3	15
Historic Environment	Various - national	Loss of character and tranquillity of towns and villages from increasing populations due to migration from urban environments as they become less habitable in a changing climate.	1	3	3	2	4	8	3	4	12
Historic Environment	Various	Erosion of heritage sites and surrounding geology risking damage to the heritage assets and landscape character of the NL and impacting tourism. Scheduled monuments on the ridge (dry acid grasslands) and Shire Ditch are particularly at risk from erosion due to a combination of footfall and climate impacts.	3	5	15	5	5	25	5	5	25
Historic Environment	Various	Risk of damage to historic and heritage assets from flooding and extreme weather events.	2	4	8	3	4	12	3	5	15
Historic Environment	Various	Risks to listed and non-designated historic buildings from structural damage, ingress of water, mould and damp.	2	3	6	4	3	12	4	4	16

Risk Receptor	Climate Change Factors	Nature of Impact	Short term (2030s)			Medium-term (2050s)			Long-term (2080s)		
			Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk
Historic Environment	Increased precipitation	Distinctive quarries throughout the NL are at risk of dramatic changes in appearance and accessibility as a result of landslides, shifts and scree movement which may be accelerated by climate change.	1	3	3	2	3	6	3	3	9
Historic Environment	Increased precipitation	Historic built environment near rivers and watercourses could be at risk from flooding and higher river levels. There are few examples in the MHNL, but Papermill at the WWT nature reserve is the main concern.	3	2	6	4	2	8	5	3	15
Place - Landscape											
Landscape variety and uniqueness	Various	Pressures from climate change leading to intensification of agriculture meaning a decline in hedgerows, grasslands/pastures, and older woodland reducing the variety of landscape types.	1	4	4	1	4	4	2	4	8
Landscape variety and uniqueness	Various	Increased land management requirement, resulting in workload increase, impacting capacity of organisations involved in land management, resourcing, costs and staff and volunteer wellbeing.	5	3	15	5	3	15	5	3	15

Risk Receptor	Climate Change Factors	Nature of Impact	Short term (2030s)			Medium-term (2050s)			Long-term (2080s)		
			Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk
Landscape variety and uniqueness	Various	Land management activities delayed or inhibited by extreme weather (such as floods, storms, fires cutting off sites etc.) and conditions caused by a changing climate (such as waterlogged soils, extreme temperatures making work not possible etc.).	5	4	20	5	4	20	5	5	25
Varying grasslands	Various	Risks to grasslands from extreme weather events, flooding and wildfires impacting landscape character.	2	4	8	4	4	16	4	4	16
Varying grasslands	Various	Reduced grazing due to environmental pressures impacting the grasslands that rely on grazing and are characteristic of the landscape. This could also result in an increase in wildfires if grazing reduces.	2	3	6	3	5	15	4	5	20
Fields and unimproved pastures	Various	Risks to wooded pastures and lone trees in pastures (impacting landscape character) if trees are knocked down or damaged by high winds or soil changes.	4	3	12	5	3	15	5	3	15
Fields and unimproved pastures	Various	Risks to landscape character if hedgerows and pastures are impacted by increased pests and diseases such as phytophthora from milder winters.	4	3	12	4	3	12	5	4	20

Risk Receptor	Climate Change Factors	Nature of Impact	Short term (2030s)			Medium-term (2050s)			Long-term (2080s)		
			Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk
Fields and unimproved pastures	Various	Pressures from climate change leading to intensification of agriculture meaning a decline in hedgerows, grasslands/pastures, and older woodland reducing the variety of landscape types.	1	4	4	2	4	8	2	4	8
Orchards	Increasing temperatures and changing climatic conditions	Increasing pressures reducing the viability of orchards (particularly traditional orchards) and other traditional farms and land management practices, resulting in a loss of landscape character.	4	3	12	5	4	20	5	3	15
Broadleaved woodland	Various	Risks to landscape character if ancient woodlands are impacted by trees being knocked down by high winds or soil changes.	3	4	12	3	4	12	4	4	16
Broadleaved woodland and other woodland	Increasing temperatures and changing climatic conditions	Risks to landscape character if ancient woodlands are impacted by increased pests and diseases.	4	4	16	5	4	20	5	5	25
Rocky outcrops and relict quarries	Increased precipitation and extreme weather	Slipping, eroding and falling rocks in historic quarries and rocky outcrops impacting landscape character and the potential risk of harm to people and the natural environment below.	2	4	8	3	4	12	4	4	16
Acid grassland and heath on hill tops	Increased precipitation	Erosion damaging grassland sites (including SSSIs) and associated footpaths, access points, and heritage monuments.	3	5	15	4	5	20	5	5	25

Risk Receptor	Climate Change Factors	Nature of Impact	Short term (2030s)			Medium-term (2050s)			Long-term (2080s)		
			Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk
Place - Farming											
Agricultural productivity	Increasing temperatures and changing climatic conditions	Reduced viability of crops and forests and an increase in failure due to new and increased pests and diseases reducing agricultural productivity.	2	3	6	4	4	16	5	4	20
Agricultural productivity	Droughts and water scarcity	Longer-term disruption to utilities and resource availability meaning scarcity of resources, particularly water, impacting agricultural productivity.	2	2	4	3	4	12	5	5	25
Agricultural productivity	Loss of pollinators	Risks to agriculture and forestry productivity due to a decline in key pollinators.	4	3	12	5	3	15	5	4	20
Agricultural productivity	Flooding and extreme weather	Reduced viability of current crops and tree species and the overall impact on agricultural productivity.	3	4	12	4	4	16	5	4	20
Agricultural productivity	increased pests and diseases	Reduced productivity from livestock, arable and forestry due to increased pests and diseases.	2	4	8	4	5	20	5	5	25
Economic impacts to farming and forestry	Droughts and water scarcity	Longer-term disruption to utilities and resource availability meaning scarcity of resources, particularly water, increasing costs for agricultural businesses.	2	4	8	3	4	12	5	5	25
Economic impacts to farming and forestry	Increasing temperatures and changing climatic conditions	Increased costs from managing pests and diseases including increased use of pesticides and medicines and increased veterinary and plant inspections.	3	4	12	4	5	20	5	5	25

Risk Receptor	Climate Change Factors	Nature of Impact	Short term (2030s)			Medium-term (2050s)			Long-term (2080s)		
			Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk
Economic impacts to farming and forestry	Increasing temperatures and changing climatic conditions	Economic opportunities for new/alternative species for agriculture and forestry.	2	-3	-6	4	-3	-12	5	-3	-15
Economic impacts to farming and forestry	Longer growing season	Opportunities for a longer growing season for forestry, arable land, and grasslands for grazing due to milder winters.	3	-2	-6	3	-2	-6	5	-2	-10
Fields and unimproved pastures bordered by hedgerows	Increasing temperatures and changing climatic conditions	Pests and diseases such as phytophthora damaging hedge and hedgerow trees in field boundaries.	2	3	6	4	3	12	5	3	15
Forestry	Flooding and extreme weather	Risks to forestry productivity and viability if trees are knocked down or damaged by high winds or soil changes.	3	3	9	3	4	12	4	4	16
Grasslands	Various	Risks to grasslands from extreme weather events, flooding and wildfires reducing areas available for grazing.	4	5	20	5	5	25	5	5	25
Grazing animals and livestock	Various	Increased time indoors for livestock due to welfare concerns in extreme weather such as high temperatures and wet weather. Increased costs as a result of the need for increased bedding, feed and addressing diseases.	3	4	12	4	5	20	5	5	25

Risk Receptor	Climate Change Factors	Nature of Impact	Short term (2030s)			Medium-term (2050s)			Long-term (2080s)		
			Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk	Likeli-hood	Impact	Risk
Grazing animals and livestock	Droughts and water scarcity	Reduced availability of water supply for livestock causing dehydration, heat stress and other animal welfare issues.	3	4	12	4	5	20	5	5	25
Soil health	Drier summers and wetter winters	Risks to soil quality including seasonal aridity and wetness and soil erosion reducing nutrient levels. A particular concern is on the acid grassland on the hills, on steep slopes and in fringe woodlands on limestone to the north of the landscape.	4	4	16	5	5	25	5	5	25
Traditional crops	Various	Increasing pressures reducing the viability of traditional orchards and other traditional farms and land management practices, resulting in a loss of these orchards.	4	4	16	5	3	15	5	3	15

-END-