



Welsh Government
Consultation Document

Draft Climate Change Adaptation Plan for Wales

Date of issue: 03 December 2018
Action required: Responses by 04 March 2019

Mae'r ddogfen yma hefyd ar gael yn Gymraeg.
This document is also available in Welsh.

Overview

Welsh Ministers are required by law to report from time to time on the objectives, actions and future priorities in relation to climate change and its impact.

This Climate Change Adaptation Plan for Wales meets those requirements by setting out 32 adaptation actions for Wales. Welsh Government now seeks public opinion on the plan.

How to respond

You can respond to this consultation by answering the questions on the form available at www.gov.wales/consultations.

Further information and related documents

This document is available at www.gov.wales/consultations

Large print, Braille and alternative language versions of this document are available on request.

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Foreword

When it comes to protecting our future generations, we have much to be proud of in Wales. So much in fact, that we have put our commitments to protect our country into law, ensuring the Wales we leave behind is enjoyed by all, for many generations to come. The Well-being of Future Generations (Wales) Act 2015 provides a common framework and vision, with seven well-being goals to help Wales develop sustainably and five ways of working to make sure our policies consider long term needs and a collaborative approach.

We are already taking significant steps to meet the well-being goals and Wales is striving towards a low carbon future which will limit the impacts of climate change. In 2016, our Environment (Wales) Act received royal assent. The Act places a duty on Welsh Ministers to ensure that by 2050, net emissions are at least 80% lower than the baseline set in legislation. Furthermore, Welsh Government is leading the way to decarbonise by committing to make the Welsh public sector carbon neutral by 2030. Whilst our decarbonisation programme will ensure our commitments to mitigate climate change are met, the *threat* of climate change from current and historic global greenhouse gas emissions has led to global warming becoming a reality. While we strive with our global partners to limit further warming to less than 2 degrees, we also need to adapt.

“A Resilient Wales”

Our new Climate Change Adaptation Plan for Wales contributes to all of the well-being goals. The plan endeavours to create a Resilient Wales by recognising the need to be prepared for the many impacts of climate change, including those that we are seeing now, and those we expect to see in the future.

The summer of 2018 was a memorable one for many and was declared by the Met Office as the joint hottest UK summer since records began. Wales, like the rest of the UK, suffered from drought conditions which stunted crop growth and threatened our water supply. Yet, at the same time, tourism boomed as tourists flocked to our beaches to enjoy the sun. By 2050, the impacts of climate change on Wales are expected to be even greater. Current climate models¹ project an increase of daily maximum summer temperatures by 3.4°C, an increase in winter rainfall by 14 per cent, a decrease in summer rainfall by 16 per cent and a rise of sea levels around Wales by approximately 22cm. Not only are storms going to become more common, but we can expect stronger winds and heavier rains along the way.

The reality of these changes, however, is the impact on our homes, our jobs, our health, our communities and our environment. We have already seen the devastation flooding can cause. In March 2018, Storm Emma, and ‘the beast from the east’ brought chaos; heavy snow led to trains and buses being cancelled across

the country, strong winds damaged homes and falling trees led to widespread power cuts. In the future, it is going to get far worse. The UK Committee on Climate Change (UKCCC) published its Evidence Report at the end of 2016, to inform the UK Government's latest Climate Change Risk Assessment. The Wales Summary highlights many threats to Wales which we need to prepare for including risks to productivity of our farms and forests, risks to wildlife and ecosystems as a result of drought, and risks to businesses from flooding and damaged infrastructure. While the UKCCC acknowledges we are already doing a lot to mitigate these and other risks, their assessment made clear that we need to do more.

In response, I am proud to publish our draft Climate Change Adaptation Plan for Wales. This plan details 32 actions to reduce the risks of climate change to Wales over the next five years; however, it doesn't stop there. We understand that our knowledge of the impacts of climate change is ever changing; therefore, this plan will continue to evolve – we will commit to a continual review of adaptation needs including the addition of any further actions required.

Delivering our plan will be a challenge, but we must all adapt and we must all commit. Wales is ready to lead the way.



Hannah Blythyn AM
Minister for Environment

Contents

PART 1 – Framework

| | |
|--|-----------|
| Introduction | 8 |
| Climate Change in Wales..... | 9 |
| The impacts from climate change | 9 |
| Climate Risks in Wales..... | 10 |
| Adaptation and decarbonisation | 11 |
| Climate Change Adaptation and the law in Wales..... | 12 |
| The Climate Change Act 2008..... | 12 |
| The Environment (Wales) Act 2016 | 12 |
| The Well-being of Future Generations (Wales) Act 2015 | 14 |
| Approach to the plan | 18 |
| Vision..... | 18 |
| Objectives | 18 |
| Structure..... | 19 |
| Monitoring & Evaluation | 22 |

PART 2 - The Actions

| | |
|---|----------------|
| Our strategic actions | 25 |
| Adaptive nature and the rural economy..... | 33 |
| Protecting our coasts and seas | 47 |
| Staying healthy..... | 57 |
| Safe homes and places..... | 67 |
| Caring for the historic environment | 80 |
| Successful Businesses | 86 |
| Resilient Infrastructure and Transport | 92 |
| Annex 1 – Summary of actions and risks | 100 |
| Annex 2 – Abbreviations | 104 |
| Annex 3 – List of Consultation Questions..... | 105 |

Part 1 – The Framework

Introduction

Significant research has been undertaken across the world and evidence shows very strongly that man-made greenhouse gas (GHG) emissions since the Industrial Revolution are leading to global warming, and that this warming is resulting in a change to our global climate.

For many years now we have understood climate change as a large-scale, long-term shift in the planet's weather patterns and average temperatures – the latest models show that Wales can expect to see significant impacts from climate change by the year 2080². Nevertheless, carbon dioxide emissions since the Industrial Revolution have increased by over 40% to levels that are unprecedented in at least 800,000 years³. This has caused warming throughout the climate system, and multiple indicators show evidence that our climate is already changing⁴; the oceans have warmed, the volume of snow and ice has diminished and, as a result, sea levels have already begun to rise.

Welsh Government is committed to mitigating climate change through a programme of decarbonisation, but we also need to make sure we are resilient and ready to adapt to the impacts of climate change as a result of past, current and future global emissions. Climate change adaptation is a response to global warming which seeks to reduce the vulnerability of our environment, economy and society to offset the effects of any adverse impacts – and to make the most of any changes that may arise.

This draft sets out our second Adaptation Plan. Our first Climate Change Adaptation Delivery Plan sits within our Adaptation Framework, detailed in chapter 15 of the Climate Change Strategy for Wales⁵. Published in 2010, it laid the foundations for a significant step towards our well-being goal of a resilient Wales. Since 2010, our achievements have included the publication and implementation of strategies to address flood and coastal erosion risk management, completion of impact assessments to understand the effects of climate change in the historic environment, and the implementation of a heat-wave plan for Wales. However, as our knowledge of the risks from climate change has grown, we recognise that we need to do more.

Welsh Government has closely supported the UK Government in developing the latest Climate Change Risk Assessment (CCRA) and in doing so, endorsed the 56 risks detailed in the UK Committee on Climate Change's supporting evidence report. This new, draft, Climate Change Adaptation Plan for Wales has been developed to respond to the risks in the CCRA, focusing on those risks identified as high priority by answering the need for more action, or research, where necessary. We welcome any comments to help inform the development of this plan – please refer to Annex 3 for a list of consultation questions.

Climate Change in Wales

The impacts from climate change

The UK Climate Projections (UKCP09)⁶ are the fifth generation of UK climate change scenarios, describing how the climate of the UK might change during the 21st Century¹. The climate model impacts were developed by the Met Office Hadley Centre with a partnership of organisations (including UK Climate Impacts Programme and Welsh Government) involved in developing tools and guidance to support the use of the projections. The projections give information on current and future climate change for the UK up to 2099. They cover England, Wales, Northern Ireland, Scotland, the Isle of Man, Jersey, Guernsey and an area of sea around the UK.

The projections provide a probabilistic view on climate change for different future GHG emissions scenarios (high, medium and low), as developed by the Intergovernmental Panel on Climate Change (IPCC)⁷. Low emissions scenarios, which would require significant mitigation actions, avoid the worst of the predicted consequences. However due to historical emissions, we are unavoidably locked into some aspects of global climate change which will require adaptation measures to be adopted across all sectors in Wales.

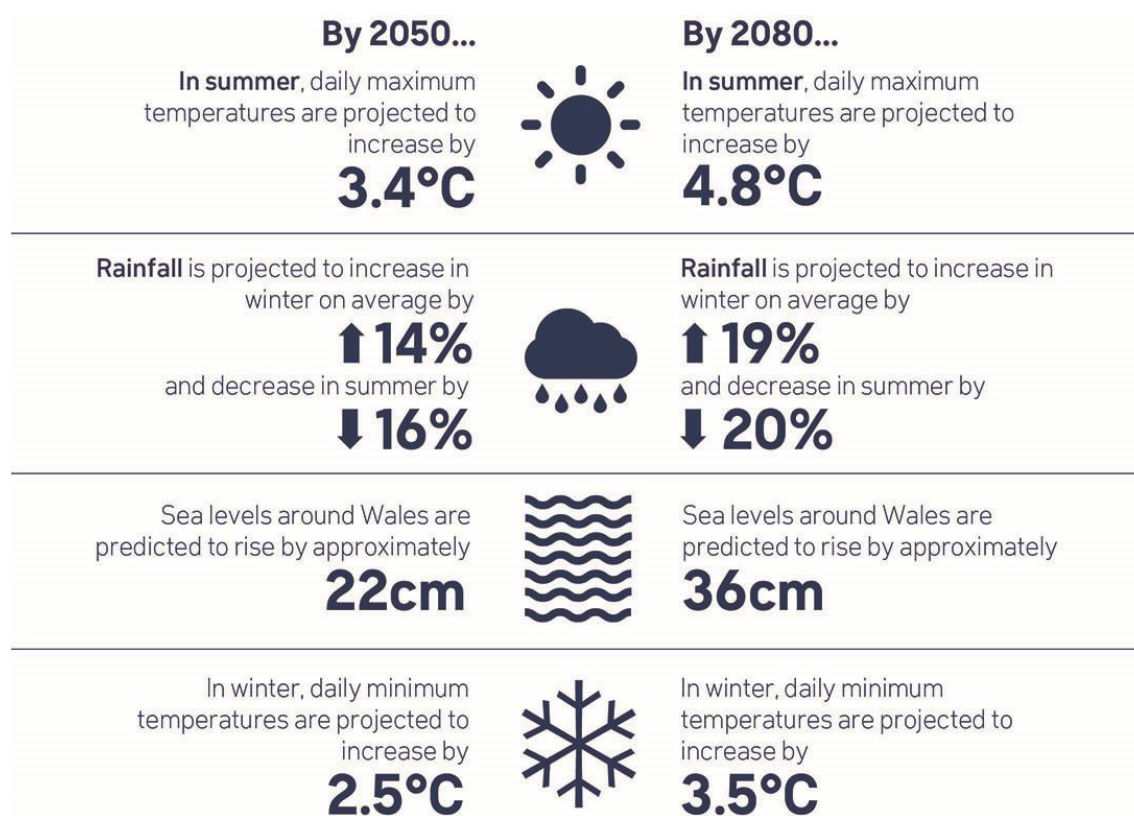


Figure 1. The projected impacts from climate change from a medium emissions scenario for 2050 and 2080.

¹ This is accurate at time of writing. The Met Office Hadley Centre is nearing the end of a programme to develop a new and far more advanced set of climate change data for 2018. The resulting UKCP18 dataset will lead to improved analysis and understanding of the impacts of climate change to Wales. The impacts detailed here will be amended soon after the new data has been published and reviewed.

Figure 1 above highlights the likely results for Wales under the medium² emissions scenario. High emissions scenarios present a much bleaker picture of the future and are the consequences of allowing emissions to grow at an unconstrained rate. For 2080, the likely results of high emissions are:

- Average annual temperatures are projected to increase by 4.1°C.
- In summer, daily maximum temperatures are projected to increase by 6.2°C.
- In winter, daily minimum temperatures are projected to increase by 4.2°C.
- Rainfall is projected to increase in winter on average by 26% and decrease in summer by 25%. Overall the total annual average rainfall is predicted to remain the same.
- Sea levels around Wales are predicted to rise by 43cm by 2080.

Climate Risks in Wales

More rain, warmer temperatures, rising sea levels, stronger winds and fiercer storms. These impacts will have an effect on all sectors across Wales in different ways. Before we begin to adapt to the impacts, it is vital we understand where these impacts will be felt the most, and understand the risks that we need to mitigate.

In order to assess the risks, the UK Committee on Climate Change (UKCCC) has looked at current policies in place and reviewed these in light of the anticipated impacts from climate change at present, and in the future. Their resulting Evidence Report Summary for Wales⁸ (CCRAER) presents a national assessment of 56 risks and opportunities arising from climate change impacting on Wales from now until the end of this century. The UKCCC's report organises the risks into five sectors in Wales, and prioritises them into four categories. Those with highest priority and stated as 'more urgent' are categorised as 'more action needed' or 'research priority'. The remaining low priority, less urgent risks are categorised as 'sustain current action' or 'watching brief'.

| | |
|--|---------------------|
| Risks to infrastructure (from all sources of flooding) | More Action needed |
| Risks to public water supplies from drought and low flows | |
| Some land management practices exacerbating flood risk | |
| Risks to ecosystems and agriculture businesses from changes in climatic conditions | |
| Risks to communities from all sources of flooding and sea level rise | Research Priorities |
| Risks to infrastructure, businesses and buildings from high river flows, erosion and extreme weather | |
| Risks and opportunities from changes in agriculture and forestry productivity | |
| Risks to people's health and well-being and associated service delivery from high temperatures, flooding and extreme weather | |

Table 1. Summary of climate change risks to Wales (adapted from Climate Change Risk Assessment Evidence Report Wales Summary, UKCCC)

² The central, 'medium; estimate is the 50% probability level – it represents an outcome that in qualitative terms, is as likely to happen as it is not.

A complete list of the more urgent risks is available in Annex 1, however, the highest priority risks to Wales are briefly summarised in Table 1 above. This Climate Change Adaptation Plan for Wales responds to the risks from the CCRA and will focus on those described as ‘more urgent’ by the UKCCC.

Adaptation and decarbonisation

While it is essential we prepare for the impacts of climate change, we must continue to do what we can to limit the cause. This means reducing and sequestering our emissions of greenhouse gases such as carbon dioxide.

The Environment (Wales) Act places a duty on Welsh Ministers to ensure that by 2050, net emissions are at least 80% lower than the baseline set in legislation. This will be achieved through the setting of interim targets for 2020, 2030 and 2040 and 5-yearly carbon budgets up until to 2050.

There is a duty on Welsh Ministers to prepare and publish a set of policies and proposals for the budgetary period. Welsh Ministers are also required to publish a statement of progress after each budgetary period. The UK Committee on Climate Change (UKCCC) will provide advice on the latest scientific evidence and report progress made against budget targets. A programme⁹ has been established to implement the requirements of the Act, which focuses on setting up the emission reduction framework.

This Climate Change Adaptation Plan for Wales has been purposefully developed separately from the decarbonisation programme. This is to make sure its actions are clear and its progress is accountable. However, it is vital to recognise the connections and synergies between the two approaches to tackle climate change, since in many cases, the actions needed are of benefit to both. Welsh Government is working very closely between the areas of adaptation and decarbonisation, both internally and with external stakeholders, to make sure both issues are considered.

There are some important examples of synergies between decarbonisation and adaptation in this plan. Deep-peat soil is a vital natural asset in terms of decarbonisation – they cover 4.3% of the total land area in Wales and represent Wales’ largest terrestrial store of carbon¹⁰. Peatlands in good condition sequester carbon dioxide from the atmosphere. However, the Climate Change Risk Assessment provides evidence that drought conditions from climate change are likely going to damage these peatlands, leading to a reversal of this process and emitting carbon dioxide. Climate change adaptation is essential here to ensure peatlands are kept wet and sustainable as carbon sinks and stores.

Another example can be found in the built environment. We need to make sure our homes and buildings are efficient to lower the amount of energy used to warm our homes, and lift families out of fuel poverty. There are a number of means to achieve this. Part L of the Building Regulations puts in place the protocols around energy efficiency which are followed by those who design and build homes. We are looking

at these regulations to try and make our homes more energy efficient and lower our carbon footprints. However, we also need to think about the future projections of our climate, because if we make our homes too efficient, there is a risk that we exacerbate the issue of over heating in our homes, impacting our health. We will therefore make sure the need to adapt to climate change is considered in the building regulations review in order to keep occupants cool in hot weather.

Climate Change Adaptation and the law in Wales

The Climate Change Act 2008

The Climate Change Adaptation Plan for Wales is supported by provisions in the Climate Change Act (CCA) 2008, which addresses among other things the impact of, and adaptation to, climate change.

The risks summarised above were extracted from the latest Climate Change Risk Assessment Evidence Report, which was developed to inform the UK Government's latest Climate Change Risk Assessment (CCRA). The CCA requires the UK Government to publish a CCRA to assess the risks to the UK from the current and predicted impacts of climate change. The Act establishes a 5-yearly cycle for review and updating of the CCRA.

There are a number of requirements, with regards to climate change adaptation, which are placed upon Welsh Ministers within the CCA. Section 80 of the Act places requirements on Welsh Ministers to produce a report from time to time on the Welsh Government's objectives, actions and future priorities regarding the impacts of climate change.

The CCA also provides Welsh Ministers with powers to produce guidance for public bodies on adapting to the impacts of climate change and discretionary powers to require public bodies to produce reports on their assessment of the current and predicted impacts of climate change.

The Environment (Wales) Act 2016

The Environment (Wales) Act 2016 provides a framework to manage Wales' natural resources in a proactive, sustainable and collaborative way and aims to position Wales as a low carbon and green economy, ready to adapt to the impacts of climate change.

There are 7 parts to the Act. Part 2 sets out the framework for emission reductions targets for Wales to decarbonise, while parts 3 to 6 set out laws with regards to carrier bag charges, waste, fisheries and marine licensing. However, parts 1 and 7 are of key interest for climate change adaptation.

Part 7 establishes the Flood & Coastal Erosion Committee and clarifies the law for other environmental regulatory regimes including flood risk management and land drainage. The Committee has a wide advisory role including advice on the wider

risks and benefits of flood and coastal erosion risk management in Wales across all sources of flooding i.e. flooding from surface water, main rivers, coastal flooding and coastal erosion.

Sustainable Management of Natural Resources

Part 1 of the Act provides for sustainable management of natural resources, an approach to managing natural resources and ecosystems so they are able to provide benefits to support our well-being now and in the future. We have learnt from the experiences of our international partners and are using international best practice drawing from the UN Convention on Biological Diversity ecosystem approach, to help Wales lead the way on Sustainable Development. Healthy and resilient ecosystems are also more able to deal with increased demands and pressures on them including from climate change.

To achieve all this, the Act provides for the preparation of a State of Natural Resources Report (SoNaRR) which is the national evidence base for SMNR and also provides an assessment of the extent to which SMNR is being achieved.

Natural Resources Policy for Wales

The Natural Resources Policy (NRP) then draws on the evidence in SoNaRR and sets out the national priority areas to both tackle the challenges to Wales' natural resources and ecosystems and realise the many opportunities they provide across the well-being goals. The national priorities are:

- Delivering nature-based solutions
- Increasing renewable energy and resource efficiency
- Taking a place-based approach.

These priorities support climate change adaptation – both through taking an ecosystem approach to adaptation, and also to support the wide social and economic challenges that will need to be tackled. The approach Welsh Government is taking to delivery is to align policies to the delivery of the national priorities. Nature-based solutions are defined by the International Union for Conservation of Nature (IUCN) as “actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits”. They include approaches to improve infrastructure, support climate change adaptation and mitigation and improve land and water management. The State of Natural Resources Report shows that these areas deliver most in terms of both ecosystem resilience and benefits across the well-being goals:

- Increasing green infrastructure in and around urban areas
- Coastal zone management and adaptation

- Increased canopy cover and well-located woodland for greatest ecosystem service value
- Maintaining, enhancing and restoring floodplains and hydrogeological systems to reduce flood risk and improve water quality and supply
- Restoration of our uplands and managing them for biodiversity, carbon, water, flood risk and recreational benefits.
- Support the development of resilient ecological networks.

Area Statements

The Act also requires Natural Resources Wales (NRW) prepare, publish and review Area Statements. Each area of Wales must be included within at least one Area Statement.

Area Statements will consider the evidence from the State of Natural Resources Report to help implement the priorities, risks and opportunities identified by the National Natural Resources Policy for the sustainable management of natural resources at the local level. This is to ensure the Natural Resources Policy takes a place based approach and that its impact is maximised.

The Well-being of Future Generations (Wales) Act 2015

The key purpose of the Well-being of Future Generations (Wales) Act is to improve the social, economic, environmental and cultural well-being of Wales, protecting our country's assets for the future. Through five ways of working, the Act makes public bodies (as listed in the Act) think more about the long-term, work better with people, communities and each other, look to prevent problems and take a more joined-up approach.

There are a number of parts to the Act, all of which are important to climate change adaptation. This is because protecting our country for future generations requires adapting to climate change. Several aspects of the Act are, however, of particular importance.

Future Trends Report

It's important that we understand the challenges that we will be facing, and have a clear picture of where we are heading. To do this, within the twelve months after an Assembly election, Ministers must publish a 'Future Trends Report' containing predictions of likely future trends in social, economic, environmental and cultural well-being of Wales. In preparing the report, Welsh Ministers must take account of the United Nations' sustainable development goals and the impact of climate change on Wales. The latest report¹¹ was produced in 2017 and includes a section on the risks of climate change, making reference to the latest Climate Change Risk Assessment. The report helps inform Welsh Ministers' decisions on policy to ensure sustainable development into the future.

Public Service Boards

The Act also establishes Public Service Boards (PSBs) for each Local Authority in Wales, made up from representatives of public bodies including Local Authorities, Health Boards, Fire and Rescue and Natural Resources Wales. Each PSB must improve the economic, social, environmental and cultural well-being of its area by working to achieve the well-being goals (set out below). To do this, each PSB must develop a Well-being Plan, and each plan must be informed by a Well-being Assessment. The Act requires PSBs to take the latest Climate Change Risk Assessment into account when developing their Well-being Assessments.

Well-being Goals

The Well-being of Future Generations (Wales) Act was the first piece of legislation in the world to link with the United Nations' Sustainable Development Goals by putting in place seven well-being goals for Wales to make sure we are all working towards the same

vision. All public bodies have a responsibility to contribute towards reaching these goals. All seven are important when thinking about the need to adapt to the impacts of climate change and examples of how we intend to do this are set out below. Some of the well-being goals are particularly important in regards to climate change. The Act defines 'a **resilient Wales**' as:

"A nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change (for example climate change)."

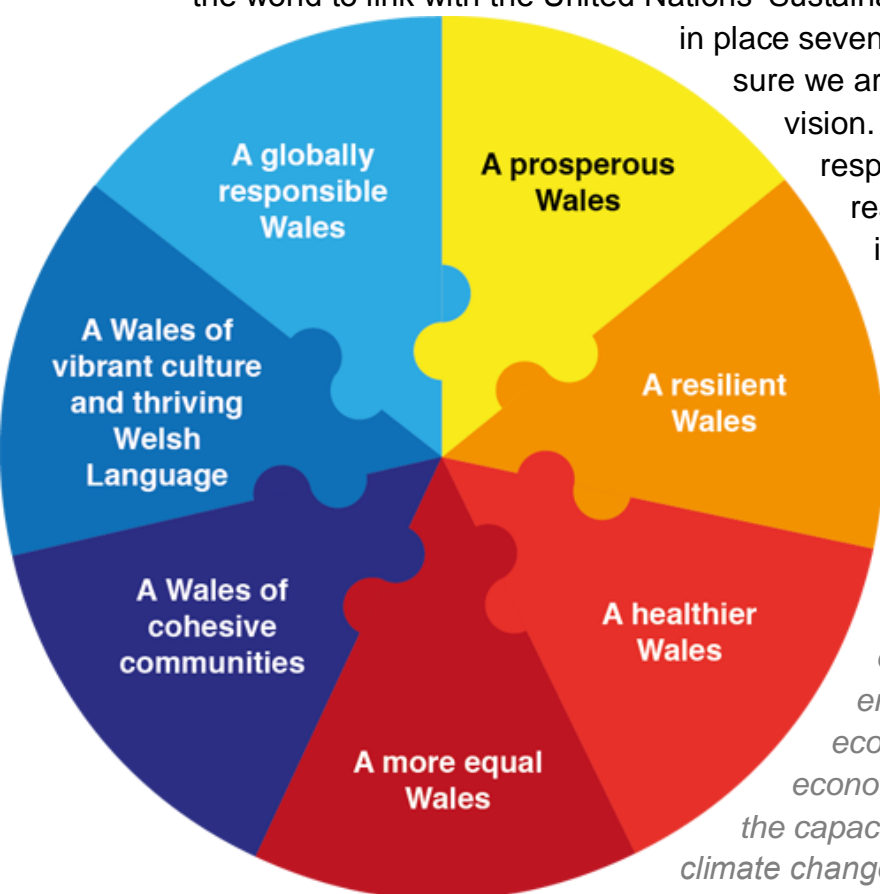


Figure 2. The Well-being Goals of the Well-being of Future Generations (Wales) Act 2015

This Climate Change Adaptation Plan for Wales goes to great lengths to reach this goal. Each of the below actions in Part 2 of this plan has been carefully considered to ensure Wales is resilient to the impacts expected from climate change in areas such as health, economy, communities and homes. Outlined below is a summary of how the actions contribute to the remaining six goals, by highlighting some of our actions moving forward.

The actions in this plan will help Wales become an innovative, productive and low carbon **prosperous Wales** which recognises the limits of the global environment. In our rural economy, for example, we are committing to work with the Agriculture Industry Climate Change Forum to develop a Sustainable Brand Values Programme, supporting adaptation in agriculture. In support of businesses in other sectors, Welsh Government will review its Climate Change Adaptation Business Tool, currently targeted towards the tourism sector, to give advice on adaptation resources and best practice. We are also looking to improve the resilience of our infrastructure in this plan, making sure our staff are able to reach their places of work through schemes such as Network Rail's Vegetation Management Capability Development Programme, to manage line-side growth and reduce incidences of weather-related cancellations.

We will also be supporting businesses through Welsh Government's Business Wales website by raising awareness of issues such as overheating in the workplace. Doing this also contributes to the goal of a **healthier Wales**. An entire section of this plan is dedicated to staying healthy and includes actions to answer the health-related research needs highlighted in the UKCCC's Climate Change Risk Assessment. Under this plan for instance, we will be increasing our understanding of the risk of extreme weather to the delivery of health and social services, revising Public Health Wales guidance related to the impacts of climate change, and improving monitoring at our ports and airports of new diseases carried by vectors such as mosquitos.

It is an unfortunate truth that those who experience inequality are more likely to be impacted by the effects of climate change. For example, the United Nations¹² highlight that inequality implies less resources for disadvantaged groups to undertake coping and recovery measures from various impacts. This plan, therefore, also includes some actions to make a **more equal Wales**. The UKCCC explain that while there are potential health benefits from warmer winters in Wales, more action is needed to manage current risks to people from cold temperatures through addressing fuel poverty. In this plan, we have reiterated our target to ensure a further 25,000 homes benefit from the Warm Homes Programme by 2021 and to complete research to evaluate the impacts of the Nest and Arbed schemes on health outcomes by 2021.

We will also be working with a number of community led organisations to support those most in need to create a more equal Wales, contributing to the goal of a **Wales of cohesive communities**. There are specific actions in the plan to work with communities. We will help improve local environments through projects such as 'Renew Wales' which uses a mentoring approach to support community projects which might otherwise lack the knowledge needed to deliver successful projects. We are also supporting the Create-Your-Space programme which aims to reconnect local communities with local ecosystems, making them aware of local environmental issues in need of adaptation.

In many cases, working to preserve local communities in this way will contribute to retaining local culture. Our adaptation plan includes a chapter on the historic environment, recognising how this sector weaves through almost every other and demonstrating the importance of cross-sector working. Actions in this chapter will ensure **a Wales of vibrant culture and thriving Welsh Language** by preserving our heritage for future generations. The Historic Environment Sector Adaptation Plan, to be published in 2019, will include actions to preserve our heritage, mitigating the damage to historic assets from extreme weather, for example. Our work with communities and schools will also provide opportunities to promote the Welsh Language.

We have detailed a number of strategic actions that cut across all parts of this climate change adaptation plan, which include our efforts in creating **a globally responsible Wales**. Wales participates in a number of international groups to promote, share and learn best practice for adaptation to climate change. This includes the Network of Regional Governments for Sustainable Development and the RegionsADAPT initiative. We also support other nations in taking steps to adapt through projects such as the Wales in Africa programme. The programme funds the 'Size of Wales' project which has already helped plant over 8 million trees in Mbale. More detail on this project and all others mentioned above is given in Part 2 of this plan below.

Approach to the plan

Vision

In the development of the Well-being of Future Generations (Wales) Act 2015, Welsh Government completed a 12 month long public conversation to understand what Wales' citizens want to see, both now and in the future. The resulting report led to a new vision for [The Wales We Want](#). It reads:

“We need to make our environment and our communities more resilient to the major environmental problems we face including addressing declining biodiversity. We need people to be healthy, to achieve their potential and to make Wales a more equal society. We need to reduce our consumption of natural resources and act to tackle the causes and consequences of climate change”.

The result confirmed a vision for a sustainable Wales engrained within the well-being goals, particularly in this case the goal of ‘A Resilient Wales’. Adapting to climate change is essential to developing sustainably into a resilient Wales. The vision we outline below reflects this view.

A Vision for Wales in 2030

With the capacity to adapt, the resources to be prepared and the knowledge needed to understand the risks and opportunities, Wales is prosperous, ambitious, unified and strong.

Wales is resilient.

Objectives

To make the above vision a reality, this Climate Change Adaptation Plan for Wales contains 32 actions to help Wales adapt to the impacts of climate change. These actions contribute to three core objectives which have been carefully chosen to ensure a multifaceted approach to mitigating the impacts. The three objectives are knowledge, capacity and resilience. Listed below, they have been colour coded to help identify how the actions contribute.



Figure 3. The three core objectives of this Climate Change Adaptation Plan for Wales.

Structure

The structure of our plan has been carefully designed to make clear what we are going to do over the next five years, in order to make Wales resilient to the impacts of climate change. The action chapters in part 2 below outline the 32 actions in seven sectors (and one strategic chapter) that we will complete over this period. Each chapter details a sector which was chosen to represent the more urgent risks as given in the UKCCC's evidence report. These sectors are shown in figure 4 below.



Figure 4. The seven sectors of the new Climate Change Adaptation Plan for Wales

The structure of each chapter has been designed to give the reader enough information early on in order to understand our commitments in summary, before then going into more detailed narrative to explain how we intend to deliver them. The start of each chapter briefly explains how each sector is affected by the multiple impacts of climate change. This is to help understand why the sector is important,

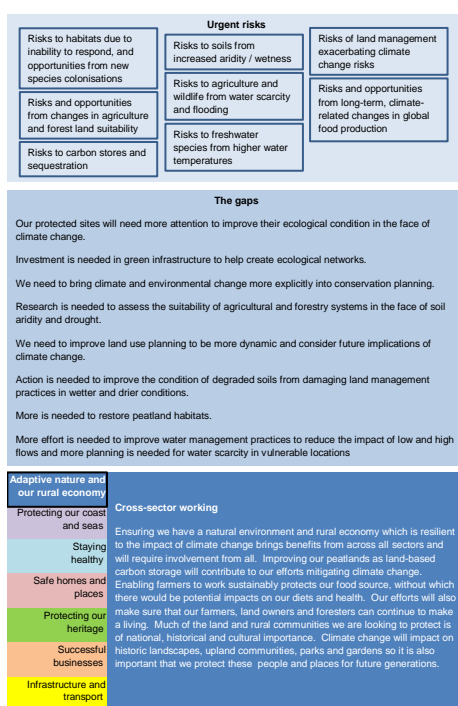


Figure 5 - example one-page summary of risks

why action is needed, and to understand the chapter in the context of the rest of our adaptation plan. Each chapter then includes a simple one-page outline (Figure 5 below) of three key considerations – the ‘urgent risks’ for the chapter, the gaps in action we need to address and a short section on cross-sector working.

The ‘urgent risks’

Our approach to this adaptation plan has been to focus on those risks given in the UK Climate Change Risk Assessment 2017 Evidence Report Summary for Wales, as ‘more urgent’. The report states these are the risks identified as ‘more action needed’ or ‘research priorities’. These risks are highlighted at the top of the one page summary.

In some cases, there are other risks from climate change for which the UK Committee on Climate Change have stated we should ‘sustain current action’. Detail against these risks, has been included at the end of each chapter where appropriate. In addition, there are 10 risks within the UK Climate Change Risk Assessment 2017 Evidence Report Summary for Wales designated as ‘watching brief’. Our approach to monitoring these risks is detailed as an action in its own right, under the strategic actions section in part 2 below.

The gaps

In coming to their conclusions on designating urgency scores to the risks in the CCRA, the UKCCC summarise each risk by suggesting the type of action needed. This provides an insight into the gaps in adaptation action in Wales and describes what could be done to rectify the gap. The middle section of the one page summary in each chapter summarises these gaps.

Cross-sector working

Each sector is not by any means discrete from any of the others. In many cases, actions within each sector will benefit others in multiple and significant ways. A short summary to explain the importance of cross-sector working is included here.

The Actions

The actions under each chapter are summarised in action tables. Each action table is colour-coded to demonstrate which of the above three objectives the action supports, and paints a clear picture of what we are committing to achieve, by when and with whom. Each chapter then ends with detail about how we intend to carry out the many commitments. The actions in our Climate Change Adaptation Plan for Wales are numbered with abbreviations relevant to each section (for example CCAPW-AN1, an abbreviation of 'Climate Change Adaptation Plan for Wales – Adaptive Nature'), and summarised in the annex. The annex also maps out the risks from the CCRA Evidence Report and actions to which they relate, for ease of reference.

A 'living' plan

It is important to understand that adaptation in Wales will be a continual process – this plan will not be a single means to an end. We need to ensure the actions outlined in this plan continue to be appropriate and deliverable once the United Kingdom leaves the European Union. We have recognised this already with our 'Brexit and our Land' consultation to develop a sustainable land management scheme post-EU, which recognises the need to adapt to the challenges of climate change (see 'adaptive nature and rural economy' below). We also understand that global knowledge with regards to climate change and adaptation is constantly improving, and that different risks and reasons to act may arise.

The UK Climate Projections

Much of what we understand about the predicted impacts from climate change and the risks these impacts are anticipated to cause come from significant amounts of research carried out by academic and research institutions across the world. The latest CCRA takes data from the Met Office's climate modelling data known as the UK Climate Projections, or UKCP09.

UKCP09 provides future climate projections for land and marine regions as well as observed (past) climate data for the UK. UKCP09 was produced in 2009, funded by a number of agencies led by Defra. It is based on sophisticated scientific methods provided by the Met Office, with input from over 30 contributing organisations. UKCP09 has been used by many organisations, including Welsh Government, to assess potential impacts of the projected future climate and to explore adaptation options to address those impacts.

At time of writing, UKCP09 was the latest and most advanced dataset available to model the potential impacts from climate change in the UK. However, the Met Office has developed new data, under the name UKCP18 published in November 2018. Welsh Government will use the latest data to inform new actions for this adaptation plan and any further research needed.

For these reasons, we will look to review and revise this plan as we progress – adding new actions as the need becomes clear. There are a number of risks from climate change that we need to understand better in order to act. The actions listed in this plan are, therefore, those we intend to begin now, working closely with organisations across the country.

Each of the actions in this document has been considered with care, following a review of the risks and opportunities highlighted in the UK Government's latest Climate Change Risk Assessment, the associated Evidence Report published by the UK Committee on Climate Change, and in consultation with sector practitioners and expert organisations.

Monitoring & Evaluation

Monitoring and evaluating the progress of any plan of action is essential to measure progress, and a suitable monitoring and evaluation framework will therefore be developed alongside this plan.

The framework will put in place the means to develop a mechanism allowing for an understanding and monitoring of the progress made by Welsh Government and its stakeholders, in the implementation of specific actions below. The framework will also allow policy makers the possibility to evaluate long-term changes produced by the plan on relevant issues, to inform the development of any further, or future actions, and to help inform our next plan.

At present, baselines and indicators for the actions in this plan are to be confirmed. However, our monitoring and evaluation framework will make clear the baselines and indicators for the actions as well as bring a level of accountability to the plan to measure our progress. In comparison to our previous adaptation plan, we will be reporting separately from our progress on decarbonisation – this is to make sure there is clarity between the two subjects so that the evidence is not lost in the mix of the two.

Welsh Government will report progress every two years. The second progress report will also be informed by a review by the UK Committee on Climate Change. This is to make sure we are obtaining independent advice on progress to feed into the development of our third adaptation plan.

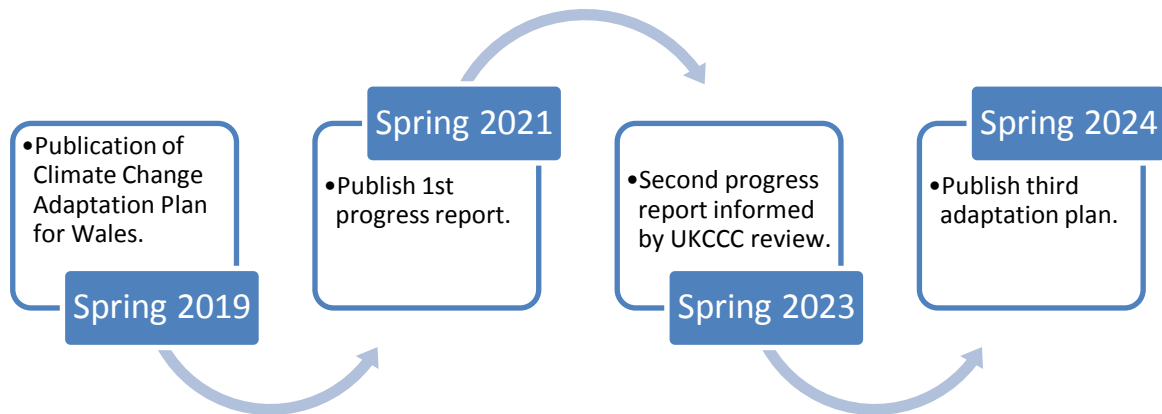


Figure 6. Reporting timeline for monitoring and evaluation.

Part 2 – The Actions

Our strategic actions

Adapting to the impacts of climate change requires a strategic approach. The way we communicate the impacts, the risks and the actions we are taking needs to be clear, concise and accessible. We also need to take a consistent approach to our research so as to ensure our actions are based on an understanding of change shared by all.

Our action plan includes a number of commitments to support adaptation efforts across all sectors. These ensure better communication and governance, as well as collaboration at a high level to develop the understanding needed to effectively adapt. By improving our approach to communication, we will be better placed to support sectors in finding resources to help them adapt. We will also work across the country with many stakeholders to fill knowledge gaps where needed, to make sure we have all the information we need before taking action.

Welsh Government is also aware that more needs to be done internally to ensure the risks of climate change are considered in all its work. This section therefore also includes actions to address this and the way we integrate adaptation into business planning elsewhere.

Climate change does not respect borders and we understand very clearly the disproportionate ways in which climate change can affect developing countries which are less able to adapt. In many cases – the parts of our world which are most vulnerable are those which historically have emitted the least amount of the greenhouse gases which we understand have led to a changing climate. Similarly, this new adaptation plan presents a chance to improve the living conditions for the more vulnerable communities in Wales and to close the inequality gaps highlighted in the Equality and Human Rights Commission's *'Is Wales Fairer'* report. It is our responsibility to support these countries and vulnerable communities and our adaptation plan includes a number of collaborative actions with nations across the world.

The risks

As this section looks at our strategic actions, all risks from the CCRA are being considered here to some degree. For example, action CCAPW-ST3 below will include supporting the UKCCC in a number of research programmes to address gaps in understanding on water supply, human behaviour and the natural environment.

Our commitments

| | |
|---------------------------------|---|
| CCAPW-ST1 Knowledge | Review and update our approach to communication for climate change adaptation in Wales |
| Summary | <ul style="list-style-type: none"> • Update the Welsh Government adaptation webpages. • Review and update online adaptation tools on the Welsh Government website to support engagement with external stakeholders. • Increase online presence to ensure climate change adaptation is kept high on the agenda. • Develop a children and young people's version of the adaptation plan to make clear the risks and action to our younger and future generations. |
| Timescale | 2019 |
| Stakeholders | All sectors |
| Who will deliver | Welsh Government |
| Indicators and baselines | To be confirmed |

| | |
|---------------------------------|--|
| CCAPW-ST2 Capacity | Integrate consideration of climate risks in all future policy and business planning within Welsh Government and encourage the same in all other public bodies |
| Summary | <ul style="list-style-type: none"> • Include climate change adaptation within our integrated impact assessment. • Review and update Welsh Government's adaptation statutory guidance as a means to improve efforts at integrating adaptation planning into all public bodies in Wales. • Review the Welsh Government's position on the use of the Adaptation Reporting Powers of the Climate Change Act 2008. |
| Timescale | 2020 |
| Stakeholders | Public Bodies Reporting bodies |
| Who will deliver | Welsh Government |
| Indicators and baselines | To be confirmed |

CCAPW-ST3
Capacity

Assess the risks and opportunities presented by climate change through active engagement in UK research programmes

| | |
|---------------------------------|--|
| Summary | <ul style="list-style-type: none"> • Collaboration with academia, research councils, NGOs, UK Government and other devolved administrations to fill knowledge gaps on the risks and opportunities of climate change. • Support development of the 3rd UK Climate Change Risk Assessment. • Collaborate with the UK Committee on Climate Change to monitor those risks designated as 'watching brief'. |
| Timescale | Ongoing |
| Stakeholders | Academia and Universities UK Government Devolved administrations Non-governmental organisations Public Bodies Research councils UK Committee on Climate Change |
| Who will deliver | Welsh Government Academia and Universities UK Government Devolved administrations Non-governmental organisations Research councils UK Committee on Climate Change |
| Indicators and baselines | To be confirmed |

| | |
|---------------------------------|--|
| Summary | <ul style="list-style-type: none"> • Support projects to help other countries adapt to climate change where they are otherwise less able. • Continue collaboration with the international adaptation community to share adaptation best practice and knowledge of climate impact and risk. |
| Timescale | Ongoing |
| Stakeholders | Welsh Government International third-sector organisations Network of Regional Governments for Sustainable Development (NRG4SD) Other nations |
| Who will deliver | Welsh Government Size of Wales Keep Wales Tidy Plant! |
| Indicators and baselines | To be confirmed |

Communication

Global knowledge of the impacts, risks and opportunities of climate change is constantly improving, so we need to ensure that the decisions we make, the support we offer and the advice we give is based upon the very latest knowledge. That means improving the way we communicate our adaptation work to ensure it is accessible, understandable and practical.

Following publication of this Climate Change Adaptation Plan for Wales, Welsh Government will overhaul its approach to communication around adaptation. This will include a complete review of webpages, and other forms of online presence to ensure everyone who needs it has access to the latest information in Wales. A children and young people's version of this plan will be developed to make sure our future generations are aware of the risks and actions needed, but also to encourage them to discuss these issues with their families.

Our 2010 Adaptation Delivery Plan led to the development of a number of online tools to support other organisations in adapting to climate change. As part of our communication overhaul, we will also bring these tools up to date with the latest information and look at new ways, such as social media, to reach out to organisations across the nation and help them adapt to climate risks. By continually reviewing the latest developments on adaptation, we will collect and share case studies of good adaptation practice to guide practitioners in their work.

Adaptation in Wales

The impacts of climate change in Wales are already being seen across many sectors and the heat wave of July 2018 rose questions of how prepared we are to deal with extreme weather situations. The latest Climate Change Risk Assessment makes clear the wide impacts of a changing climate and we therefore need to ensure that the risks and impacts are reviewed in all policy making from now on. Not only must we work to adapt, but we also need to ensure that none of our future decisions exacerbate the risks. Welsh Government has now included consideration of climate change risks in the integrated impact assessment to embed adaptation into policy making in the future.

Welsh Government will support private and public sector bodies, where possible, to achieve our vision of a resilient Wales. To do this, it will review the current statutory adaptation guidance for public bodies and all other organisations to ensure it is as effective as it can be in encouraging and supporting other organisations in preparing adaptation plans. The Climate Change Act 2008 affords Welsh Government a discretionary power, known as the Adaptation Reporting Power, to direct certain bodies ('reporting authorities') to report on their preparations for climate change. Welsh Government consulted on the use of this power early in 2011 and decided not to invoke the power. In light of the risks highlighted in the Climate Change Risk Assessment, Welsh Government will review its position on the use of this power.

Research and understanding

The UKCCC highlights 21 risks in its Climate Change Risk Assessment Evidence Report as 'Research Priorities' for Wales. As all the risks highlighted in the report are cross-cutting, it is important to include a strategic action to ensure our efforts to address knowledge gaps are co-ordinated and consistent in nature. Welsh Government has committed to addressing a number of research gaps separately in actions listed elsewhere in this document. Nevertheless, we have already begun to work with the UKCCC, UK government and research councils to answer cross-sector questions, such as how the risks from climate change interact. We will report on our research efforts periodically and use the resulting evidence to help develop further adaptation actions in the future. The research will also contribute to the third Climate Change Risk Assessment, due to be published in 2022.

Welsh Government also commits to continued collaboration with the UK Committee on Climate Change to monitor the levels of risks across all sectors. Ten of the risks within the UK Climate Change Risk Assessment 2017 Evidence Report Summary for Wales have been designated as 'watching brief'. The UKCCC defines these risks as those which 'should be kept under review, with long-term monitoring of risk levels and adaptation activity so that further action can be taken if necessary'. Welsh Government contributes to the funding of the Committee's Adaptation Sub-

Committee, and will continue to work with them to ensure the long term monitoring of these risks in the development of future Climate Change Risk Assessments.

Case Study

Welsh Government is collaborating with the Economic and Social Research Council (ESRC) funded seminar series CASCADE-NET - Civil Agency, Society and Climate Adaptation to Weather Extremes. The seminar series, led by the University of the West of England, looks to answer how people interpret climate risks in social learning, including the role of social platforms and social networks for knowledge sharing and capacity building (in increasing the agency of civil society in extreme weather resilience). The outcomes from the seminar series will inform research and policy agendas for adaptation in the future.

Working with the rest of the world

Welsh Government is a member of the RegionsAdapt framework, which sits within the Network of Regional Governments for Sustainable Development (nrg4SD). The nrg4SD acts as the voice of subnational governments at UN negotiations, European Union initiatives and global discussions on environmental and sustainable development affairs. With RegionsAdapt, we work to inspire and support regional governments to take concrete action, collaborate and report efforts on climate change adaptation. Welsh Government will continue to collaborate and share knowledge with other states and regions within the group to enable adaptation at a global level.

Case Study – Nature Based Solutions

Bringing together sub-national governments willing to ensure a nature based approach to decarbonisation and climate change adaptation is a key pillar of our climate action.

Recognising this, Welsh Government introduced a Nature Based Climate Action Memorandum of Understanding (MoU) at the United Nations Framework Convention on Climate Change (UNFCCC) Conference of Parties (COP) 21 in Paris, 2015, alongside the sub-national governments for Basque, Catalonia, Manitoba, Quebec and Sao Paulo.

The MoU:

- brings sub-national governments together willing to ensure that nature based solutions are a mechanism of climate action.
- offers an opportunity for states, regions, and cities to share ideas and best practices on the role nature based solutions offer for climate adaptation and mitigation
- provides a model for other sub-national governments to join
- provides a platform for collaboration and cooperation opportunities to increase technical and scientific understanding.

Signatories of the MOU have committed to:

- promote investments to enhance ecosystem resilience as part of the response to climate change
- look to natural and green infrastructure solutions
- use tools and assessments that promote a greater understanding of the wider value of biodiversity and healthy ecosystems
- develop tools that measure the benefits of joined up approaches
- increase technical and scientific cooperation.

The MoU is available to view at:

<https://gov.wales/topics/environmentcountryside/consmanagement/natural-resources-management/environment-act/memorandum-of-understanding/?lang=en>

Through the EU-funded Ireland Wales Programme 2014-2020, adaptation of the Irish Sea and Coastal Communities to Climate Change is designated one of three priorities for action. Examples of projects supported by this programme are detailed below in the 'Protecting our Coast and Seas' chapter. The programme enables co-operation with Ireland to preserve and enhance the shared marine and coastal environment in the face of climate change.

Welsh Government also supports a number of other initiatives to help other countries across the world. Size of Wales was created by the Wales' Millennium Development Goals Task Force as part of Wales' response to the dual challenges of climate change and international poverty reduction. The aim of Size of Wales is to bring people in Wales together to help sustain an area of tropical forest "the size of Wales" (some two million hectares) as part of a national response to climate change. The goal was reached in March 2013 and, since then, Size of Wales and its supporters have set a new target of protecting an area of rainforest equivalent to "twice the size of Wales" (four million hectares). Welsh Government funding to Size of Wales also covers a climate change education and awareness raising programme, which Size of

Wales is uniquely positioned to deliver through its international experience and understanding of climate change and its impacts.

Size of Wales has close links with the “10 Million Trees” tree-planting project in Mbale, Uganda, which receives ongoing funding under Welsh Government’s Wales for Africa programme. This project has already planted over 8 million trees and forms a key part of the education and engagement work carried out by Size of Wales. It showcases pioneering work in providing incomes for farmers and families through fruit and coffee crops and bee-keeping, shade for animals and people, soil stabilization, as well as providing a carbon store for emissions. Size of Wales also sits on the board of the “Plant!” scheme run by Natural Resources Wales where two new trees are planted for every new birth and adoption of a child in Wales, one in Wales and one in Mbale, Uganda.

We go further yet in supporting children on environmental issues on the global scale. The Eco-Schools programme engages millions of children across some 70 countries, making it the largest environmental educational programme in the world. The Eco-Schools programme is operated globally by the Foundation for Environmental Education (FEE), based in Copenhagen. In Wales, the Welsh Government funds Keep Wales Tidy (£391,125 approved for 2018-19, an increase of 5%) to operate the Eco-Schools programme. It covers over 90% of schools representing over 430,000 pupils in Wales, one of the highest participation rates in the world. This highly successful programme has been run by Keep Wales Tidy since 1998 and has been supported by Welsh Government and its predecessor bodies since then. Some 800 Welsh schools have now attained the International Green Flag award, the highest level under the programme. Of these, some 320 schools have become “platinum” schools with four Green Flags. A detailed case study is given in the ‘Homes and Places’ section below.

Adaptive nature and the rural economy

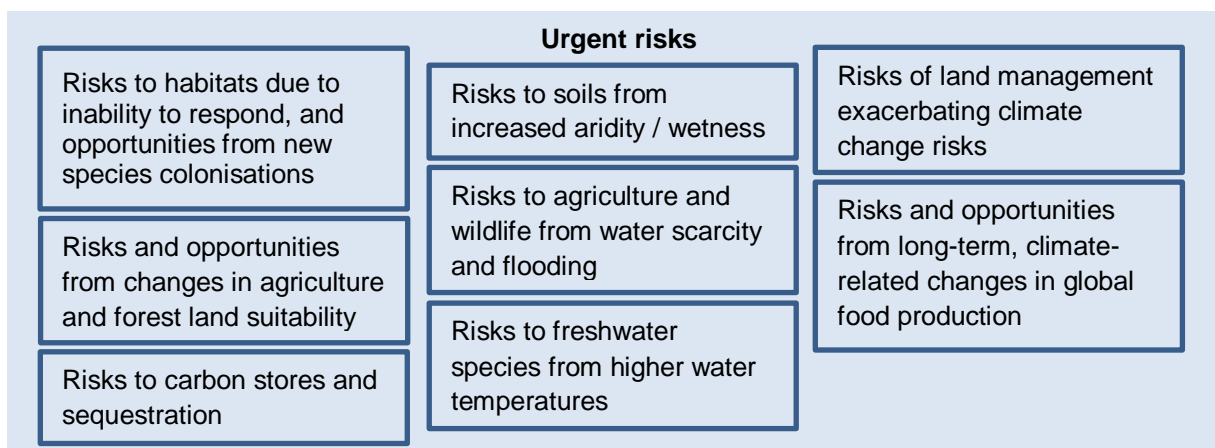
This first sector-based chapter focuses on the actions needed to ensure our natural environment and rural economy remain resilient against the impacts of climate change. The CCRA Evidence Report suggests the impacts will bring a number of significant challenges for the natural environment and agriculture. For example, all classes of crops and livestock are at risk from episodic events of heavy rains and droughts. The resulting impact and consequential loss could be felt for some years to come, both financially and physically. Conversely, there may be options to diversify into alternative crops. Nevertheless, due to other physical limitations, such as gradient, stone, rock outcrops and soil depth, Wales has up to 80% of its Utilised Agricultural Area (UAA) classed as Area of Natural Constraints (ANC). This creates other challenges that can be difficult to overcome such as distance from markets and processing facilities, as well as poor infrastructure. Understanding the challenges and risks, and identifying options and actions is therefore an essential step in developing a strategic approach to climate change.

There is a general consensus that climate change will potentially favour Invasive Non-Native Species (INNS) leading to increasing numbers of new species and spread of established INNS. Changes in temperature are likely to stress native species, decreasing resistance to invasion. Similarly, increased frequency of episodic events such as flood and fire could benefit INNS. However, as the climate warms, the distribution of species is expected to be driven northward and to higher altitudes, bringing challenges to agriculture and the maintenance of biodiversity.

Changes in agricultural and forestry productivity may also lead to increased / changing use of pesticide. Increased occurrence of winter floods and summer droughts is likely to lead to a greater volume of pesticides being lost to watercourses. A loss in the number of active substances available (through tighter regulatory restrictions or through changes in agricultural practice) would in all likelihood lead to an increase in the rate of resistance development in target pest species (and hence reduced food production). More work is needed to understand these sorts of interactions in the future.

The State of Natural Resources Report, the State of Nature Report and UK National Ecosystem Assessment confirm the continuing decline of biodiversity, ecosystems and the services we derive from our natural resources. This has been caused by, amongst other things, the loss and fragmentation of semi-natural habitats, pollution, exploitation of marine ecosystems, and invasive species. Climate change is an over-riding factor, interacting with all of the above to produce additional stress.

The observed increase in average temperatures has had generally positive effects upon terrestrial invertebrates during spring and summer. However, warmer and wetter winters have also had negative effects on moth and butterfly populations.



The gaps

Our protected sites will need more attention to improve their ecological condition in the face of climate change.

Investment is needed in green infrastructure to help create ecological networks.

We need to bring climate and environmental change more explicitly into biodiversity planning and management.

Research is needed to assess the suitability of agricultural and forestry systems in the face of soil aridity and drought.

We need to improve land use planning to be more dynamic and consider future implications of climate change.

Action is needed to improve the condition of degraded soils from damaging land management practices in wetter and drier conditions.

More action is needed to restore peatland habitats.

More effort is needed to improve water management practices to reduce the impact of low and high flows and more planning is needed for water scarcity in vulnerable locations

| Adaptive nature and our rural economy | |
|---------------------------------------|---|
| Protecting our coast and seas | Cross-sector working Ensuring we have a natural environment and rural economy which is resilient to the impact of climate change brings benefits from across all sectors and will require involvement from all. Improving our peatlands as land-based carbon storage will contribute to our efforts mitigating climate change. Expanding our woodland cover is a critical component of reducing GHG emissions from the land based sector, and also helps to mitigate the effects of climate change. Enabling farmers to work sustainably protects our food source, without which there would be potential impacts on our diets and health. Our efforts will also make sure that our farmers, land owners and foresters can continue to make a living. Much of the land and rural communities we are looking to protect is of national, historical and cultural importance. Climate change will impact on historic landscapes, upland communities, parks and gardens so it is also important that we protect these people and places for future generations. |
| Staying healthy | |
| Safe homes and places | |
| Protecting our heritage | |
| Successful businesses | |
| Infrastructure and transport | |

Our commitments

| CCAPW-AN1 Resilience | Protect land as an asset to carbon storage and sequestration |
|---------------------------------|---|
| Summary | <ul style="list-style-type: none"> • Complete the delivery of the 'Peatlands for the Future' programme. • Use the statutory and policy framework in Wales to deliver woodland creation to optimise the benefits provided by forestry, woodland and trees. • Increase our efforts to protect peatlands from drought and flood and to restore organic soils to become active peatlands. • Restoration of afforested deep peatlands sites on Welsh Government woodland estate. |
| Timescale | Ongoing |
| Stakeholders | Natural Resources Wales Non Governmental Organisations Action Groups Academia Landowners and Woodland Managers Local Authorities |
| Who will deliver | Natural Resources Wales Non Governmental Organisations Action Groups Academia Landowners and Woodland Managers Local Authorities |
| Indicators and baselines | To be confirmed |

CCAPW-AN2

Resilience

Safeguard, enhance and promote our woodlands as an asset to adapt to climate change

| | |
|---------------------------------|---|
| Summary | <ul style="list-style-type: none">• Continue delivery of our Woodland for Wales programme to bring woodland habitats, native woodlands, Plantations on Ancient Woodland Sites (PAWS) and other special woodlands sites into favourable management to improve their resilience and biodiversity.• Develop and maintain a risk register of pests and diseases and their threat to tree health in Wales.• Implement the <i>P.ramorum</i> (sudden oak death) recovery programme.• Protection of ancient, veteran and heritage trees. |
| Timescale | Ongoing |
| Stakeholders | Natural Resources Wales Animal and Plant Health Agency Non Governmental Organisations Action Groups Academia Landowners and Woodland Managers Local Authorities |
| Who will deliver | Welsh Government Natural Resources Wales Animal and Plant Health Agency Non Governmental Organisations Action Groups Academia Landowners and Woodland Managers Local Authorities |
| Indicators and baselines | To be confirmed |

CCAPW-AN3
Resilience

Mitigate the impacts of invasive non-native species to protect and enhance ecosystem resilience, quality of life and economic interest in Wales

| | |
|---------------------------------|---|
| Summary | <ul style="list-style-type: none"> • Collaborate on, and implement actions in the GB invasive non-native (INNS) strategy. • Incorporate biosecurity measures into marine proposals to reduce the risk of introducing and spreading marine INNS. • Coordinate, set priorities and raise awareness of INNS in Wales through the Wales INNS group. • Implement the EU Invasive Alien Species Regulation obligations. • Introduce contingency plans to respond to newly arrived INNS. • Develop a grey squirrel management action plan for Wales. • Incorporate grazing management plans with clear objectives to maintain important habitats. |
| Timescale | 2018–2023 |
| Stakeholders | UK Government and Devolved Administrations Natural Resources Wales GB Non-native Species Secretariat Conservation NGOs and forums Farmers, graziers, land managers and woodland owners |
| Who will deliver | Welsh Government Natural Resources Wales Farmers, graziers, land managers and woodland owners Conservation NGOs and forums |
| Indicators and baselines | To be confirmed |

CCAPW-AN4
Capacity

Mitigate the risk of flood and drought in forestry and agriculture

| | |
|---------------------------------|---|
| Summary | <ul style="list-style-type: none"> • Promotion of the UK Forest Standard and benefits of certification through the UK Woodland Assurance Scheme. Improve uptake of sustainable forest management practices including good forest design and the protection of soil and water. • Promotion of good environmental, agricultural practice to increase resilience of soils and water which includes good soil and nutrient management plans. • Implement our River Basin Management Plans. |
| Timescale | Various |
| Stakeholders | Welsh Government Natural Resources Wales Environment Systems Cranfield University Conservation and woodland NGOs Defra |
| Who will deliver | Welsh Government Environment Systems Cranfield University RSK ADAS Ltd |
| Indicators and baselines | To be confirmed |

CCAPW-AN5
Capacity

Establish and deliver a climate smart agriculture mitigation and adaptation framework

| | |
|---------------------------------|---|
| Summary | <ul style="list-style-type: none"> • Work with the Agriculture Industry Climate Change Forum to develop a Sustainable Brand Values Programme, supporting adaptation in agriculture. • Collaborate with academia to improve knowledge and share understanding of adaptation in agriculture. • Develop a Knowledge Hub to share best practice and identify future research to improve the research pipe in applied science on farms. |
| Timescale | Sustainable Brand Values Draft Programme to be in place by 2019 |
| Stakeholders | Agriculture Industry Climate Change Forum Natural Resources Wales Agriculture and Horticulture Development Board Farming and forestry NGOs |
| Who will deliver | Agriculture Industry Climate Change Forum Agriculture and Horticulture Development Board Farming and forestry NGOs |
| Indicators and baselines | To be confirmed |

CCAPW-AN6
Knowledge

Deliver the Capability, Suitability and Climate (csc) programme

| | |
|---------------------------------|---|
| Summary | <ul style="list-style-type: none"> • Produce agricultural capability maps using the United Kingdom Climate Predictions (UKCP) 2009 and 2018 data sets. • Assess the suitability of different crops under the different climate change scenarios. • Identify future research and adaptation needs for land use. |
| Timescale | To be completed by June 2020 |
| Stakeholders | Aberystwyth University (IBERS) Natural Resources Wales Environment Systems Cranfield University RSK ADAS Ltd |
| Who will deliver | Aberystwyth University (IBERS) Natural Resources Wales Environment Systems Cranfield University RSK ADAS Ltd |
| Indicators and baselines | To be confirmed |

| | |
|---------------------------------|--|
| Summary | <ul style="list-style-type: none"> A new Land Management Programme for Wales which includes an Economic Resilience Scheme and a Public Goods Scheme. |
| Timescale | <ul style="list-style-type: none"> White paper to be delivered Spring 2019 Transitional arrangements to move from current to new support / schemes 2020–2025 |
| Stakeholders | Welsh Government Natural Resources Wales Welsh farming unions WEL member organisations and Environmental NGOs Woodland organisations Dwr Cymru/Hafren Dyfrdwy |
| Who will deliver | Welsh Government Natural Resources Wales |
| Indicators and baselines | To be confirmed |

Woodlands and peatlands

Woodland creation is currently supported through Welsh Government's Glastir programme. Support for new woodland planting will be considered as part of the future land management policy and support mechanisms. An increase in woodland cover is essential to the delivery of the climate change and decarbonisation obligations of the Welsh Government. Welsh Government has set a new short-term target to increase woodland cover by at least 2000 hectares per annum from 2020 to 2030 and beyond. Planting will be undertaken in accordance with UK Forest Standards where planting on deep peat, environmentally sensitive and high quality agricultural land is avoided. The UK Forest Standard is the Government's reference standard for sustainable forest management in the UK. Guidelines on how to meet the UKFS requirements are set out in sub-sections covering biodiversity, climate change, historic environment, landscape, people, soil and water.

The restoration of peatland soil is an important component of land use management for climate change adaptation, both in terms of biodiversity and maintenance of carbon storage and sequestration. Peatlands are also home to a significant amount of archaeological material. Where woodland removal is proposed for peatland habitat restoration, there should be full consideration of the impact on decarbonisation policies and net carbon impact should be assessed. Woodland should only be removed where sites have a high likelihood of a successful restoration and a peatland restoration plan is in place. Natural Resources Wales have undertaken an assessment of the carbon status of the Welsh Government Woodland Estate (WGWE) in terms of emissions and sequestration. This will help inform management

decisions such as restoring and expanding key peatland habitats. A number of sites have been identified on the WGWE for this purpose subject to available resources.

Peatlands in good ecological condition provide the best conditions for carbon storage and sequestration. However, adverse management of peatland in terms of drainage can result in the loss of carbon to the atmosphere as CO₂ and as particulate organic carbon. Therefore, our peatlands restoration work will also reduce the risks from climate change by increasing resilience of soils from increased aridity and wetness. Our actions will go a long way to put a stop on the feedback cycle which damages our peatlands and the natural ability of our soils to store carbon. Completing delivery of our 'Peatlands for the Future' programme will ensure:

- All Welsh Peatlands supporting semi-natural habitat will be subject to sustainable management by 2020.
- The total area of semi-natural habitats on peat will be increased by 5,000 hectares by 2020.

As stated in our Woodland for Wales Action Plan, we will continue to bring identified special woodland sites, Plantations on Ancient Woodland Sites (PAWS) and native woodlands and priority habitats into favourable management on WGWE. We will also encourage private landowners to do the same. The gradual restoration and management of woodland habitats will increase their resilience to the impacts of climate change and better support the wide range of species that depend upon them. Progress is being made by Natural Resources Wales on the restoration of selected PAWS sites to a more natural state on the WGWE, as well as management of protected sites and woodland habitat network improvement projects. The planting of new, native woodlands for biodiversity, as well as expanding and improving connectivity for existing woodland habitats, also contributes to resilience.

We are keen to ensure our woodlands are resilient to the increasing incidences of pests and diseases likely through climate change. An example is *P.ramorum* or 'Sudden Oak Death' which is an exotic fungus-like pathogen known to affect a wide range of host plants. While the management of the disease has had a devastating effect on larch in Wales, it has provided opportunities to improve the age structure and increase the species diversity of Welsh woodlands which contribute to landscape and future resilience.

The biodiversity, cultural and landscape value particularly of ancient, veteran and heritage trees is well documented. Our woodlands act as areas for recreation and means of income, bringing benefits to health, our communities and the economy. However, the measures to protect them could be improved. Pests and diseases have significant potential to impact on the health of trees and woodlands and undermine their timber productivity and the benefits they provide as habitats. The creation and maintenance of a risk register for Wales is central to monitoring threats, taking into account climate change and informing decisions on effective tree health

control, woodland management and species selection. Welsh Government and NRW will participate in the GB and NI Tree Health Advisory Group to ensure that Wales has access to the latest information about management approaches to pests and diseases across the UK countries.

Biodiversity

A key priority of the Welsh Government's Natural Resources Policy is to deliver nature based solutions to help improve environmental, social and economic resilience.

The publication by Buglife Cymru of 'B-Lines' across Wales aims to create and restore at least 150,000 hectares of flower rich habitat (at a UK level) aiming to link existing wildlife areas together, benefitting the dispersal of bees and butterflies and other pollinators and wildlife.

NRW's LIFE Natura 2000 (N2K) Programme has created 11 Thematic Action Plans (including climate change and habitat fragmentation) detailing priority actions to address major issues and risks which will have an adverse impact on N2K features across the network. Actions include:

- Ensure that maintaining and enhancing the features of N2K sites in the face of climate change is fully integrated within the implementation of the Nature Recovery Action Plan as critical components of ecosystem resilience.
- Ensure that climate change implications for marine N2K sites are considered in the Marine Plan, including investigating impacts of changing fisheries practice due to climate change.
- Complete habitat and species network/connectivity mapping for all groups of N2K habitats and species.

Under the Delivering Nature Based Solutions priority of our Natural Resources Policy, and within our Nature Recovery Action Plan, we are prioritising the development of green infrastructure and resilient ecological networks to maintain and enhance the resilience of Wales' ecosystems.

The Area Statements produced by NRW as a result of the Environment (Wales) Act 2016 will provide an important evidence base and arena for collaborative action. They will also help to provide evidence to inform the actions of land managers in the future, for example by responding to take up public benefit opportunities that might be available within the future Public Goods Scheme (see 'Future Land Management Programme for Wales' below) that is included within the 'Brexit and our Land'¹³ consultation, launched in July 2018 .

Water

Our River Basin Management Plans will help ensure access to water for agriculture. River Basin Management Plans are an existing measure under the Marine Strategy Framework Directive (MSFD) contributing to improving the state of the UK's marine and coastal environments. The aim of the MSFD is for the UK to achieve Good Environmental Status in its waters by 2020. The plans consider the pressures facing Wales' water environment. Our rivers, lakes, wetlands, groundwaters, estuaries and coastal waters, including those in protected areas, all fall under these plans. They are updated on a six yearly cycle and are prepared in consultation with a wide range of organisations and individuals.

Sustainable agriculture

Throughout 2018, the Agriculture Industry Climate Change Forum worked in collaboration with Amaeth Cymru and wider stakeholders to develop a set of sustainable values across the supply chain from Farm to Fork. The work has helped improve understanding of the threats and options arising from climate change, build adaptive capacity and increase resilience in the agricultural sector. As a result, an adaptation framework has been produced to contribute towards a Sustainable Brand Values Programme to be published in 2019. In collaboration with Aberystwyth University, we will continue to improve and share understanding of best practice of climate change adaptation in agriculture. The suggested avenues for adaptation include farm production practice, farm financial management, technological developments and governmental programmes. Actions could include:

Cropping Adaptations

- Research and uptake of crop/forage varieties for increased temperatures and drought tolerance.
- Forage varieties to increase water retention, reduce flood risk during extreme weather events through enhanced root development and soil water retention.
- Water management technologies to ensure greater water efficiency and to prevent negative impact from extreme precipitation and flooding by increasing the use of riparian zones.
- Changing crops / forages according to season and location.
- To minimise impact of animal feed costs, encourage home grown feed where possible and encourage more mixed farming practices to adapt to risks such as monoculture exacerbated by climate change.

Livestock adaptations

- Grazing management to maximise gains (timing, plant species) to prevent soil degradation and avoid build up of pathogens.

- Extensive but appropriate conservation grazing to reduce wild fire risk and safeguard important habitat.
- Utilise genetic improvement and ability to select the animals best suited to changing condition such as heat stress.
- Nutritional management and diet regimes to maximise feed utilisation to adapt to the risks of feed shortages.
- Infrastructure changes to avoid heat stress in summer and protect against wet conditions in winter.
- Increase disease surveillance and importation control (especially for vectors).

Soils

Soil is fundamental to nearly everything we do. It is a finite natural resource which once lost, is gone forever. Soil sealing, degradation and climate change are significant global problems and Wales has a responsibility to understand, maintain and enhance its soils for the future generations.

The Capability, Suitability and Climate (CSC) programme will refine and link the Predictive (ALC) Agricultural Land Classification Map (land capability) to the latest climate projection data. This will allow Welsh Government to model how agricultural land capability and suitability may change under different climate change scenarios. The agricultural land classification system uses seasonal averages meaning climate data may be used to assess soil wetness, droughtiness and timing / intensity of rain and temperature under different climate scenarios. Seasonality is important for crops – plants demand heat and rain at key points. The research will also be important in identifying risks between cropping options and soil. The programme will allow policy makers to start thinking about adaptation measures to tackle flood risk, droughtiness, environmental damage to soils and crop selection.

The refined Predictive ALC Map will also support Welsh Government Planning Policy to conserve our most productive soils. It will allow land users, planners and policy makers to make informed decisions on the use of high quality agricultural land in the planning system.

Future Land Management Programme for Wales

In light of the UK's exit from the EU, and various ongoing environmental challenges, a new land management programme for Wales is being devised. Extensive stakeholder consultation has taken place with the Ministerial Round Table and its sub groups. The output from this engagement as well as other sources of evidence and the Natural Resources Policy has resulted in proposals for two new schemes to underpin future support in Wales, both of which will have benefits to support adaptation to climate change.

The Economic Resilience Scheme has been proposed to help farmers and other land managers manage future risks of a trading environment outside of the EU, as

well as adverse climate related conditions (in energy, water efficiency, adaptation of productive agriculture, forestry, flood management, emerging pests and pathogens). The Economic Resilience Scheme will also allow land managers to realise further opportunities such as product diversification, new markets and smarter supply chains, innovative technology and circular economy.

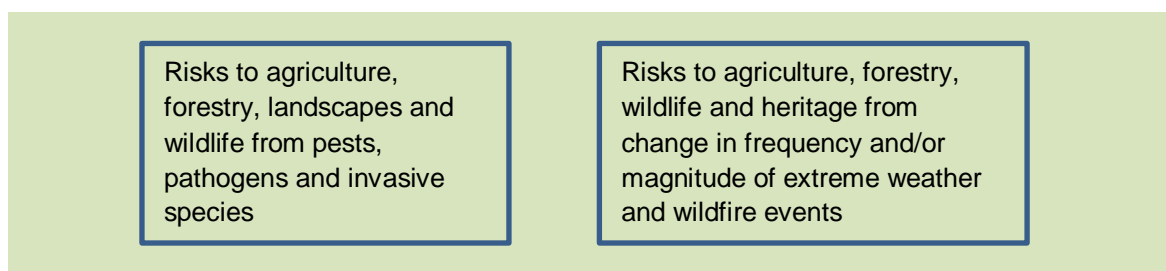
The Public Goods Scheme has been proposed¹⁴ to address ongoing and future environmental failures that are not currently supported by market mechanisms. In addition to addressing environmental challenges, delivering public goods can be an additional and alternative income stream for those farmers unable to compete on food production. Public Goods relevant to climate change adaptation could include;

- Reduction in carbon emissions through restoring degraded peat bogs.
- Sequestering carbon through restored peat bogs and afforestation.
- Flood risk prevention through peat bog restoration, tree planting, habitat restoration in targeted locations upstream from flood risk areas.
- Enhancing biodiversity through increased habitat resilience (condition and linkage) which should allow species the space and opportunity to increase and shift their range.

The merits of developing results based schemes and landscape scale collaborative working are being explored to maximise benefits from this scheme.

Current action against other risks

Two further risks were identified in the Climate Change Risk Assessment relevant to this chapter, for which the UKCCC stated current action should be sustained to ensure their mitigation. These risks are:



Our current action against these risks is summarised below.

Pests and diseases

In their CCRA Evidence Report, the UKCCC states that a warmer climate provides an increased likelihood of pests and diseases in agriculture that were previously limited by climate. The potential increase of Invasive Non-Native Species will be monitored and mitigated through a number of strategic actions. In collaboration with the UK Government, we will be working to implement the key actions in the GB invasive non-native (INNS) strategy. Our draft Welsh National Marine Plan¹⁵ also

includes a requirement that marine proposals should ‘include biosecurity measures to reduce the risk of introducing and spreading invasive non-native species’. We will co-ordinate our priorities on INNS with the Wales INNS Group. We will introduce measures to enforce breaches of the IAS Regulation, develop and introduce Pathway Action Plans to address priority pathways of unintentional introduction and spread of INNS, and provide additional funding to NRW up to 2019 to run a targeted INNS programme for Wales. In addition, we will develop contingency plans for terrestrial vertebrates, invertebrates and plants, freshwater invertebrates and plants and the marine environment to rapidly respond to the incursion of new INNS.

Extreme weather and wildfire

Extreme weather events leading to strong winds and dry weather can be a significant problem to agriculture forestry and wildlife. Projections show there will be increased potential due to climate change for wildfires and wind damage which needs mitigation. The UKCCC recognises that these risks are already well understood. The UK National Risk Register considers the risk of wildfire as seriously as it does other national risks such as flood and pandemic disease. There are individual emergency plans in place for these issues published by organisations such as the forestry commission and Welsh Government work closely with emergency services and NRW to avoid these risks where possible. We will continue to monitor the impacts of extreme weather events on agriculture and forestry to mitigate issues where possible.

Protecting our coasts and seas

This section of the adaptation plan is dedicated to impacts of climate change on the seas that surround our country and the coastlines that line them. Our coastal environment is at particular risk from climate change due to sea level rise and there is much at risk on our coasts. Many of Wales' largest towns, cities and communities face our seas. The coast is home to farms and businesses, forms much of our tourism and includes significant monuments to our heritage.

Rising sea levels exacerbated by storm surges can harm our homes. Storms will likely become stronger and more common, so we need to be prepared to manage our coastal landforms and habitats and consider the long term effects.

Historic buildings and archaeological sites located in low-lying areas are at potential risk of loss or damage from predicted sea-level rise and more frequent storms. Such events can also expose previously hidden or unknown archaeological sites. To date our response has been largely reactive and limited to recording and investigation as loss is occurring. However, better outcomes may be achieved through planned and anticipatory adaptation. Attempts to respond to sea-level rise may themselves have an impact on the historic environment, whether in the construction of coastal defences or the creation of manageable habitats such as salt marsh.

Changes in water pH (mostly acidification) may also affect the long-term stability of underwater cultural heritage, increase attrition of metal objects and cause as yet largely unknown effects on timber. With increased storminess, the higher energy oceans bring more turbulence. As well as increased physical disruption to the foreshore and intertidal sites, changing currents and increased energy underwater will have an impact on submerged archaeology. Ocean acidification is known to be detrimental to biodiversity also. The UKCCC stated that it is highly likely that UK coastal waters will be impacted by the issue as CO₂ emissions continue to rise. Research has shown some species are moving northwards to cooler seas and that the warmer seas are affecting the timing of sea migrations.

There may be new openings in this sector if changes to water temperature, acidity and productivity lead to increased fishery yields for example, but we still need to do more to understand the risks climate change may bring.

Urgent risks

Risks to habitats and heritage in the coastal zone from sea level rise and loss of natural flood protection

Risks to the viability of coastal communities from sea level rise

Risks to infrastructure services from coastal flooding and erosion (see 'Resilient Infrastructure and Transport')

Risks and opportunities to marine species, fisheries and marine heritage from acidification and higher temperatures

The gaps

More work is needed to allow for dynamic readjustment of coastal landforms and habitats, particularly in terms of increased sediment supply and realignment opportunities.

Further research is needed around the impacts of climate change on marine ecosystems, especially in changes of acidity, dissolved oxygen content and temperature.

Improved social and economic understanding is needed of the implications to the fishing industry in order to identify what level of adaptation is required.

| | |
|---------------------------------------|--|
| Adaptive nature and our rural economy | Cross-sector working Our coastlines need particular attention to the risks brought by rising sea levels and storm surges caused by climate change. Many of our important assets are located along the coasts, meaning collaboration in our efforts to adapt is important. While the coastline is home to a significant number of species whose habitats need protecting, it also a home for us – a large proportion of our cities, towns and communities will be at risk. The coast and seas hold a significant amount of heritage, including many historic shipwrecks. Wales' economy depends considerably on tourism along the coasts. Our businesses will need to adapt to the changing climate to ensure visitors continue to come, and we will of course need to ensure our digital and transport infrastructure is resilient to allow all of these sectors to continue running efficiently all the while. |
| Protecting our coast and seas | |
| Staying healthy | |
| Safe homes and places | |
| Protecting our heritage | |
| Successful businesses | |
| Infrastructure and transport | |

Our commitments

| CCAPW-MC1 Resilience | Improve the resilience of habitats and heritage in Wales' coastal zones from the impacts of climate change |
|---------------------------------|---|
| Summary | <ul style="list-style-type: none"> • Understand the quality and quantity of existing habitats within the coastal zone, and establish a programme of delivery of compensatory habitat around Wales. • Habitat compensation will be delivered in the long term in line with the life of the Shoreline Management Plans. |
| Timescale | Ongoing |
| Stakeholders | Wales Coastal Monitoring Centre Natural Resources Wales (managing National Habitat Creation Programme) National Trust |
| Who will deliver | Welsh Government Wales Coastal Monitoring Centre Natural Resources Wales |
| Indicators and baselines | To be confirmed |

CCAPW-MC2
Knowledge

Carry out research to better understand the magnitude of ocean acidification and higher temperature risks and opportunities for marine ecosystems and heritage

Summary

- Collaborate on research to improve knowledge of the impacts of ocean acidification and higher water temperatures on fish stocks and ecosystems, including impacts for fish disease and aquaculture.
- Research on opportunities for fishing industry diversification and/or increasing the value of current activities and future planning to address challenges associated with acidification and higher water temperatures.
- Establish the baseline state of the underwater historic environment and potential changes.
- Ensure that underwater cultural heritage considerations are included in relevant plans and policies (such as the Wales National Marine Plan) and seek to incorporate environmental monitoring into marine licensing conditions.

Timescale

By 2022

Stakeholders

Wales Marine Action and Advisory Group
Wales Marine Fisheries Advisory Group
Royal Commission on the Ancient and Historical Monuments of Wales
UK heritage agencies
Higher education establishments
Commercial partners

Who will deliver

Welsh Government
Royal Commission on the Ancient and Historical Monuments of Wales
UK heritage agencies
Higher education establishments
Commercial partners

Indicators and baselines

To be confirmed

CCAPW-MC3
Capacity

Provide updated policy and guidance on coastal adaptation

| | |
|---------------------------------|--|
| Summary | <ul style="list-style-type: none"> • Update, consult on and deliver the Welsh Government National Strategy for Flood and Coastal Erosion Risk Management. • Develop and communicate a new Coastal Adaptation Toolkit. • Engage with the newly formed Wales Coastal Monitoring Centre. |
| Timescale | By 2019 |
| Stakeholders | Welsh Government Natural Resources Wales Wales Coastal Group Forum Local Authorities |
| Who will deliver | Welsh Government Natural Resources Wales Wales Coastal Group Forum Local Authorities |
| Indicators and baselines | To be confirmed |

Ireland Wales Programme

The EU funded Ireland Wales Programme 2014-2020 is a maritime programme connecting organisations, businesses and communities on the West coast of Wales with South-East Ireland. It provides opportunities for partners across the sea border to work together to address common economic, environmental and social challenges.

One of the three priorities of the programme is adaptation of the Irish Sea and Coastal Communities to Climate Change. Through the programme, capacity and knowledge of climate change adaptation across the Irish Sea and its coastal communities is being increased by sharing best practice and expertise by monitoring the impacts of climate change.

Four approved projects are underway under the programme:

- **Ecostructure.** Raising awareness of eco-engineering solutions to the challenge of coastal adaptation to climate change by providing developers and regulators with accessible tools and resources, based on interdisciplinary research in the fields of ecology, engineering and socioeconomics. Ecostructure aims to promote the incorporation of secondary ecological and societal benefits into coastal defence and renewable energy structures, with benefits to the environment, to coastal communities and to the blue and green sectors of the Irish and Welsh economies.

- **Bluefish.** Developing knowledge and understanding of the marine resources of the Irish Sea and Celtic Seas by addressing knowledge gaps regarding the effects on, and potential vulnerability of, selected commercial fish and shellfish from predicted climate change. Through the transfer of knowledge, transnational expertise and best practice with respect to study and management of commercial fish, shellfish and aquaculture under a climate change context, and through the strong marine science partnership of the consortium (including 4 Irish and Welsh HEIs), its aim is to provide region-wide adaptation strategies for the benefit of coastal communities.
- **Acclimatize.** Closing the knowledge gap in relation to the faecal pollution of 'at-risk' urban and rural bathing waters in Ireland and Wales by identifying and quantifying pollution streams and determining their impact on these waters through a dynamic period of climate change.
- **CHERISH.** Increasing cross-border knowledge and understanding of the impacts (past, present and near-future) of climate change, storminess and extreme weather events on the cultural heritage of reefs, islands and headlands of the Irish Sea (more detail in the 'Caring for the Historic Environment' chapter below).

One further project is being added to the programme to further the advances of adaptation in the marine environment. The STREAM (Sensor Technologies for Remote Environmental Aquatic Monitoring) project will bring together partners on both sides of the Irish Sea to better understand the impact of climate change, lower the cost of marine observation and accelerate the process of data provision. The €5.4 million project is led by the Waterford Institute of Technology, with project partners Swansea University and Cork Institute of Technology. Data collected will be shared locally to keep coastal communities informed about the local impacts of climate change.

Coastal Communities

Sea level rise caused by climate change, along with increased incidence of storms, means the risk of coastal inundation and flooding of coastal communities is high. There are a number of communities which are already vulnerable to spring tides and coastal surges – with projected sea level rise, some of those communities may become unsustainable. The Shoreline Management Plans (SMPs – see below) set out the preferred management strategies for dealing with this risk over the next century.

Shoreline Management Plans (SMPs)

SMPs are large scale assessments of the risks associated with coastal processes which help reduce the risks to people, development, historic and natural environments. Their aim is to identify coastal risk management policies to reduce the risks to people and the developed, historic and natural environments, over the long term. SMPs identify the best approach or approaches to managing risks over 100 years (from 2005) from both flooding and coastal erosion both for individual areas and the wider coast. SMPs set priorities for coastal Local Authorities to investigate options to protect the shoreline and develop schemes accordingly. The second iteration of plans was published in 2014 and forms the policy for long term management of risk along the entire shoreline of Wales. There are four SMPs covering Wales:

- SMP 19 Anchor Head to Lavernock Point (Severn Estuary)
- SMP 20 Lavernock Point to St Ann's Head (South Wales)
- SMP 21 St Ann's Head to Great Orme's Head (West of Wales)
- SMP 22 Great Orme's Head to Scotland (North West England and North Wales)

To strengthen our position, Welsh Government has reviewed the National Strategy for Flood and Coastal Erosion Risk Management for consultation in the Winter 2018/19, to be published in 2019. A measure will be included in the National Strategy update to report on progress on SMP Action Plans, with an annual report being submitted to Welsh Government, from the Wales Coastal Group Forum.

Under the new strategy, Welsh Government is working with the Wales Coastal Group Forum (led by coastal Local Authorities) to develop a Coastal Adaptation Toolkit. The toolkit will include engagement guidance based on the lessons learned from Fairbourne³ to work with the community on coastal adaptation. By including coastal Local Authorities in the development of the Toolkit, we hope to improve, and build upon previous methods to engage with communities and improve resilience.

In addition, Welsh Government has recently funded the establishment of the Wales Coastal Monitoring Centre to collate data on the changing Welsh coastline which will help to inform decisions and priorities for coastal adaptation and potential schemes, on a national basis.

Habitats

The integrity of protected (or nationally significant) coastal habitats in Wales is managed through the Conservation of Habitats and Species Regulations (termed the

³ Fairbourne is a low lying coastal community on the Mawddach Estuary with around 300 properties. It is at risk from tidal, river and potentially groundwater flooding as sea levels rise. The West of Wales Shoreline Management Plan 2 recommends that the village is protected during epoch 1. In the medium term, however (over the next 50 years), the plan is for managed realignment.

‘Habitat Regulations’). Habitat Regulation Assessments were undertaken for the 4 SMPs in Wales, which estimated the amount of compensatory habitat which will be needed to implement the various SMP policies over the 100 year period.

Those assessments may have used differing methodology to calculate the compensatory habitat needed (the target). In order to understand the impact on habitats from the provision of new coastal defences, we will refine the methodology (to be informed by the ‘What is coastal squeeze?’ research & development project) and establish an agreed target for all SMP policies in Wales. We will also establish how much sediment supply and erosion is happening around Wales to track the current impacts of climate change through the Wales Coastal Monitoring Centre. Where SMPs indicate the preferred future risk management policy is ‘Managed Realignment’, there is potential to create compensatory habitat as coastal defences move back, allowing habitats to be created in front of the defence.

Welsh Government meets its Habitats Regulations requirements through the National Habitat Creation Programme (NHCP). The NHCP was established to scope for and provide any necessary coastal habitat compensation as a result of plans or projects funded through the flood and coastal erosion risk management programme(s) related to Shoreline Management Plan policies.

Case Study - Habitat creation at Cwm Ivy

Cwm Ivy on the Gower peninsula was a SSSI site of lowland fen meadow and freshwater ditches behind a sea wall defence, owned by the National Trust.

The Shoreline Management Plan policy for this section of the coast is No Active Intervention, meaning there is no planned investment in coastal defences as it is not cost effective to defend the coastline and the natural environment is capable of defending the coast.

At the time of developing the Shoreline Management Plan, the area of land in Cwm Ivy was noted as being strategically important as it provided an opportunity to create compensatory habitat to maintain the integrity of the Natura 2000 sites affected by coastal squeeze, as required by the Habitats Directive.

Until August 2014 the Wales Coast Path route crossed the sea wall; the route was diverted following a high tide breach of the sea wall. Further stormy weather in 2014 continued to accelerate the breach, allowing salt water to infiltrate the area behind the sea wall.

NRW in partnership with the National Trust took this breach of the sea wall as an opportunity to implement the No Active Intervention policy at Cwm Ivy, i.e. not repairing the breach in the sea wall and achieving a long term sustainable solution returning the area to it's natural state (i.e. before construction of the sea wall) as a saltmarsh within the estuary. The site has the potential to create 38 Ha of habitat – primarily saltmarsh, in the long term. Early stages of saltmarsh habitat development are established in about a half of the site, which is on track with expectations. Discussions are ongoing with the Wales Coast Path and City and County of Swansea to develop a sustainable solution to the Wales Coast Path.

Ocean acidification

Welsh Government recognises that there is limited knowledge available with regards to the anticipated effects of ocean acidification from climate change and the impacts this may have on the biodiversity of our seas. Before we take action on ocean acidification, we will collaborate with other bodies across the UK to research the effects of higher water temperatures on fish stocks and ecosystems, including impacts for fish disease and aquaculture. We will then look to see how the changes will impact the fishing industry and consider our future planning to address the challenges associated with acidification and higher water temperatures.

Marine heritage

In order to ensure our marine heritage is considered in the scope of climate change adaptation we will work with partner organisations, including heritage agencies, commercial partners and higher education establishments to raise awareness and promote research and collaborative working around data collection and sharing. With the correct data, this will then allow us to establish the baseline state of our underwater historic environment and consider the potential changes as a result of climate change. Once we know more about the potential impacts, we will work to ensure that underwater cultural heritage considerations are included in relevant plans and policies (such as the Wales National Marine Plan) and seek to incorporate environmental monitoring into marine licensing conditions where appropriate.

Current action against other risks

One further risk is noted in the CCRA, for which the UKCCC recommends current action is sustained.

Risks to aquifers and habitats from saltwater intrusion

Aquifers and saltwater intrusion

In Wales, the Habitats Regulations implement the EU 'Habitats Directive' on the Conservation of natural habitats. This legislation provides the legal framework for the protection of habitats and species of European importance in Wales. The UKCCC recognises our efforts to mitigate the potential for saltwater intrusion to harm freshwater aquifers, which is in part being delivered through our work to create compensatory habitat through the requirements of the Habitat Regulations (see above).

Staying healthy

Climate change has the potential to directly impact the health and well-being of Welsh citizens, due to increased temperatures, the risk of flood and other weather extremes. In addition, it has the potential to impact the delivery of health and well-being care.

The UKCCC's CCRA evidence report⁸ states there are about 2,000 heat-related deaths per year across the UK and the risk of high temperatures to health is projected to increase as temperatures rise. Conversely, it also states there are between 35,800 and 49,700 cold-related deaths per year across the UK. Climate change is projected to reduce the health risks from cold. However, the number of cold related deaths is projected to decline only slightly due to the effects of an ageing population increasing the number of vulnerable people at risk from high temperatures. Warmer climates in Wales may also see an increase in disease carrying pests, such as ticks and mosquitos.

Flood water may be polluted by sewage, chemicals and/or animal faeces if water has run off fields. Sewage may escape through drains, along with rodents. Polluted flood water can cause a wide range of infectious diseases, including diarrhoeal disease. Other risks include injuries, drowning, contact with chemicals, being stranded, having no power and no clean water. Not having the means to recover from flooding events can also impact adversely on mental health and well-being.

For those particularly reliant on rain for their livelihoods, a lack of rain can cause financial hardship, and mental health problems as a consequence. Farming communities may be most significantly impacted – with crop and livestock losses leading to loss of income and an increase in stress and depression. Drought may also lead to increased use of private, unregulated water sources, with risks of infectious disease. Indeed, there are already large numbers of private water supplies in rural Wales putting people at risk from prolonged drought, leading to a complete loss of water.

The risks to health and social care delivery are wide in scope. Climate change has the potential to disrupt staff, affect the use of buildings and potentially damage equipment. There are also potential issues around thermal comfort of staff and patients in places of care – including care in the home. Several hospitals, care homes and GP surgeries are thought to be at a greater risk of flood due to their geographical positions and projections show this risk will increase. The increased risk of extreme weather events will also make access to care difficult in emergencies.

Urgent risks

Risks to health and well-being from high temperatures

Risks to health and social care delivery from extreme weather

Potential benefits to health and well-being from reduced cold

Risks to passengers from high temperatures on public transport

Risks to health from changes in air quality

Risks to health from vector-borne pathogens

Risks to people, communities and buildings from flooding (see 'Safe homes and places')

The gaps

More work is needed to understand the total risks, and benefits, of increased temperatures to all building types in Wales.

Research is needed to better understand how people behave in hot weather, as well as the effectiveness of public measures for overheating. In addition, further work is needed to reduce fuel poverty in Wales. Research is also needed to understand the effects of fuel poverty, both now and into the future. Steps need to be put in place to ensure improvements involving insulation also consider effective ventilation in buildings so projected risks from overheating are not exacerbated.

Research is needed to assess how current action against flood relates to the current risk, including future plans of flood defence spending, implementation of SuDs and to help understand the changing risks to new developments on flood plains.

More action is needed to consider adaptation needs for the delivery of care at home.

Improved understanding is needed to assess the connections between climate change and air quality. Long term trend data is needed to consider the impacts on those living chronic respiratory disorders.

Ongoing surveillance and research of vector borne pathogens is also needed.

Adaptive nature and our rural economy

Protecting our coast and seas

Staying healthy

Safe homes and places

Protecting our heritage

Successful businesses

Infrastructure and transport

Cross-sector working

If we do not maintain good levels of health, other sectors will likely suffer as a result. Poor health from overheating in the workplace or on public transport will impact our businesses if our workforce is unable to attend their places of work as a result.

Monitoring the potential changes regarding vector borne pathogens will require working with the transport sector in our ports and airports. This also needs consideration in the context of animal health; The factors which may put humans at greater risk, such as increased temperatures, are equally likely to put other animals at risk too.

The health impacts from floods and storm surge may be more strongly felt in our coastal communities as sea levels rise. Maintaining our roads to ensure they are resilient to floods and excessive temperatures will also ensure our emergency services are able to access those in critical need of care.

Our commitments

| | |
|---------------------------------|---|
| CCAPW-SH1 Knowledge | Increase understanding of the risk increased temperatures bring to health and well-being |
| Summary | <ul style="list-style-type: none"> • Increase knowledge of trend data and forecasts to understand the severity of the risk to health. • Improve collaboration and joined up working to ensure effective sharing of information. • Continue maintenance of heat related guidance in the Public Health Wales (PHW) Extreme Weather Guidance. |
| Timescale | Ongoing for collation of data on health. |
| Stakeholders | Public Health Wales NHS Owners of new homes |
| Who will deliver | Welsh Government Public Health Wales NHS Planning Authorities Developers and house builders |
| Indicators and baselines | To be confirmed |

| | |
|---------------------------------|--|
| CCAPW-SH2 Resilience | Continue tackling fuel poverty through the Welsh Government Warm Homes Programme |
| Summary | <ul style="list-style-type: none"> • A further 25,000 homes to benefit from the Warm Homes Programme by 2021. • Complete research to evaluate the impacts of the Nest and Arbed schemes on health outcomes by 2021. • Develop new proposals to tackle fuel poverty. |
| Timescale | Ongoing |
| Stakeholders | Welsh Government British Gas Arbed am Byth Local Authorities |
| Who will deliver | Welsh Government British Gas Arbed am Byth Local Authorities |
| Indicators and baselines | To be confirmed |

CCAPW-SH3

Capacity

Update and revise plans and advice in line with research to increase understanding of the risk extreme weather brings to health and social care delivery

| | |
|---------------------------------|---|
| Summary | <ul style="list-style-type: none"> • Increase our understanding of the risk of extreme weather to the delivery of health and social services. • Improve contingency planning. |
| Timescale | Ongoing |
| Stakeholders | Public Health Wales NHS, including emergency services & patient transport Social Services & Settings Natural Resources Wales Local Authorities |
| Who will deliver | Public Health Wales NHS, including emergency services & patient transport Natural Resources Wales Welsh Government |
| Indicators and baselines | To be confirmed |

CCAPW-SH4

Capacity

Ensure climate change risk is considered in all future policy development to improve air quality in Wales

| | |
|---------------------------------|--|
| Summary | <ul style="list-style-type: none"> • Deliver the Clean Air Plan for Wales 2018. • Adoption of the National Emission Ceilings Directive (NECD). • Provision of air quality information and forecasts for the public. |
| Timescale | Ongoing |
| Stakeholders | Welsh Government Devolved Administrations Public Health Wales Natural Resources Wales Welsh Air Quality Forum |
| Who will deliver | Welsh Government Devolved Administrations Public Health Wales Natural Resources Wales Welsh Air Quality Forum |
| Indicators and baselines | To be confirmed |

CCAPW-SH5
Knowledge

Increase understanding of the risk from vector borne pathogens

| | |
|---------------------------------|---|
| Summary | <ul style="list-style-type: none"> • Continuation of monitoring at ports and airports for mosquitoes. • Raised awareness about Lyme disease amongst health care professionals and the general public. • Increased understanding of the risk of vector borne pathogens. |
| Timescale | Ongoing |
| Stakeholders | Public Health Wales NHS including GPs and associated supply chains Visit Wales/tourism industry Natural Resources Wales Local Authorities Public |
| Who will deliver | PHW NHS including GPs and associated supply chains Visit Wales/tourism industry Natural Resources Wales Local Authorities |
| Indicators and baselines | To be confirmed |

Increased temperatures

Extreme weather events, including cold snaps, heat-waves and floods, can have an adverse impact on public health. This is particularly the case for vulnerable people such as the elderly, the very young or people with pre-existing medical conditions. Therefore, Public Health Wales have an Extreme Weather Advice guidance document in place and this is maintained year round. There is also advice available for organisers of outdoor events and for those with child care responsibilities. Public Health Wales are revising their advice to ensure we are prepared for the enhanced risk from climate change in the future, and will be including a new section on how to deal with the health impacts of drought.

Case study - Public Health Wales (PHW) advice around Extreme Weather Events

When the Met Office forecasts extreme or abnormally cold or hot weather in Wales, Public Health Wales (PHW) considers issuing timely and proportionate advice to the public. This advice – tailored to different audiences and scenarios – is available year-round on the PHW website at: <http://www.wales.nhs.uk/sitesplus/888/page/94885>.

When extreme weather is forecast, especially if over a prolonged period, proactive communications are issued reminding people where and how they can access this advice.

During the 2017/18 winter period, PHW issued messages on this topic on four separate occasions. It did so using different methods of electronic communication such as intra and inter-net news stories and social media, and in January and February 2018 when there was extreme cold weather and considerable snowfall, supplemented these with media interviews for ITV and BBC by Environmental Public Health Team members. On each occasion, standard public health cold weather messages were re-iterated based on PHW guidance and links were made to specific hazards such as falls and carbon monoxide poisoning. In the summer months between June and August 2018, PHW issued advice on how to manage risks associated with extended spells of hot weather, and again referred people to their guidance. As with the extreme cold communications earlier in the year, PHW issued several tweets with simple messages and gave interviews to both BBC and ITV news programmes.

It should be noted that actions taken by PHW during spells of extreme cold and/or heat do not constitute an 'alert' and so should not be regarded as a formal trigger for action by other public bodies. The issue of alerts is for Met Office and other specialists and is beyond the remit of PHW. However, any public health advice issued is shared across the NHS with colleagues in Health Boards, and also the Welsh Government, for information.

Public Health Wales supports the need to consider temperature and health in the context of public transport. However, at present, there is no specific health advice for public transport scenarios. Welsh Government will call upon the newly established Transport for Wales to consider the impact of overheating on transport as their work develops (see 'Resilient Infrastructure and Transport' below). Should they wish to develop guidance, Public Health Wales will advise and contribute as appropriate. Working in conjunction with Public Health Wales and other relevant bodies beyond, Wales will also be encouraged to ensure a consistent approach to this issue across the UK.

Welsh Government has also begun scoping work for a review of Part L (energy) of the Building Regulations (see 'Safe Homes and Places'). The review will focus on energy efficiency methods, but a key aspect of the work will be the consideration of

overheating, to ensure energy efficient home design and planning does not exacerbate the problems of too much warmth. The review will investigate action to reduce overheating in new homes as well as the potential for unintended overheating or poor air quality from external wall insulation. Our intention is that better home design will reduce the incidence rate of overheating in the home into the future.

Health and social care delivery

Our continual review of the Public Health Wales Extreme Weather Guidance will include consideration of the impact of climate change on the delivery of health and social care.

Extreme weather events are reflected in the National Risk Assessment for the NHS in Wales - the NHS and Local Authorities have statutory duties to consider and plan for these risks. In order to plan, a climate change matrix has been developed by NHS Shared Services Partnership – Specialist Estate Services (NWSSP-SES) for the health boards and NHS Trusts to consider in terms of their estate. They need to identify the facilities that are at risk of flooding (or future risk of flooding) and then identify the plans they have in place to address this. These include emergency plans for service disruption and staffing. For new developments, the planning process together with tools like BREEAM will inform decisions in terms of where facilities are being built.

In cases of cold spells and snow storms, Health Boards have emergency procedures in place to respond to the increased demand on health services and issues affecting staff getting into work. We will be reviewing these procedures to reflect the additional future risks brought about by climate change to ensure continued health care delivery into the future.

In terms of overheating, adaptation measures for the existing NHS building stock would principally be the increased uptake of cooling (air-conditioning) but that has a subsequent impact on energy use that we are trying to reduce in line with the public sector's ambition to be carbon neutral by 2030. For new developments the design process will take further climatic predictions into account.

Reduced cold

The UK Committee on Climate Change have clarified that further measures need to be taken in the next 5 years to tackle the large numbers of cold homes and to reduce the effects of cold weather on health, notwithstanding climate change. In Wales, a household is considered to be in fuel poverty if it needs to spend more than 10% of its net income on all household fuel use to maintain a satisfactory heating regime. Latest published data for Wales indicates that in 2016, 291,000 (23%) households were living in fuel poverty¹⁶. The research also estimates a further 80,000 households in Wales would have been in fuel poverty without the impact of energy efficiency improvements.

The most effective way in which the Welsh Government can tackle fuel poverty is to improve the energy efficiency of homes and we are doing this effectively through the Welsh Government Warm Homes programme. Under the programme, our two schemes Nest and Arbed have been designed to achieve three social, economic and environmental objectives, to reduce the impact on fuel poor households, create green jobs and business opportunities, and reduce greenhouse gas emissions in the domestic sector. Our investment will lever in up to £24m of EU funding, in addition to funding from the UK Energy Company Obligation (ECO). We have committed to installing energy efficiency measures in up to 25,000 homes through the Warm Homes Programme by 2021. Welsh Government is also continuing to invest in the Fuel Poverty Health Data Linking Project. This project will evaluate the impacts of the Nest and Arbed schemes on health outcomes and broader well-being outcomes - for example, whether there have been improvements to educational attainment through living in a warmer home. Six years of research funding has been committed for this work until March 2021.

Welsh Government is funding a programme of investment to secure data and analysis needed to inform present and future decisions in relation to domestic housing and energy efficiency, and other fuel poverty measures. The resulting data will inform discussion with stakeholders regarding our future actions on tackling fuel poverty in Wales.

Air Quality

The UKCCC highlight the point that higher ambient temperatures can lead to increased ozone concentrations. In addition, increased incidence of storms may result in more episodes of 'thunderstorm asthma'.

Under our Clean Air Programme, Welsh Government has published a cross-government Clean Air Plan for Wales to reduce the burden of poor air quality on human health and the natural environment. The programme includes a requirement to comply with European and domestic legislative air quality obligations. In the delivery on the plan, we will ensure the potential for climate change to exacerbate the impacts of poor air quality is considered.

The adoption of the National Emission Ceilings Directive (NECD) allowed the EU to ratify the 2012 revision of the Gothenburg Protocol. Member State limits, or ceilings, have been set for five pollutants responsible for the acidification and eutrophication of the natural environment, and the formation of ground level ozone which impacts both human health and the environment. Ozone concentrations would be exacerbated by temperature increases resulting from climate change. These pollutants can travel long distances and across national borders. Under the NECD, each Member State is required to publish, by April 2019, a National Air Pollution Control Programme, setting out the measures it will put in place to reduce emissions of these pollutants, to meet the 2020 and 2030 emission reduction commitments.

The Welsh Government will set out its plans to help achieve the UK's future emission reduction commitments within the UK National Air Pollution Control Programme, which will be published before 1 April 2019.

To ensure the provision of air quality information, Welsh Government maintains the 'Air Quality in Wales' website¹⁷. The site includes data from the region's monitoring sites, and information on related air quality issues. The site will help the public and other users of data determine whether they, or their children, are likely to be at risk from air pollution. Information on groups who may be affected is provided on the additional information page. If users find that they may be at risk, they are referred to health messages corresponding to the highest forecast level of pollution as a guide.

A significant reduction in public and environmental exposure to harmful airborne pollutants from all sources is the ambition of the Clean Air Zone Framework for Wales, which was published for consultation in April 2018. The draft Framework sets out the expected approach to be taken by local authorities when implementing and operating a Clean Air Zone. The Framework is also intended to provide an impetus for actions to improve air quality over and above compliance thresholds.

Vector-Borne Pathogens

In order to be prepared for the increased risk of disease from vector-borne pathogens such as mosquitoes and ticks, we will work to achieve a better understanding of how climate change could exacerbate the issue in Wales. This will include how climate change may affect vectors' ability to establish themselves in Wales, diseases they may carry and spread, as well as treatment requirements and costs.

We will commit to continued support for ongoing surveillance of non-native vectors at key ports and airports in Wales. Port medical officers will work with port health officers to ensure robust surveillance remains in place at existing monitoring sites. Working with the Port Health Expert Panel, Public Health Wales will develop and support delivery of a table top exercise for port authorities to identify potential barriers to delivery of effective mitigation response. In addition, we will research what other action may be needed to understand and survey where such vectors may be entering Wales in the future – consideration will be given to extending surveillance to other potential vector entry sites including both civil and military facilities. Working with Public Health Wales we will consider the evidence of effectiveness of surveillance at distribution centres in England. We will map distribution centres in Wales and advise on the merit of extending surveillance to distribution centres.

With regards to native populations, we will work with experts to ensure where more blue / green infrastructure is used to address issues such as flooding, this does not lead to an increase of pests such as mosquitos, which may use the infrastructure as breeding grounds. We will also investigate where the largest populations of native

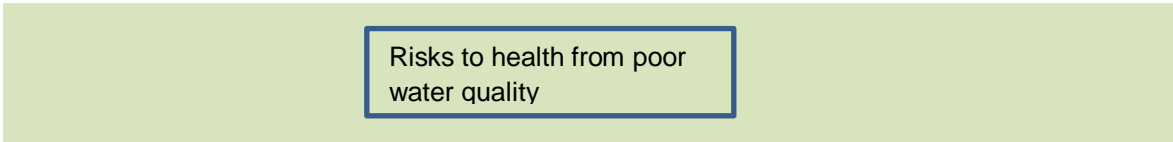
vectors are, and the options needed to control them. Currently, the risk from mosquitos is considered low. However, to mitigate future risks, Public Health Wales will work with Natural Resources Wales on potential habitats. This will include putting in place effective measures for urban and peri-urban blue and green space to prevent habitats for vectors.

Ticks are already a problem in Wales. Ticks can transmit Lyme disease, and it is understood infection rates could increase as our climate warms. The National Institute for Health and Care Excellence produces guidance¹⁸ on Lyme disease covers awareness raising for healthcare professionals and information for patients. Furthermore, Public Health Wales has published guidance¹⁹ on what to do to avoid tick bites, and how to deal with any potential infection. In addition to our awareness raising efforts, we will target students and visitors to Wales, including those attending festivals. Public Health Wales will consider how best to communicate messages to these and work with universities to review their communicable disease plans, ensuring actions to support Lyme disease prevention are robust.

Finally, we will review the list of notifiable diseases in the Public Health (Control of Disease) Act 1984. Regulations for the notification of infections in Wales came into force in 2010 and we will consider and consult on whether or not Lyme disease should be added as a notifiable disease.

Current action against other risks

One further risk is included for this section, and highlights the risk to health from poor water quality. This risk was scored as ‘sustain current action’ by the UKCCC.



Risks to health from poor water quality

Water quality

The issue of water quality is managed within the water strategy. Welsh Government will maintain current policies within the water strategy to maintain high levels of water quality and protect the health of our people. See ‘Safe homes and places’ below for more information about these policies.

Safe homes and places

This chapter focuses on people, in spaces, and the actions we need to take to be resilient from climate change. Our homes, families, communities and friends are all at risk from the impacts of climate change, and the way they're all affected differs depending on where the impacts are felt and how we might adapt. This section has been included to make sure we are taking the human and spatial aspect of the risks from climate change into account. Various forms of inequality has been shown to adversely affect the levels at which communities are impacted by climate change. The IPCC's 1.5°C Special Report implies urgent, ambitious climate action that puts vulnerable people first, therefore our adaptation actions has been drafted to do just this.

The risks to people and places are wide-ranging and come from all aspects of the impacts we can expect, such as drought, flooding, sea level rise, storms and overheating. We need to think about how climate change might affect those who are often vulnerable to the cold and how this might change as our winters warm. Overheating is a particular problem in our homes, as well as other buildings. While we continue to protect the vulnerable from the cold, we need to ensure that homes are well ventilated to create safe environments during periods of extreme heat.

Projections suggest we should expect drier summers which could mean a greater incidence of water shortages and drought. A lack of water has the potential to harm many aspects of our lives, such as the means to grow food, support our wildlife and quench our thirst. Conversely, too much water comes with a significant risk too. We can now expect to see more rain in the winter and with it, increased likelihood of floods, damaging our homes and buildings and, potentially, flooding our sewers.

The risk of flood will also increase due to the impact climate change has on our oceans. Rising sea levels, along with increase in incidence of storms, has the potential to bring significant damage to the communities along our coastlines, as well as the habitats that line them.

A recent consultation on the 10th edition of Planning Policy Wales recognised climate change as a global challenge, with impacts felt at the local level presenting a significant risk to people, property, infrastructure and natural resources. We need to plan for these impacts, reducing the vulnerability of our natural resources and build an environment which can adapt to climate change. The planning system plays a significant role in managing this risk. Development allowed today will be around for decades to come. The most important decision the planning system makes is to ensure the right developments are built in the right places.

Urgent risks

Risks to public water supplies from drought and low river flows

Potential benefits to health and well-being from reduced cold (see 'staying healthy')

Risks to the viability of coastal communities from sea level rise

Risks of sewer flooding due to heavy rainfall

Risks to health and well-being from high temperatures (see 'staying healthy')

Risks to people, communities and buildings from flooding

The gaps

Work is needed to understand the total risk and benefits of increased temperatures on all types of building in Wales.

Research is needed to better understand how people behave in hot weather, as well as the effectiveness of public measures.

More work is needed to reduce the prevalence and impacts of fuel poverty. Steps are needed to ensure improved insulation of housing does not exacerbate the future projected problems of overheating and how homes can be better ventilated.

Research is needed to assess the current and future risks to different building types from different exposure levels of wind and driving rain, as well as the effectiveness of relevant adaptation.

There is a need for greater uptake of Sustainable Urban Drainage Systems in new developments.

| | |
|---------------------------------------|---|
| Adaptive nature and our rural economy | Cross-sector working <p>Ensuring we have safe homes and communities requires input from all sectors. The need to understand the issue of overheating in buildings will have to include hospitals, schools and businesses. In the home, tackling the potential problems of excessive insulation will also be important to our health.</p> <p>Ensuring we act on surface and sea water flooding means protecting our homes and buildings, but it will also protect our roads and infrastructure, as well as the businesses that operate in our communities.</p> <p>Any resulting work to understand the impact extreme weather has on building fabric could well be useful in the Historic Environment as we look to new ways to protect our heritage. Additionally, since much of our nature now resides in our urban environments, it is important we consider its role in this section, too.</p> |
| Protecting our coast and seas | |
| Staying healthy | |
| Safe homes and places | |
| Protecting our heritage | |
| Successful businesses | |
| Infrastructure and transport | |

Our commitments

| | |
|---------------------------------|--|
| CCAPW-HP1 Capacity | Ensure the planning system in Wales plays a key role in facilitating clean growth and helps build resilience to the impacts of climate change |
| Summary | <ul style="list-style-type: none"> • Develop and publish a new National Development Framework (NDF) for Wales. • Future review of planning policy and guidance on managing flood risk in Technical Advice Note 15. • Increase the use and quality of green infrastructure through nature based solutions. |
| Timescale | By 2020 |
| Stakeholders | Welsh Government Planning Authorities Infrastructure providers Regional economic boards Ports and harbour operators Transport for Wales Natural Resources Wales Developers |
| Who will deliver | Welsh Government Planning Authorities Infrastructure providers Regional economic boards Ports and harbour operators Transport for Wales Natural Resources Wales Developers |
| Indicators and baselines | To be confirmed |

CCAPW-HP2
Resilience

Influence the design of homes and buildings to protect them from the impacts of climate change

| | |
|---------------------------------|---|
| Summary | <ul style="list-style-type: none"> • Review part L (energy efficiency) of the Building Regulations to mitigate the risk of overheating. • Ensure opportunities for climate change adaptation are considered in Welsh Government research on decarbonising Wales' housing stock. • Ensure all future programmes to review the building regulations consider the need for climate change adaptation. |
| Timescale | Ongoing |
| Stakeholders | Welsh Government House builders and developers Planning authorities Local Authorities |
| Who will deliver | House builders and developers Planning authorities |
| Indicators and baselines | To be confirmed |

CCAPW-HP3
Capacity

Improve measures to protect homes and communities from the risks of flooding

| | |
|---------------------------------|--|
| Summary | <ul style="list-style-type: none"> • Require all future developments in Wales (with the exception of single dwellings with areas of less than 100m²) to be designed and built in accordance with mandatory SuDS standards. • Introduce evidence based long-term planning for waste water and sewerage management and develop a planning framework for implementation in Wales. • The update to the National Strategy for Flood and Coastal Erosion Risk Management in Wales covers measures to protect homes and communities from the risks of flooding. |
| Timescale | Ongoing |
| Stakeholders | Welsh Government Developers Sustainable Drainage Approving Body Water companies UK Government NRW |
| Who will deliver | Welsh Government Developers Sustainable Drainage Approving Body Water companies NRW |
| Indicators and baselines | To be confirmed |

| | |
|---------------------------------|--|
| CCAPW-HP4 Resilience | Support adaptation and capacity building at the community level |
| Summary | <ul style="list-style-type: none"> Continue to fund community led climate change adaptation projects (such as the current Welsh expenditure of the BIG Lottery dormant accounts funding). |
| Timescale | Ongoing |
| Stakeholders | Welsh Government BIG Lottery Fund Create Your Space Renew Wales |
| Who will deliver | BIG Lottery Fund Create Your Space Renew Wales |
| Indicators and baselines | To be confirmed |

| | |
|---------------------------------|--|
| CCAPW-HP5 Resilience | Work with Public Service Boards to support adaptation and capacity building at the regional level |
| Summary | <ul style="list-style-type: none"> Work with Public Service Boards to develop knowledge of climate risk at the regional level. Identify regional adaptation options to be made locally and to help cope with the negative impacts of climate change. Share knowledge and best-practice with public bodies, and other organisations, across Wales. |
| Timescale | Ongoing |
| Stakeholders | Welsh Government Natural Resources Wales Public Service Boards |
| Who will deliver | Welsh Government Natural Resources Wales Public Service Boards |
| Indicators and baselines | To be confirmed |

Planning

Welsh Government's new National Development Framework (NDF) will be published by Welsh Ministers in 2020. The NDF will be the highest level development plan for Wales, meaning it must be taken into account when preparing Local and Strategic Development Plans, and when deciding upon planning applications. It will show and

designate nationally significant projects which will be supported by the planning system.

Preparatory work is underway and a Preferred Strategic Option was subject to consultation in summer 2018. It stated “the NDF will ensure that the planning system in Wales plays a key role in facilitating clean growth and decarbonisation and helps build resilience to the impacts of climate change”. This provides the hook to enable the NDF to outline actions or measures the planning system can facilitate or deliver in support of our adaptation objectives. The impact of the NDF on adaptation will likely focus on ensuring developments are located appropriately, reflecting the policy set out in Planning Policy Wales.

Any future review of planning policy and guidance on managing flood risk (including Technical Advice Note 15) will give greater focus than is currently the case on the importance of adaptation. This could include the development of a companion guide advising developers, householders and landlords on how homes and premises can be adapted to be resilient to climate change, in a Welsh context.

Urban Green Infrastructure

A national priority of our Natural Resources Policy is to deliver more urban ‘Green Infrastructure’ through nature-based solutions. Green infrastructure includes all our open spaces and networks of habitats, parks, playing fields, allotments, private gardens, ponds, rivers, canals, woodland and hedges. It includes street and garden trees. It can be engineered to form green roofs and walls or sustainable urban drainage. It can also be part of our transport corridors and other links between our built up areas and their surroundings so they ‘join up’.

Urban green infrastructure provides a wide range of benefits to support adaptation to climate change and to realise those benefits the quality of urban green infrastructure, it is important in particular that it is biodiverse where appropriate. We have established a cross disciplinary working group to drive forward the collective action needed for delivery.

Flooding

Flooding is a key concern from climate change. Current estimates show over 200,000 properties in Wales are at risk of flooding from rivers, the sea and surface water. The direct impact on people can include injuries, drowning and the stress and anxiety caused by these situations. The UK Committee on Climate Change stated that a higher uptake of Sustainable Drainage Systems (SuDS) is needed in new developments to relieve pressure on the public sewer system. From January 2019, using legislative powers from the Flood and Water Management Act 2010, all future developments in Wales (with the exception of single dwellings with areas of less than 100m²) will be required to be designed and built in accordance with the mandatory SuDS standards. In addition to seeking local planning authority approval,

developers will also have to seek the technical approval of the local Sustainable Drainage Approving Body (SAB) for the drainage components of a proposed site.

Under the legislation, Local Authorities will discharge the SAB function and SABs will be responsible for the approval of SuDS schemes in compliance with statutory SuDS standards and for the adoption and maintenance of these post construction if all conditions are met. The SAB adoption duty under Schedule 3 to the 2010 Act, requires the SAB to adopt the SuDS, so long as it is built and functions in accordance with the approved proposals, including any SAB conditions of approval. Post adoption, the SAB has responsibility for maintaining the system.

There is currently no requirement for sewerage undertakers to develop and maintain a strategic waste water and sewerage management plan. At current levels of investment, public sewers may not be replaced for up to 700 years. This aging sewerage and drainage infrastructure needs to be surveyed, maintained and upgraded in order to continue to operate effectively and the impact on customer bills now and in the future taken into account. The Welsh Government is working with water companies, regulators and Local Authorities to introduce evidence based long term planning for waste water and sewerage management. This is a collaborative project, and we have been supporting the UK wide 21st century drainage programme, an industry-led project established to look at how long term planning for sewage and drainage could be implemented, and how it could be technically and evidentially supported. Once this work has been completed we will work with the regulators and undertakers to develop a planning framework for implementation in Wales.

Welsh Government is working with stakeholders to change the behaviour of consumers, with regards to how our sewers are used. For example, there are educational programmes and campaigns²⁰ to discourage flushing wet wipes or pouring saturated fats down sinks as these block the sewers, damage the infrastructure and exacerbate sewer flooding. The issue of flooding is a key concern to Public Health Wales (PHW). Flood water may be polluted by sewage, chemicals or animal faeces if water has run off fields. Polluted flood water can cause a wide range of infectious diseases, including diarrhoeal disease. Alongside their extreme weather events guidance, PHW provides advice²¹ on how to manage the potential, and often real, health impacts of flooding.

The National Strategy for Flood and Coastal Erosion Risk Management in Wales sets out Welsh Government's policy on delivery of flood and coastal erosion risk management to people, properties and businesses in Wales. As part of the update to the National Strategy for Flood and Coastal Erosion Risk Management in Wales, a measure will be included for NRW to prepare an updated 'Future Flooding in Wales' report which will use the current number of properties at risk of flooding to help inform the level of future investment in flood and coastal erosion risk management in Wales.

Coastal change

The National Strategy for Flood and Coastal Erosion Risk Management in Wales sets out our policies on flood and coastal erosion risk management. This includes the role of Shoreline Management Plans (SMPs – see ‘Protecting our coasts and seas’) to manage the threat of coastal change.

The Strategy is currently being reviewed, and a measure will be included to report on progress on SMP Action Plans, with an annual report being submitted to Welsh Government. More detail on our action for coastal communities is detailed in the ‘Protecting our coasts and seas’ section above.

Adaptation at the community level

Welsh Ministers, in exercising the powers conferred on them under the Dormant Bank and Building Society Accounts Act 2008, currently consult and direct Welsh expenditure of funding from dormant bank accounts, managed by the BIG Lottery Fund. This helps develop community led and inclusive approaches to address the causes of climate change and build resilience to its impacts, with the aim of encouraging behaviour change to be rolled out to other parts of Wales.

Two programmes are underway which are particularly important to delivering climate change adaptation at the community level – ‘Renew Wales’ and ‘Create Your Space’.

Renew Wales²² uses a mentoring approach by working with influential peers and people of expertise, to support community projects which might otherwise lack the knowledge needed to deliver successful projects. The organisation has already supported the delivery of hundreds of projects across the country. £600k has been committed from the BIG fund to continue this support until at least March 2020, and projects include efforts to refurbish community hubs to make them resilient to extreme weather and woodland maintenance programmes to protect local biodiversity.

The Create Your Space²³ programme is focussing on six larger-scale projects, having received £2.2m from the dormant account fund. These 7-year projects work closely with communities, businesses, Local Authorities, the third sector and Welsh Government, on initiatives relating to the natural environment. The projects are significant and varying in scope, meaning there are lots of opportunities for good practice knowledge sharing at the practitioner level. The Cwlwm Seiriol project in Anglesey, for example, aims to reconnect local communities with local ecosystems, making them aware of the local environmental issues. The ‘Welcome to our woods’ group based in Treherbert aims to tackle the issues from unemployment by creating a more diverse, enterprising and resilient local economy based on natural resources, landscape and low carbon products.

The Eco-Schools Project (see 'Our strategic actions' above) has also led to the development of a number of community led initiatives in Wales.

Case study - Rhyl High School SuDS

Using Eco-Schools funding provided by Welsh Government, Rhyl High School, in Denbighshire, is undertaking a project to plant flower and vegetable growing beds and use the opportunity to manage land by increasing water storage, reducing run-off and improving water quality.

The project is also reducing the possibility of localised flooding. The outcomes of the project are as follows:

- 4 raised beds constructed (of an area of 31.4m²). With average rainfall of 1000mm, it is estimated they could store 31,400 litres of water per annum.
- 1 Poly-tunnel (with water collection) constructed. At 9m², the tunnel is able to store 9000 litres.
- 6 planters installed (at an area of 3m²). Total water storage of 3,000 litres.
- 1 container with 1000 litre water collection capacity installed.

A 100m² area was then grassed rather than being concreted. 100,000 litres which would have gone straight to drains will now be stored longer on site. 320 trees were also planted to create a new hedge, at 140m long. Although information on how much water trees absorb varies, mature trees can remove 100 litres per day, whereas saplings take 45 litres per inch diameter of tree per week, so approximately 6.5 litres per day. The trees therefore have the potential to remove 116,800 litres per year.

Adaptation at the regional level

The Well-being of Future Generations (Wales) Act 2015 led to the creation of 19 Public Service Boards (PSBs) across Wales – one for each Local Authority. The purpose of PSBs is to improve the economic, social, environmental and cultural well-being in its area by strengthening joint working across all public services in Wales. Each PSB must prepare and publish a Local Well-being Plan setting out its objectives and the steps it will take to meet them.

PSBs must carry out Well-being Assessments to inform the development of their plans and, in doing so, must pay due regard to the latest Climate Change Risk

Assessment. In order to develop best-practice in the actions against climate change taken by PSBs, Welsh Government will support two PSB projects as pilots, and share the knowledge learned with all PSBs and other public bodies to support regional adaptation work moving forward. The area statements produced by NRW will be an important evidence base to support PSB's developing nature based solutions to climate change risks as well as to help understand and address the risks and impacts upon natural resources and ecosystems at a more local level.

The Gwent Strategic Well-being Advisory Group identified that piecemeal adaptation can often be counterproductive and expensive, and that regional collaboration on climate change adaptation would better enable local delivery of public services. Therefore, a project has been developed to bring five communities together across Gwent to work together and identify adaptation options. The project will lead to the development of narrative and graphical outputs as powerful tools which can then be used by decision makers in taking the steps needed to develop resilient communities.

The Ceredigion PSB has set out a well-being aim to make the area more resilient. Their aim is to 'create environmentally responsible and safe communities that can adapt and respond to the effects of climate change'. To do this they intend to support communities to enhance their relationships with their environments and to help them prepare for extreme weather events. In a first step towards achieving this aim, Ceredigion PSB identified the need to complete a detailed regional climate change impact assessment to outline the areas of risks, as well as the responses, actions and options available to them and their communities.

Welsh Government commits to working with these and other PSBs to support the adaptation options at the regional level. We will take knowledge and examples of best practice from projects such as these and share them widely, so as to help prepare all regions across Wales for the local effects from climate change that they could expect. We are also working with Local Resilience Forums to look at their role in responding to extreme weather events. See 'Resilient Infrastructure and Transport' below for more information.

Homes and buildings

Wales has 1.4 million homes across a wide range of housing types, including a significant proportion of older buildings. Despite national Building Regulations being introduced in 1965, with local standards in existence since the 1930s, we have some of the oldest and least thermally-efficient building stock in Europe. Nevertheless, new construction offers opportunities to incorporate new energy systems and to implement much higher standards of energy efficiency.

Wales has a slightly higher proportion of solid-wall homes than the UK average, which means more of our housing stock is more expensive to insulate. Around 1 in 5 of our homes is not connected to the gas grid, higher than the UK as a whole. The

energy efficiency of our homes was a key consideration in the consultation for our decarbonisation programme and we recently undertook detailed research into actions to decarbonise the Welsh Housing Stock by 2050. These included research into physical types of housing retrofit activities and consider the risks of potential overheating in buildings retrofitted in the way described.

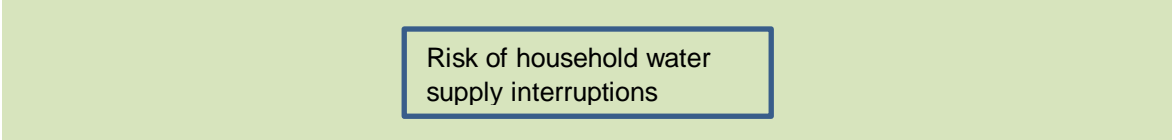
The 2014 review of Part L (Conservation of Fuel and Power) of the Building Regulations in Wales resulted in aggregate performance improvements to new buildings of 8% for residential and 20% for non-domestic buildings. These improvements led to significant carbon emission and economic efficiency savings from our homes. The review also made improvements to existing buildings undergoing work. However, consultation proposal options for new dwellings of higher standards were not taken forward in the light of a depressed housing market following the 2008 crash.

Nevertheless, subject to the timetable for leaving the EU, the Energy Performance of Buildings Directive Recast 2010 continues to influence domestic policy and requires implementation of a range of provisions. These include 'nearly zero energy' new buildings by 1 January 2019 (for those owned and occupied by the public sector) and by 1 January 2021 (for all new buildings). The intention now is to develop a set of proposals over the next 12 months which build on the 2014 changes and which take account of current concerns, including issues around adaptation and overheating. We anticipate the proposals to go out to public consultation during first half of 2019.

Any future programmes to review the Building Regulations will also consider needs for climate change adaptation in the home. This will include action aimed at tackling the risks to building fabric from moisture, wind and driving rain.

Current action against other risks

One further risk is included for this section, and highlights the need to sustain current action on water supply. The risk is scored 'sustain current action' in the UKCCC's evidence report.



Risk of household water supply interruptions

Water Strategy

Identifying and mitigating the effects of climate change on water resources in Wales is deeply embedded in the development of Welsh Government policy, the regulation of the industry and planning and investing for the future. For these reasons, the long-term goals of the water sector include continuous adaptation to climate change and reducing the industry's carbon footprint. Unlike parts of England, Wales is not forecast to have a water supply deficit over the next 30 years. (Welsh Water has

identified two zones that may fall into deficit, but they are developing a programme of investment to ensure sufficient water resources in these areas are maintained). Policies are in place to safeguard the continuity of public water supplies during droughts and from burst pipes in cold weather. These concerns are kept under review to make sure long-term risks continue to be managed appropriately.

The Water Strategy for Wales sets out our vision and approach to ensuring a resilient, and affordable water supply and environment over the next 25 years. The availability of resilient and affordable water supplies is essential to support health and survival of the people of Wales, the economy (including future growth) and the environment.

Water companies have duties to develop robust plans to ensure effective management, maintenance and development of our water resources and supply systems. These plans include:

- Water Resource Management Plan (WRMP) every five years to set out how the undertaker intends to maintain the balance between supply and demand for water over the next 25 years. The next plans by Welsh undertakers must be published by 2020, and
- Drought plans setting out how they will continue, during a period of drought, to discharge its duties to supply adequate quantities of wholesome water

These plans are produced on a 5 yearly cycle and submitted to Ofwat, the economic regulator, for scrutiny. When considering these proposals, Ofwat take into account statutory guidance published by the Welsh Government in the Strategic Priorities Statement²⁴. We published this in 2017 and engaged extensively with stakeholders. It puts a strong emphasis on ensuring the resilience of both water resources and sewage and drainage infrastructure. New Welsh Guidelines for WRMPs will be published by 2025.

In addition, NRW has a statutory duty for long-term water resources planning and is a statutory consultee in the development and review of water undertaker drought plans. They review and advise Welsh Ministers on draft plans. During a drought, they regulate water undertakers (a company appointed to provide water services) to ensure that they follow their plans to ensure water supplies are protected for both people and the environment.

Leakage is a high priority issue for customers and can damage the industry's reputation. We have encouraged Ofwat to take a robust line on reducing leakage, and it has set water companies a minimum target to reduce it by 15 % by 2025. We expect water companies to continue to innovate and develop expertise in preventing, identifying and repairing leakage more effectively. To reduce water demand, the Welsh Government also participates in the UK Government's Water Efficiency Project. The project includes an initiative to examine the feasibility of a water

efficiency labelling scheme for products that use water, along the lines of current energy efficiency labelling schemes for gas and electrical projects.

Welsh Government is aware of the particular risk faced by those reliant on private water supplies in Wales. In addition to the above, we are part-funding research to increase our understanding of the impacts of climate change on water availability, including private supply. This research will support the UKCCC's development of the next Climate Change Risk Assessment.

Caring for the historic environment

The historic environment of Wales is made up of individual historic features, archaeological sites, historic buildings and historic parks, gardens, townscapes and landscapes, collectively known as historic assets. The most important of these historic assets have statutory protection through scheduling, listing or designation as a conservation area. The historic environment is a precious, irreplaceable resource that brings important economic, social, cultural and environmental benefits to the people of Wales, and it needs to be managed and sustained for the benefit of present and future generations.

Climate change brings a number of significant challenges for the historic environment. A strategic study for the sector has identified that whilst a relatively small number of historic assets are at high risk, a large number of assets are potentially at moderate risk from a wide range of climate change events and trends. Cumulatively these risks should be considered of high significance. Potential slight positive outcomes are evident but limited.

The impacts are likely to be numerous for historic buildings, structures and settlements and include flooding, structural damage and increased damp, encouraging insect infestation and fungal growth. Historic bridges and riverside structures may be more susceptible to scour and collapse, whilst water shortages and changing agricultural practices will have a profound impact on historic landscapes. Changes in the distribution of tree and plant species will affect the character of our ancient woodland, hedgerows and designed landscapes, parks and gardens. The desiccation of peats and wildfires in upland areas may also expose and lead to the loss of previously undisturbed buried archaeology.

Marine and coastal historic assets, including our historic seaside resorts, located on the foreshore are at risk from rising seas and increased storminess. Submergence of archaeological evidence will impact upon historic landscapes, but may not result in complete destruction of the evidence. However, erosion of historic assets, whether underwater or along the coastline, will have a more profound and irreversible impact.

There may be some less harmful changes as a result of climate change. Long, dry summers can lead to new archaeological discoveries in the form of parch marks and crop marks, revealing previously unknown buried sites. Hotter, drier summers may also increase tourism potential and support economic development. However, increased visitor numbers can harm fragile historic environments, which need to be carefully managed to reduce their vulnerability.

Unless action is taken, the damage to and potential loss of individual historic assets as a result of climate change is likely to harm our understanding and appreciation of those assets and the cultural significance of the wider historic landscape. It will also impact on the quality of the environment in which we live, work and spend our leisure time.

Urgent risks

Risks to culturally valued structures and the wider historic environment

Risks to building fabric from moisture, wind and driving rain

Risks to and opportunities for marine species, fisheries and marine heritage from ocean acidification and higher water temperatures

Risks to bridges and pipelines from high river flows and bank erosion

Risks to habitats and heritage in the coastal zone from sea-level rise; and loss of natural flood protection

The gaps

More research is needed to better quantify the risks and measures needed, regarding the historic built environment.

More work is needed to allow for dynamic re-adjustment of coastal landforms and habitats, particularly in terms of increased sediment supply and realignment opportunities.

National level modelling is needed to increase understanding of how the risk of increased river flow may change in the future and how this impacts our bridges.

A national assessment of bridge scour is needed. It is not known at a national level what bridges are used to carry services.

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| Adaptive nature and our rural economy | <p>Cross-sector working</p> <p>The things that make up our heritage in Wales can be found in almost every corner of the country. Some of the things we need to protect in our historic environment include the ancient trees protected in our Woodland for Wales plan, and our work in the agricultural sector helps care for buried archaeology, historic landscapes and ancient hedgerows. Work done elsewhere will also protect many of the bridges at risk from bridge scour (see 'Resilient Infrastructure and Transport') and the ship-wrecks in our warming seas (see 'Protecting our coast and seas').</p> <p>Cross-sector working is evidently essential when caring for our historic environment. By protecting peatlands to maintain their roles as carbon sinks, we'll also be protecting a significant amount of archaeological material that lies within them, and our efforts to mitigate the effects of flood in our communities will go some way to protect our historic buildings too.</p> |
| Protecting our coast and seas | |
| Staying healthy | |
| Safe homes and places | |
| Protecting our heritage | |
| Successful businesses | |
| Infrastructure and transport | |

Our commitments

| | |
|---------------------------------|---|
| CCAPW-HE1 Resilience | Increase resilience of the historic environment by taking action to adapt and respond to the risks, reduce vulnerability and maximise the potential benefits |
| Summary | <ul style="list-style-type: none"> • Publish and disseminate the Historic Environment and Climate Change Sector Adaptation Plan. • Undertake stakeholder engagement to identify leads and timescales for the implementation of the action plan. • Implement, monitor and review the action plan. |
| Timescale | Ongoing |
| Stakeholders | Public Health Wales |
| Who will deliver | Historic Environment Group in conjunction with Welsh Government |
| Indicators and baselines | To be confirmed |

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|---------------------------------|--|
| CCAPW-HE2 Knowledge | Improve understanding of the threats and opportunities for the historic environment, from changing weather and climate in the short, medium and long-term. The potential impacts could be direct or indirect, and may result from adaptation undertaken for other purposes |
| Summary | <ul style="list-style-type: none"> • Develop an enhanced spatial mapping project to identify, understand and help prioritise historic assets at risk. • Investigate the potential effects of climate change on the maintenance and management of historic assets. • Develop and implement methodologies for monitoring change, understanding processes and impacts, and assessing risk to assist the development of adaptation policies and programmes. |
| Timescale | Ongoing |
| Stakeholders | Royal Commission on the Ancient and Historical Monuments of Wales Historic Environment Group Natural Resources Wales Transport for Wales Network Rail Wales Infrastructure Group Local Authorities Utility companies |
| Who will deliver | To be confirmed. |
| Indicators and baselines | To be confirmed |

CCAPW-HE3
Capacity

Work with partner organisations and other sectors to raise awareness of the potential impacts of climate change on the historic environment and to develop the methodologies, tools and guidance needed to build adaptive capacity in the sector

Summary

- Raise awareness of the potential impacts of climate change on the historic environment.
- Embed historic environment considerations in national and local policy statements and plans.
- Develop and showcase selected sites as case studies to identify the key issues, test options for management regimes and inform good practice.
- Develop and disseminate best-practice guidance on climate change adaptation to improve the management and resilience of historic assets.

Timescale

Ongoing

Stakeholders

Historic Environment Group
Welsh Government
Natural Resources Wales
Fit for the Future Network
Museums, Historic Sites, Etc.

Who will deliver

To be confirmed

Indicators and baselines

To be confirmed

Delivery through the Sector Adaptation Plan

The actions identified in HE1, HE2 and HE3 set out the high level strategic response to the risks identified in the CCRA Summary for Wales. These will be expanded upon in the Historic Environment and Climate Change Sector Adaptation Plan (SAP) that is due to be published by the Historic Environment Group in 2019. The SAP will therefore be the mechanism for coordinating work in this sector.

The main objective of the SAP is to encourage collaboration and action across all sectors that will improve understanding, build adaptive capacity and increase the resilience of the historic environment. It will be a living document, reviewed and updated regularly as our understanding of the threats and options for the historic environment develops.

Indeed, if climate change proceeds as projected, then changes that would naturally occur over many hundreds of years will happen much more quickly. We will need to adapt equally quickly and are likely to pass through many interim stages. Monitoring, documenting and learning from these various stages will be critical.

Early actions

Raising awareness of the risks to the historic environment and developing partnerships to deliver the SAP action plan will be a priority. Given the need for research to establish baseline data, early actions are likely to include the establishment of a cross-sector steering group with responsibility for setting the strategic objectives and direction of the enhanced spatial mapping project. The steering group's remit will include identifying gaps in our knowledge and promoting specific research questions to be taken forward by external partners. The steering group will also work to help raise awareness of the mapping project and the growing evidence base that it will be gathering. This will help to support the integration of historic environment considerations into climate change adaptation policies and programmes more generally.

Working cross-sector, we will support research to identify historic assets at risk and develop case studies that can be disseminated more widely through new and existing networks, such as the Fit for the Future Network and the Historic Environment Adaptation Working Group. An example is research into the number of historic bridges at risk of scour now and in the future, and the amount of adaptation underway nationally. We have already mapped the bridges that are listed (approximately 1,000) and scheduled (58) to identify those with statutory protection.

We will also work to develop and promote good practice guidance where possible, including advice on building maintenance, property flood resilience and post-flood recovery of traditional and historic buildings.

Case study – CHERISH

CHERISH is a five-year Ireland-Wales project, bringing together four partners across two nations: the Royal Commission on the Ancient and Historical Monuments of Wales; the Discovery Programme, Ireland; Aberystwyth University: Department of Geography and Earth Sciences; and Geological Survey Ireland. It began in January 2017 and will run until December 2021; it will receive €4.1 million of EU funds through the Ireland Wales Co-operation Programme 2014-2020.

CHERISH is a cross-disciplinary project aimed at raising awareness and understanding of the past, present and near-future impacts of climate change, storminess and extreme weather events on the rich cultural heritage of our sea, islands and coast. It links land and sea and employs a variety of techniques and methods to study some of the most iconic coastal locations in Ireland and Wales.

These range from terrestrial and aerial survey and laser scanning, geophysical survey and seabed mapping, through to paleo-environmental sampling, excavation and shipwreck monitoring.

The main aims of the project are to:

- **Target data and knowledge gaps to raise awareness of heritage in remote coastal locations.** One example of this has been through the commissioning of 25cm 'leaves off' LiDAR for six Welsh Islands at low tide, providing the first highly-accurate 3D geometric data for the islands and enabling the creation of new archaeological maps of them.
- **Discover, assess, map and monitor heritage on land and beneath the sea and establish new baseline data and recording standards.** In CHERISH project areas, the Geological Survey Ireland has commenced marine mapping of the seabed, recording both known and previously unknown shipwrecks. Continued monitoring of a selection of shipwrecks through survey and diving will help understand the impact of ocean acidification and higher temperatures on the long-term stability of underwater cultural heritage.
- **Reconstruct past environments and weather history.** Sediment cores have been taken at several CHERISH study sites, which in addition to reconstructing past environments, is likely to reveal the physical and chemical indicators of past storm activity.

For more information see the CHERISH website -

<http://www.cherishproject.eu/en/>

Successful Businesses

Wales had an estimated 254,500 enterprises active in 2017, employing circa 1.1 million people. Of these, nearly 39% of people were employed in large enterprises, 12% - medium, 14% - small and the remaining 33% in micro businesses.

Businesses are at risk from climate change due to a number of reasons. Directly, buildings and other sites of work are at risk of damage from extreme weather events such as flooding or high winds. Those on the coast are at risk from rising sea levels and storm surges. Indirectly, our businesses are also threatened by reduced employee productivity due to higher temperatures and infrastructure disruption. The secondary effects of these sorts of disruption go far and wide. Teaching staff not being able to reach their schools during extreme weather events has often lead to school closures, leading to further disruptions for parents and, of course, children. In the construction industry, severe storm can cause delays, leading to financial loss. In some cases, there may be benefits to businesses - The July 2018 heat wave, for example, is understood to have led to a boom of tourism to Wales' many coastal resorts. There are also risks to business supply chains. These can come from several different impacts from climate change and includes the impact of extreme weather damaging the infrastructure networks needed to move goods around Wales, the UK and internationally.

The means by which businesses are able to adapt to these impacts varies significantly. Larger organisations are, more often than not, better enabled to absorb the impacts of staff not reaching their places of work or relatively short term drops in productivity. However, adaptation for smaller organisations can be difficult since priorities often lie elsewhere to ensure viability. In addition, the UK Committee on Climate Change's evidence report suggests that organisations often activate business continuity plans only after they have been impacted by an extreme weather event. This section of the adaptation plan seeks to ensure our businesses are prepared and protected from the impacts of climate change both now and into the future.

Urgent risks

Risks to business sites from flooding.

Risks to businesses from reduced employee productivity, due to infrastructure disruption and higher temperatures in working environments.

Risks to business from loss of coastal locations and infrastructure.

The gaps

More research is needed to understand how future spending and uptake of flood defence in Wales protects businesses.

Further work needs to be done to ensure businesses in Wales have access to the incentives, tools and information needed to be able to adapt to the impacts of climate change.

More needs to be done to understand the costs and benefits of different adaptation options from the loss of coastal locations for businesses, to provide the means for early and cost effective adaptation.

Research is needed to understand the interdependencies between business and infrastructure, types of employment at greater risk and the effectiveness of planned or autonomous adaptation – particularly to thermal discomfort.

| | |
|---------------------------------------|--|
| Adaptive nature and our rural economy | <p>Cross-sector working</p> <p>Wales needs an economy that can support its country through the risks that climate change is projected to bring. Having a strong economy will allow our businesses, big or small, the means to be able to adapt to impacts such as flood and overheating.</p> <p>These impacts however, are also health concerns. The involvement of expertise in public health is not only needed to provide advice to business for health and safety concerns, but also because much of what we do to adapt will also be of relevance to our hospitals and care homes. Sustaining our businesses also means making sure we can continue to rely on our world-famous landscapes and heritage as interests to tourism. Furthermore, our utility, digital and transport infrastructure form the veins of our economy. It is essential we recognise the threats to this structure to support and adapt our businesses into the future.</p> |
| Protecting our coast and seas | |
| Staying healthy | |
| Safe homes and places | |
| Protecting our heritage | |
| Successful businesses | |
| Infrastructure and transport | |

Our commitments

| | |
|---------------------------------|---|
| CCAPW-SB1 Knowledge | Do more to understand the risks to businesses from infrastructure disruption and higher working temperatures |
| Summary | <ul style="list-style-type: none"> UK-wide research undertaken to identify industry sectors at risk and potential climate change mitigating options for businesses. |
| Timescale | By 2023 |
| Stakeholders | Welsh Government Businesses and Infrastructure Operators Carbon Trust Waste and Resources Action Programme Energy Savings Trust Business forums, federations and clubs Economic Ambition Boards |
| Who will deliver | Welsh Government Businesses and Infrastructure Operators Carbon Trust Waste and Resources Action Programme |
| Indicators and baselines | To be confirmed |

| | |
|---------------------------------|---|
| CCAPW-SB2 Capacity | Provide support to businesses to help them adapt to the future risks from climate change |
| Summary | <ul style="list-style-type: none"> Revision of Business Wales website, newsletter and twitter content to provide relevant and absorbing advice. Delivery of workshops to businesses to raise awareness of climate change issues. Provide 1-2-1 business advice to companies that are moving towards building an adaptation plan. |
| Timescale | Ongoing |
| Stakeholders | Welsh Government Carbon Trust Waste and Resources Action Programme Energy Savings Trust Business forums, federations and clubs Economic Ambition Boards |
| Who will deliver | Welsh Government Carbon Trust Waste and Resources Action Programme |
| Indicators and baselines | To be confirmed |

Research for businesses

At time of writing, there is no specific Welsh (or in-depth UK) research available that identifies specific actions to address business risks and impacts of increased higher temperatures within working environments. Further research is required to better understand key interdependencies between business and infrastructure, the types of employment at greatest risk, and the effectiveness of planned or autonomous adaptation. Research will provide the early steps to understanding these interdependencies, and in the case of higher temperatures, adapting workplace temperature guidance and building standards. This could include, for example, advice on how buildings can be kept in a tolerable range for thermal stress or thermal discomfort reflecting the building's use.

It is proposed that UK-wide research is undertaken to identify specific industry sectors at most risk and potential mitigating actions to minimise business risk and maximise employee health. Welsh Government will ensure that Wales is comprehensively catered for within research to enable the development of appropriate support.

Support for businesses

Flooding poses a significant risk to business sites, both in terms of damage to assets and in preventing employees from being able to access work premises. Research for the UK (which included a sample of businesses in Wales) suggested that the proportion of private sector organisations saying they have business continuity plans in place for flooding increased from 42% to 58% between 2008 and 2013. However, the report reflected that the smaller the business, the less likely they would have a plan in place.

By providing business advice to a wide range of organisations, Welsh Government will enable awareness raising within the business management and owners community. Using our Business Wales platform, we aim to provide relevant and absorbing content the website, newsletter and twitter feeds, a range of 1-to-many workshops to raise awareness of the issues, and 1-2-1 business advice to companies that are moving towards building an adaptation plan. This will include a review of our Climate Change Adaptation Business Tool²⁵, currently targeted towards the tourism sector. The Adaptation Business Tool provides detail of the risks to each subsector within the tourism industry, with useful infographics and suggestions on how to adapt. The tool will be reviewed to expand further into Historic Environment related tourism, and will be considered as a blue-print to helping all other business sectors in a similar way. Welsh Businesses also encourages businesses to adapt to climate change by using the UKCIP's 'BACLIAT' vulnerability assessment tool²⁶.

Developed with businesses, the tool helps those who need it to find out how climate change poses a risk to them, and points users to further support.

Case study

Vibrant and Viable Places was Welsh Government's regeneration programme from 2014 to 2017. The programme invested £124m of capital funding to develop viable and economically sustainable communities across Wales. The programme framework ensured adaptation to the effects of climate change was a key consideration:

"Apart from providing a stunning setting to work and live in, many of the raw materials that stimulated the industrial revolution and previous economic growth in Wales came from the natural environment, and that same environment offers new opportunities for tourism, local sustainable food production, carbon storage, and renewable energy generation and, when managed properly, can mitigate the damaging effects of climate change such as flooding."

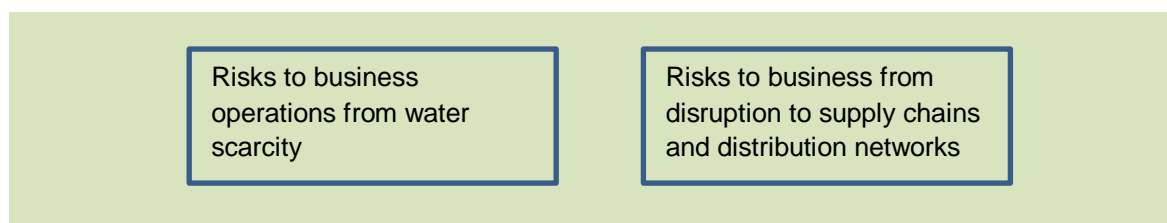
One good example of this can be found in the regeneration work being completed along the coastline of Colwyn Bay. The Colwyn Bay Waterfront Project was initiated to address the condition of the existing coastal defences along the waterfront in Colwyn Bay. The majority of existing defences here dated back to the turn of the 20th century. The decline in beach levels left the defences exposed in many areas and the increased severity and frequency of storm events combined with the threat of climate change posed an ever increasing threat to businesses and infrastructure along the waterfront and the town itself. As the town depended on many tourism businesses for its economy, the decision was made to vastly overhaul the existing flood defences to provide long lasting and effective coastal protection. The programme was also used as an opportunity to enhance tourism by creating a promenade that would attract both local residents and visitors, providing a boost to the local economy.

Mike and Lesley Lewis own the Colbourn Hotel in Colwyn Bay. They said:

"It's been a very busy summer, and we have had only positive feedback on the prom from all our guests who have come from all over the world. Many of our guests have already booked to come and stay again next year. We have also noticed guests are staying a little longer this year, which benefits the whole area from tourist attractions, restaurants, pubs, and local shops. It's such a great improvement for Colwyn Bay."

Current action against other risks

We intend to sustain current action for two further risks in this chapter, as was stated in the UKCCC's evidence report. These risks, and a brief description of our actions against them follows.



Water scarcity

Our approach to managing water supply is considered in detail under the 'Safe homes and places' section above. In addition, Welsh government published a reformed water abstraction licensing system in 2016 to allow for a more flexible response to shortages and changes in demand for water use. The UKCCC highlight there has been a decline in water use by businesses since 2000. Water abstraction will be monitored to ensure our policies remain effective.

Supply chains and distribution networks

Successful business operation and competition will require knowledge of the risks from climate change, including those risks to supply chains and distribution networks. The UKCCC identified that a lot of guidance already exists for businesses to manage their supply chains, and large companies are already working with suppliers to consider the projected issues, with wider benefits for smaller companies. Autonomous adaptation in the sector will likely continue and will be supported.

Resilient Infrastructure and Transport

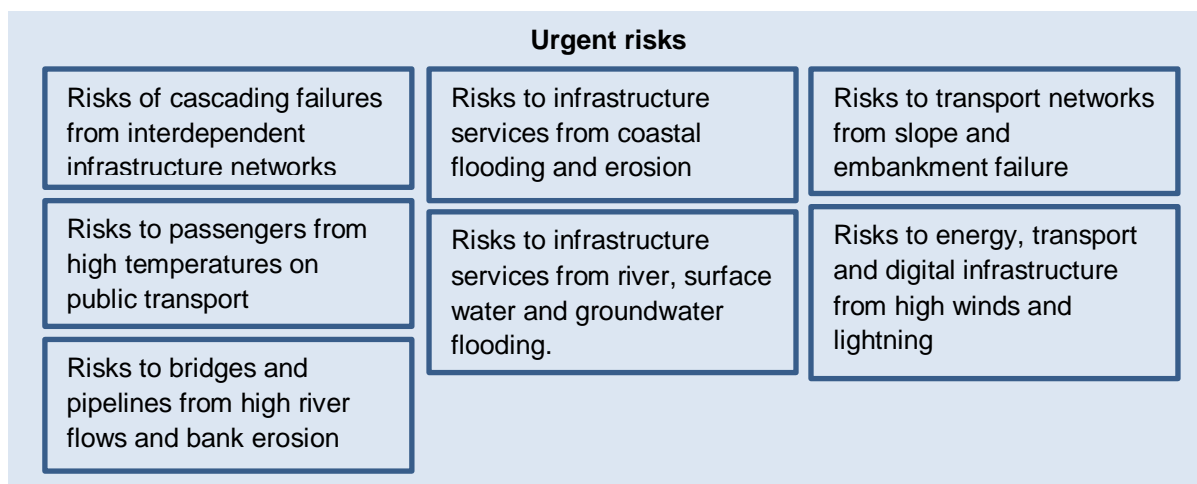
Having a resilient infrastructure and transport system is often something we take for granted. Even things as simple as turning on the TV, phoning home or taking the bus to work are all at risk from climate change. However, in the same way, climate change has a way of demonstrating just how critical our infrastructure can be and, ultimately, how important it is that we ensure it runs effectively no matter what.

Climate change has the potential to affect our infrastructure in many ways leading to a multitude of issues. High winds and lightning may damage our energy, digital and transport systems making power cuts more likely without adaptive measures being put in place.

Transport is at risk in a number of ways. Bridge scour (the undermining of bridge foundations) from higher and faster river flows is likely to become a more common phenomenon affecting not just roads, but other bridges such as rail or utility infrastructure. Away from bridges, the foundations of transport networks are considered more likely to be eroded away as slopes and embankments deteriorate from flash floods to the point of danger. We need to do more to understand these issues.

Too much heat is known to 'melt' the tarmac on our roads, cripple ironwork and even lead to power faults. If we are to have a resilient infrastructure network, we need to ensure the consideration of these issues in the future as projections suggest the likelihood of hotter and more frequent heat waves may increase. There may be options to improve, as well as adapt to risks in the coming winters since warmer weather may also mean less issues from cold snaps, such as burst water mains. Nevertheless, the winters will likely bring more rain, and too much water is a problem. Flooding poses risks to all aspects of our infrastructure; this includes transport, energy, digital and communications. The impacts to water supply, drainage and sewers are considered in the safe homes and places section above.

Emergency services can only operate if our communication networks are working and if roads are accessible. We need to consider the impacts that cascading failures across multiple infrastructure services may bring. Many of the impacts from climate change pose risks of health and safety. These dangers include threats from storms damaging utility infrastructure, road and railways, and the problem of overheating in public transport.



The gaps

More Wales-level evidence needed for both temperature and infrastructure related risks.

More work is needed to reduce the amount of surface water entering the sewer systems.

There is a need to improve coordination of surface water management with road maintenance and drainage works.

National level modelling and research is needed to understand how risk of increased peak river flow may change in the future, alongside a national assessment of bridge scour.

Further modelling is needed on the increased risk of tree-related faults to energy and rail networks due to projected increases vegetation growth rates.

There is a need for better understanding around the effects of increased speed and frequency of high winds on infrastructure and transport.

| | |
|---------------------------------------|---|
| Adaptive nature and our rural economy | <p>Cross-sector working</p> <p>Many of the risks highlighted in this section have important relationships with other sectors. The ways in which our infrastructure networks are connected means that they are often mutually vulnerable. A damaged water supply can lead to floods, impacting transport networks and ultimately leading to delays to our emergency services.</p> <p>Overheating in public transport needs to be adapted to by those who operate our public transport networks, but the impacts of the risk are health related and collaboration is needed to fully understand the implications. The risks to transport infrastructure needs to be considered from multiple angles also. Many of our bridges are listed as having historical importance. Failing energy and digital infrastructure will impact on just about every aspect of our lives. Our businesses, homes, schools and hospitals are all at risk if we cannot make these resources resilient.</p> |
| Protecting our coast and seas | |
| Staying healthy | |
| Safe homes and places | |
| Protecting our heritage | |
| Successful businesses | |
| Infrastructure and transport | |

Our commitments

| | |
|---------------------------------|---|
| CCAPW-IT1 Knowledge | Improve understanding of the risks from climate change to transport infrastructure in Wales |
| Summary | <ul style="list-style-type: none"> • Welsh Government to ensure Wales is comprehensively catered for within research undertaken for transport to enable the development of appropriate support. • Work with Highways England in setting new standards on climate change for road transport. • Review of transport sector case studies to share best practice in adapting to transport related climate change risks in Wales. |
| Timescale | By 2020 |
| Stakeholders | Welsh Government Highways England UK Road Liaison Group Natural Resources Wales Network Rail Local Authorities |
| Who will deliver | Welsh Government UK Department for Transport Highways England UK Road Liaison Group Welsh Local Government Association Network Rail Local Authorities |
| Indicators and baselines | To be confirmed |

CCAPW-IT2
Capacity

Strengthen our preparedness against multiple risks to interdependent infrastructure networks

| | |
|---------------------------------|---|
| Summary | <ul style="list-style-type: none"> • Complete delivery of pilot exercise to improve emergency response to threats to infrastructure. • Roll out new infrastructure emergency response processes across all Local Resilience Forums. • Work with utility companies specifically to address the risk of a total failure of the UK's national electricity transmission network. |
| Timescale | Ongoing |
| Stakeholders | UK Government Local Resilience Forums Distribution Network Operators |
| Who will deliver | Welsh Government UK Government Local Resilience Forums Distribution Network Operators |
| Indicators and baselines | To be confirmed |

CCAPW-IT3
Knowledge

Raise awareness of the level of risk to bridges and pipelines from climate change, and address research gaps to help inform mitigation

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|---------------------------------|---|
| Summary | <ul style="list-style-type: none"> • Understand the research gaps into erosion and scour, and address the gaps. • Improve understanding of the level of risk to bridges and pipelines across Wales, the bridge owners involved, and the action being taken. |
| Timescale | 2023 |
| Stakeholders | NRW Network Rail Wales Infrastructure Group Local Authorities Utility companies |
| Who will deliver | Welsh Government Network Rail Local Authorities |
| Indicators and baselines | To be confirmed |

Researching adaptation in transport infrastructure

Infrastructure across Wales is exposed to a range of climate hazards. Impacts on some assets have the potential to cascade onto others as part of interdependent networks. Flooding poses the greatest long-term risk to infrastructure performance from climate change, but the growing risks from heat, water scarcity and slope instability caused by severe weather could be significant. Welsh Government is supporting Highways England in the publication of new Design Manual for Roads and Bridges environment advice notes. The work will include new advice on road drainage and water environment and will help ensure the resilience of our road network from flood.

Transport for Wales

Wales has very recently established a new organisation, Transport for Wales. In Prosperity for All: Economic Action Plan²⁷, we detailed the important role Transport for Wales will take, working with our new regional teams, the emerging regional transport authorities and partners to create an integrated public transport network, covering the rail and bus networks. The Economic Action Plan also made clear that the network would focus “on the needs of passengers and it will be safe, reliable, affordable and low carbon”. Welsh Government will call upon Transport for Wales to ensure that new, and improvements to existing transport infrastructure for which they are responsible, will be done in consideration of the risks to transport raised in the latest Climate Change Risk Assessment, including the need to address the problem of overheating, the risks from floods and high winds, and risks from slope and embankment failure.

Case Study – Green Corridors

The European Climate-ADAPT partnership recommends the use of green corridors as a nature based solution to improve biodiversity and animal species dispersal.

The Green Corridor initiative announced in July for the Welsh Government Trunk Road and Motorway network will be investigating measures on the “soft estate” to assist with climate change adaption. This may include planting to contribute to water storage and slope stability as well as improving existing corridors for wildlife to use. More information regarding the announcement is available by clicking the following link:

<https://gov.wales/newsroom/transport/2018/180724-green-corridors-improve-gateways-into-wales/?lang=en>

Bridges

More research is also needed to identify the number of bridges at risk of bridge scour now and in the future, as well as the amount of adaptation underway nationally. This will provide the early steps needed to enable better decisions in the near future (over the next 5 years), especially where measures may be required that have long lead times such as relocating or rerouting bridges. Work on understanding the research gaps is already underway and we are now working with the British Geological Survey to discuss how research into fluvial scour might be taken forward.

Following research, we will work with stakeholders to fully understand how the risk to pipelines and bridges will be mitigated across the sector. We have already mapped approximately 1,000 listed and scheduled bridges, identifying those with statutory protection (see 'Caring for the Historic Environment' above). All of the bridges carrying the strategic road network have been risk-assessed and prioritised for scour repairs in accordance with best practice guidance.

Infrastructure resilience

Energy distribution and transmission is not a devolved competency to Welsh Government and is managed by the UK Government's Department for Business, Energy & Industrial Strategy (BEIS). Distribution Network Operators (DNOs) are required by law to keep power lines free of vegetation and undertake programmes of resilience vegetation management. It is also the responsibility of the owners of infrastructure networks to ensure resilience for surface and sea water flood, and there are positive examples of this. Working with the Landmark Information Group, Wales and West Utilities have developed an infrastructure vulnerability mapping tool from climate change projections, including sea level rise inundation, new tide-lines, tidal flooding, fluvial flooding for different emission scenarios and probabilities. The tool also considers changes in rates of river bed and bank erosion, potential bridge impacts and transport infrastructure impact. All DNOs must publish climate change adaptation reports as a requirement of the UK Governments use of adaptation reporting powers, nevertheless, the CCRA calls for more research to understand the increased risk of tree-related faults to infrastructure. Welsh Government will call upon the UK government to ensure the UK energy network is resilient to extreme weather events and to ensure the unique factors and threats of climate change in Wales are a consideration in any research.

The Welsh Government is a member of the Cabinet Office-led Infrastructure, Resilience and Security Working Group (IRSWG) and is working closely with the UK Government, other devolved administrations and Local Resilience Forums in Wales on the existing risk to critical infrastructure. This includes work around the UK Sector Resilience Plans which set out risks to 13 sectors (including energy, transport and emergency services) and measures to improve resilience where necessary. The Welsh Government is currently running a pilot in Dyfed-Powys which brings together

responder agencies and utility companies to strengthen preparedness around the various risks to infrastructure. This pilot will eventually be rolled out to other Local Resilience Forum areas in Wales. Welsh Government is also working closely with utility companies specifically to address the risk of a total failure of the UK's national electricity transmission network.

Railways

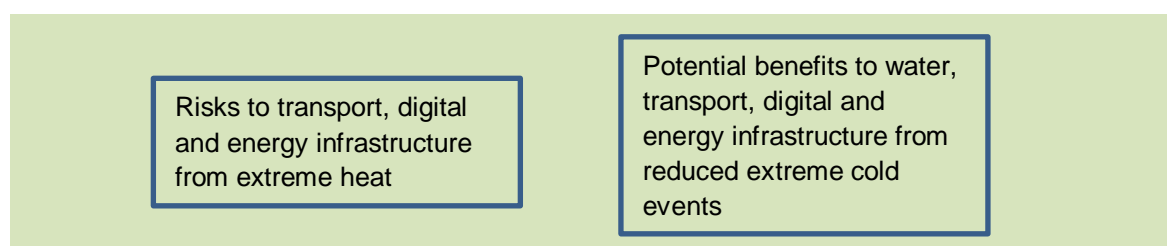
As the owner of most of Britain's railway infrastructure, Network Rail is responsible for much of the maintenance and resilience of the rail network against the impacts and risks from climate change. Weather resilience was a strategic priority of the organisation's 2016 Wales Route Study and, on top of their Weather Resilience and Climate Change Adaptation (WRCCA) plans, Network Rail have also published an adaptation report²⁸ outlining the risks and actions taken to control them. In Wales, one such action is the Coastal Alert System which forecasts coastal flooding, wave overtopping and toe scour up to 36 hours in advance. A number of other projects are also underway with Network Rail to improve the resilience of the rail network in Wales. Much of these works are being undertaken to respond to a number of impacts including flood risk and risks from slope and embankment failure.

Network Rail is investing £50m on the North Wales Coast under their Railway Upgrade Plan. The project includes enhancements using innovative lightweight polystyrene-blocks to successfully overcome challenging soft ground conditions. Work has also been undertaken to improve the drainage. Network Rail has also launched a Vegetation Management Capability Development Programme to introduce new standards and action to manage line-side growth. Welsh Government will continue to work with Network Rail and ensure adaptation needs are considered in line with the risks from the CCRA into the future.

KeolisAmey, as Wales' new rail service operator, have agreed a contract for 148 new trains to be provided for a modernised train service in Wales. The trains will go some way towards the problem of overheating on public transport by ensuring all carriages are cooled by air conditioning.

Current action against other risks

There are two further risks against which we will continue to sustain current action, as was recommended by the UKCCC in their evidence report. These are as follows.



Extreme heat and reduced cold weather events

There are a number of policies and procedures in place across our infrastructure networks in the event of extreme heat conditions. The de-rating of power lines is a standard procedure in hot weather to protect energy distribution, which has no short or long term consequences. DNOs have already begun adaptation activities, including taller poles, allowing for line sag on hot days.

The impact of hot weather on the rail network is included in Network Rail's Wales Route Climate Change Adaptation Plan.

Welsh Government accepts the UKCCC's analysis with regards to benefits from reduced cold weather events, since adaptation in such cases is likely to be autonomous.

Annex 1 – Summary of actions and risks

Full detail of the climate change risks to Wales is available in the Wales summary of the UKCCC's Climate Change Risk Assessment Evidence Report⁸. A table of the 'more urgent' risks is given below for reference.

| Risk No. | Risk Title | Category / Scoring | Risk No. | Risk Title | Category / Scoring |
|----------|--|--------------------|----------|---|--------------------|
| Bu. 1 | Risks to business sites from flooding | Research Priority | Ne. 6 | Risks to agriculture and wildlife from water scarcity and flooding | More Action Needed |
| Bu. 2 | Risks to business from loss of coastal locations and infrastructure | Research Priority | Ne. 7 | Risks to freshwater species from higher water temperatures | Research Priority |
| Bu. 5 | Risks to business from reduced employee productivity, due to infrastructure disruption and higher temperatures in working environments | Research Priority | Ne. 8 | Risks of land management practices exacerbating flood risk | More Action Needed |
| In. 1 | Risks of cascading failures from interdependent infrastructure networks | More Action Needed | Ne. 12 | Risks to habitats and heritage in the coastal zone from sea-level rise; and loss of natural flood protection | More Action Needed |
| In. 2 | Risks to infrastructure services from river, surface water and groundwater flooding | More Action Needed | Ne. 13 | Risks to and opportunities for marine species, fisheries and marine heritage from ocean acidification and higher water temperatures | Research Priority |
| In. 3 | Risks to infrastructure services from coastal flooding and erosion | More Action Needed | Pb.1 | Risks to health and wellbeing from high temperatures | Research Priority |
| In. 4 | Risks of sewer flooding due to heavy rainfall | More Action Needed | Pb.2 | Risks to passengers from high temperatures on public transport | Research Priority |
| In. 5 | Risks to bridges and pipelines from high river flows and bank erosion | Research Priority | Pb.4 | Potential benefits to health and wellbeing from reduced cold | More Action Needed |
| In. 6 | Risks to transport networks from slope and embankment failure | More Action Needed | Pb.5 | Risks to people, communities and buildings from flooding | Research Priority |
| In. 9 | Risks to public water supplies from drought and low river flows | More Action Needed | Pb.6 | Risks to the viability of coastal communities from sea level rise | Research Priority |
| In. 11 | Risks to energy, transport and digital infrastructure from high winds and lightning | Research Priority | Pb.7 | Risks to building fabric from moisture, wind and driving rain | Research Priority |
| Ne. 1 | Risks to species and habitats due to inability to response to changing climatic conditions | More Action Needed | Pb.8 | Risks to culturally valued structures and the wider historic environment | Research Priority |
| Ne. 2 | Opportunities from new species colonisations | More Action Needed | Pb.9 | Risks to health and social care delivery from extreme weather | Research Priority |
| Ne. 3 | Risks and opportunities from changes in agricultural and forestry productivity and land suitability | Research Priority | Pb.10 | Risks to health from changes in air quality | Research Priority |
| Ne. 4 | Risks to soils from increased seasonal aridity and wetness | More Action Needed | Pb.11 | Risks to health from vector-borne pathogens | Research Priority |
| Ne. 5 | Risks to natural carbon stores and carbon sequestration | More Action Needed | | | |

The below tables summarise the actions outlined in this adaptation plan and which of the above risks the actions aim to mitigate.

| No. | Action title | Bu. 1 | Bu. 2 | Bu. 5 | In. 1 | In. 2 | In. 3 | In. 4 | In. 5 | In. 6 | In. 9 | In. 11 | Ne. 1 | Ne. 2 | Ne. 3 | Ne. 4 | Ne. 5 | Ne. 6 | Ne. 7 | Ne. 8 | Ne. 12 | Ne. 13 | Pb. 1 | Pb. 2 | Pb. 4 | Pb. 5 | Pb. 6 | Pb. 7 | Pb. 8 | Pb. 9 | Pb. 10 | Pb. 11 |
|-----|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|
| ST1 | REVIEW AND UPDATE OUR APPROACH TO COMMUNICATION FOR CLIMATE CHANGE ADAPTATION IN WALES | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ST2 | INTEGRATE CONSIDERATION OF CLIMATE RISKS IN ALL FUTURE POLICY AND BUSINESS PLANNING WITHIN WELSH GOVERNMENT AND ENCOURAGE THE SAME IN ALL OTHER PUBLIC BODIES | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ST3 | ASSESS THE RISKS AND OPPORTUNITIES PRESENTED BY CLIMATE CHANGE THROUGH ACTIVE ENGAGEMENT IN UK RESEARCH PROGRAMMES | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ST4 | SUPPORT THE INTERNATIONAL COMMUNITY TO ADAPT TO CLIMATE CHANGE AT A GLOBAL LEVEL | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AN1 | PROTECT LAND AS AN ASSET TO CARBON STORAGE AND SEQUESTRATION | | | | | | | | | | | | x | | | x | x | x | | x | | | | | | | | | | | | |
| AN2 | SAFEGUARD, ENHANCE AND PROMOTE OUR WOODLANDS AS AN ASSET TO ADAPT TO CLIMATE CHANGE | | | | | | | | | | | | x | | x | x | x | | | x | | | | | | | | | | | | |
| AN3 | MITIGATE THE IMPACTS OF INVASIVE NON-NATIVE SPECIES TO PROTECT AND ENHANCE ECOSYSTEM RESILIENCE, QUALITY OF LIFE AND ECONOMIC INTEREST IN WALES | | | | | | | | | | | | x | x | x | | | | | | | | | | | | | | | | | |
| AN4 | MITIGATE THE RISK OF FLOOD AND DROUGHT IN FORESTRY AND AGRICULTURE | | | | | | | | | | | | | | | | | x | | x | | | | | | | | | | | | |
| AN5 | ESTABLISH AND DELIVER A CLIMATE SMART AGRICULTURE MITIGATION AND ADAPTATION FRAMEWORK | | | | | | | | | | | | x | x | x | x | | x | | x | | | | | | | | | | | | |
| AN6 | DELIVER THE CAPABILITY, SUITABILITY AND CLIMATE (CSC) PROGRAMME | | | | | | | | | | | | x | x | x | x | | x | | x | | | | | | | | | | | | |
| AN7 | DELIVER CLIMATE CHANGE ADAPTATION THROUGH THE NEW LAND MANAGEMENT PROGRAMME FOR WALES | | | | | | | | | | | | x | x | x | x | x | x | | x | | | | | | | | | | | | |

| No. | Action title | Bu. 1 | Bu. 2 | Bu. 5 | In. 1 | In. 2 | In. 3 | In. 4 | In. 5 | In. 6 | In. 9 | In. 11 | Ne. 1 | Ne. 2 | Ne. 3 | Ne. 4 | Ne. 5 | Ne. 6 | Ne. 7 | Ne. 8 | Ne. 12 | Ne. 13 | Pb. 1 | Pb. 2 | Pb. 4 | Pb.5 | Pb.6 | Pb.7 | Pb.8 | Pb.9 | Pb.10 | Pb.11 | | |
|-----|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|-------|-------|-------|------|------|------|------|------|-------|-------|---|--|
| MC1 | IMPROVE THE RESILIENCE OF HABITATS AND HERITAGE IN WALES’ COASTAL ZONES FROM THE IMPACTS OF CLIMATE CHANGE | | x | | | | x | | | | | | x | | | | | | | | | x | x | | | | | x | | x | | | | |
| MC2 | CARRY OUT RESEARCH TO BETTER UNDERSTAND THE MAGNITUDE OF OCEAN ACIDIFICATION AND HIGHER TEMPERATURE RISKS AND OPPORTUNITIES FOR MARINE ECOSYSTEMS AND HERITAGE | | | | | | | | | | | | x | | | | | | | | | | x | | | | | | | | | | | |
| MC3 | PROVIDE UPDATED POLICY AND GUIDANCE ON COASTAL ADAPTATION | x | x | | | | x | | | | | | | | | | | x | | | | x | | | | | x | x | | | | | | |
| SH1 | INCREASE UNDERSTANDING OF THE RISK INCREASED TEMPERATURES BRING TO HEALTH AND WELLBEING | | | | | | | | | | | | | | | | | | | | | | x | x | x | | | | | | x | x | x | |
| SH2 | CONTINUE TACKLING FUEL POVERTY THROUGH THE WELSH GOVERNMENT WARM HOMES PROGRAMME | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | |
| SH3 | UPDATE AND REVISE PLANS AND ADVICE IN LINE WITH RESEARCH TO INCREASE UNDERSTANDING OF THE RISK EXTREME WEATHER BRINGS TO HEALTH AND SOCIAL CARE DELIVERY | | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | x | | | |
| SH4 | ENSURE CLIMATE CHANGE RISK IS CONSIDERED IN ALL FUTURE POLICY DEVELOPMENT TO IMPROVE AIR QUALITY IN WALES | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | | x | | |
| SH5 | INCREASE UNDERSTANDING OF THE RISK FROM VECTOR BORNE PATHOGENS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | |
| HP1 | ENSURE THE PLANNING SYSTEM IN WALES PLAYS A KEY ROLE IN FACILITATING CLEAN GROWTH AND HELPS BUILD RESILIENCE TO THE IMPACTS OF CLIMATE CHANGE | x | x | | x | x | x | x | x | x | x | x | | | | | | | | | | | x | | | | x | | x | | | | | |
| HP2 | INFLUENCE THE DESIGN OF HOMES AND BUILDINGS TO PROTECT THEM FROM THE IMPACTS OF CLIMATE CHANGE | x | | | | | | x | | | | | | | | | | | | | | | x | | | x | x | x | x | | x | | | |
| HP3 | IMPROVE MEASURES TO PROTECT HOMES AND COMMUNITIES FROM THE RISKS OF FLOODING | x | | | | | | x | | | | | | | | | | | | | | | | | | | x | | x | | | | | |
| HP4 | SUPPORT ADAPTATION AND CAPACITY BUILDING AT THE COMMUNITY LEVEL | | | | | | | | | | | | | | | | | | | | | | x | | | | x | x | | | | | | |
| HP5 | WORK WITH PUBLIC SERVICE BOARDS TO SUPPORT ADAPTATION AND CAPACITY BUILDING AT THE REGIONAL | | | | x | | | | | | | | | | | | | | | | | | x | | | | x | x | | | | | | |

| No. | Action title | Bu. 1 | Bu. 2 | Bu. 5 | In. 1 | In. 2 | In. 3 | In. 4 | In. 5 | In. 6 | In. 9 | In. 11 | Ne. 1 | Ne. 2 | Ne. 3 | Ne. 4 | Ne. 5 | Ne. 6 | Ne. 7 | Ne. 8 | Ne. 12 | Ne. 13 | Pb. 1 | Pb. 2 | Pb. 4 | Pb. 5 | Pb. 6 | Pb. 7 | Pb. 8 | Pb. 9 | Pb. 10 | Pb. 11 |
|-----|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|
| HE1 | INCREASE RESILIENCE OF THE HISTORIC ENVIRONMENT BY TAKING ACTION TO ADAPT AND RESPOND TO THE RISKS, REDUCE VULNERABILITY AND MAXIMISE THE POTENTIAL BENEFITS | | | | | | | | x | | | | | | | | | | | | x | x | | | | | | | x | | | |
| HE2 | IMPROVE UNDERSTANDING OF THE THREATS AND OPPORTUNITIES FOR THE HISTORIC ENVIRONMENT, FROM CHANGING WEATHER AND CLIMATE IN THE SHORT, MEDIUM AND LONG-TERM. THE POTENTIAL IMPACTS COULD BE DIRECT OR INDIRECT, AND MAY RESULT FROM ADAPTATION UNDERTAKEN FOR OTHER PURPOSES | | | | | | | | | | | | | | | | | | | | x | x | | | | | | | x | | | |
| HE3 | WORK WITH PARTNER ORGANISATIONS AND OTHER SECTORS TO RAISE AWARENESS OF THE POTENTIAL IMPACTS OF CLIMATE CHANGE ON THE HISTORIC ENVIRONMENT AND TO DEVELOP THE METHODOLOGIES, TOOLS AND GUIDANCE NEEDED TO BUILD ADAPTIVE CAPACITY IN THE SECTOR | | | | | | | | | | | | | | | | | | | | x | x | | | | | | | x | | | |
| SB1 | DO MORE TO UNDERSTAND THE RISKS TO BUSINESSES FROM INFRASTRUCTURE DISRUPTION AND HIGHER WORKING TEMPERATURES | x | x | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SB2 | PROVIDE SUPPORT TO BUSINESSES TO HELP THEM ADAPT TO THE FUTURE RISKS FROM CLIMATE CHANGE | x | x | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| IT1 | IMPROVE UNDERSTANDING OF THE RISKS FROM CLIMATE CHANGE TO TRANSPORT INFRASTRUCTURE IN WALES | | | | x | x | x | | x | x | | x | | | | | | | | | | | | x | | | | | | | | |
| IT2 | STRENGTHEN OUR PREPAREDNESS AGAINST MULTIPLE RISKS TO INTERDEPENDENT INFRASTRUCTURE NETWORKS | | | | x | x | x | | | | | x | | | | | | | | | | | | | | | | | | | | |
| IT3 | RAISE AWARENESS OF THE LEVEL OF RISK TO BRIDGES AND PIPELINES FROM CLIMATE CHANGE, AND ADDRESS RESEARCH GAPS TO HELP INFORM MITIGATION | | | | | x | | | x | | | | | | | | | | | | | | | | | | | | x | | | |

Annex 2 – Abbreviations

| | |
|---------------|---|
| ALC | Agricultural Land Classification |
| ANC | Area of Natural Constraints |
| BREEAM | Building Research Establishment Environmental Assessment Method |
| CCA | Climate Change Act 2008 |
| CCRA | Climate Change Risk Assessment |
| CCRAER | Climate Change Risk Assessment Evidence Report |
| CSA | Climate Smart Agriculture |
| CSC | Capability, Suitability & Climate |
| EU | European Union |
| FCERM | Flood and Coastal Erosion Risk Management |
| FEE | Foundation for Environmental Education |
| GHG | Greenhouse Gas Emissions |
| INNS | Invasive Non-Native Species |
| IPCC | Intergovernmental Panel on Climate Change |
| MSFD | Marine Strategy Framework Directive |
| NDF | National Development Framework |
| NECD | National Emission Ceiling Directive |
| NFM | Natural Flood Management |
| NGO | Non-Governmental Organisation |
| NHCP | National Habitat Creation Programme |
| NHS | National Health Service |
| NRG4SD | Network of Regional Governments for Sustainable Development |
| NRP | Natural Resources Policy |
| NRW | Natural Resources Wales |
| NWSSP-SES | NHS Shared Services Partnership Special Estate Services |
| PAWS | Plantations on Ancient Woodland Sites |
| PHW | Public Health Wales |
| SAB | Sustainable Drainage Approving Body |
| SMP | Shoreline Management Plan |
| SSSI | Site of Special Scientific Interest |
| SuDS | Sustainable Drainage Systems |
| UAA | Utilised Agricultural Area |
| UKCCC | United Kingdom Committee on Climate Change |
| UKCIP | United Kingdom Climate Impacts Programme |
| UKCP09/UKCP18 | United Kingdom Climate Projections |
| UKFS | United Kingdom Forest Standards |
| WGWE | Welsh Government Woodland Estates |

Annex 3 – List of Consultation Questions

1. Are you responding as an individual or on behalf of an organisation? If you're responding on behalf of an organisation, please provide the organisation's name.

☐

Individual

☐

Organisation

Name of organisation:

We've identified some potential actions to adapt to climate change over the next five years but want to know how you think we should take these ideas forward and what else could be done.

When we refer to 'actions' in this consultation, we mean those detailed in Part 2 of the Climate Change Adaptation Plan for Wales.

2. Overall, to what extent do you agree with the potential actions for adapting to climate change set out in this document? (1=completely agree, 5=completely disagree)

☐

1

☐

2

☐

3

☐

4

☐

5

Please explain the reasons for your answer:

3. Please tell us if you have any ideas for how we should deliver the potential actions for adapting to climate change.

4. We strongly believe everybody has a role to play in adapting to climate change. What ideas do you have to adapt and contribute to our objectives?

It is particularly important that we continue to communicate the risks and impacts of climate change to encourage individuals, businesses and other organisations to be prepared. We also need to ensure these people and organisations are aware of Wales' adaptation efforts so they are able to access the tools available to support them. Welsh Government has made a number of commitments to improve communication in this area.

5. What else can Welsh Government do to improve communication around the risks and impacts of climate change and the need for adaptation?

6. How can you contribute to communicating the risks and impacts of climate change and the need for adaptation?

Through our actions to adapt to climate change, we want to maximise the wider benefits and minimise adverse effects for the people of Wales, both now and in the future.

7. How do you think the potential actions to adapt to climate change might affect you or the organisation you work for?

8. How do you think the potential actions in this plan might affect the following?

- Public health
- Communities
- The Welsh language
- Equality
- Children's rights

9. How do you think the potential actions to adapt to climate change might contribute to achieving the national well-being goals? You can read descriptions of the goals at <https://futuregenerations.wales/about-us/future-generations-act>

10. Do you have any other comments about this consultation?

Annex 4 – References

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