



HM Government

UK Climate Change Risk Assessment 2017

January 2017



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UK Climate Change Risk Assessment 2017

Presented to Parliament pursuant to Section 56 of the
Climate Change Act 2008

January 2017



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Executive summary

In December 2015, the UK joined 195 countries in signing an historic global deal to tackle climate change. The Paris Agreement commits the international community to reduce greenhouse gas emissions in order to avoid some of the most severe impacts of climate change. Despite this, we know that some changes to the climate are already inescapable due to past emissions of greenhouse gases. These changes present challenges and opportunities to all aspects of our society, and we must act on these if we are to achieve our ambitions of creating a stronger, more resilient economy and a natural environment that benefits people and can provide the vital resources and services we need.

Climate change is not only a challenge of the future. We are already observing changes in the UK climate, with average temperatures having risen by around 1°C over the last century. We are seeing a trend towards warmer winters and hotter summers, sea levels around our coast are rising by around 3mm a year and there is emerging evidence of changing rainfall patterns. The heavy rainfall and flooding over the winter of 2015/16 – although they cannot yet be attributed to climate change – illustrate the costs and disruption that can be caused by extreme weather. The ongoing development of the Government's 25 Year Environment Plan is one example of how we are building climate adaptation into our plans and investments to ensure that we are resilient for the future.

The Climate Change Act 2008 is an important piece of UK legislation that, on a five-yearly cycle, requires the Government to compile an assessment of the risks for the UK arising from climate change, and then to develop an adaptation programme to address those risks and deliver resilience to climate change on the ground. The Act established the Committee on Climate Change as an independent statutory body to advise the UK and Devolved Governments on setting and meeting carbon budgets and preparing for climate change. It also established the Adaptation Sub-Committee of the Committee on Climate Change specifically to provide advice on climate change risks and opportunities and to report regularly on UK progress on adaptation.

In accordance with the requirements of the Act, we present here the Government's second assessment of the risks and opportunities for the UK of the current and predicted impact of climate change, which follows on from the first report published in 2012. It draws primarily on an independent *Evidence Report* commissioned from the Adaptation Sub-Committee by the UK and the Devolved Governments.¹ The *Synthesis Report* of the *Evidence Report* sets out six urgent priorities for action over the next five years. In general, the Government endorses the conclusions of the Adaptation Sub-Committee, with the exception of some of those on food security.

1 Committee on Climate Change (2016) *UK Climate Change Risk Assessment 2017 Evidence Report* can be accessed at: www.theccc.org.uk/UK-climate-change-risk-assessment-2017/

We are very grateful to all of those who contributed so generously of their time and expertise to the production of the *UK Climate Change Risk Assessment 2017 Evidence Report*. Hundreds of leading scientists participated as authors and reviewers, drawing on a wealth of research from the UK's world-leading academic institutes as well as a range of other expert sources. Consistent with our commitment to open data, all the underpinning evidence has been published by the Committee on Climate Change, to ensure that government, businesses and other stakeholders have the information they need to take action.

Our statutory commitments under the Climate Change Act 2008 are unaffected by the decision to leave the EU. Leaving the EU offers a unique opportunity to shape our environment and economy for the benefit of all and we will do this in a way that provides as much support as possible to the environment's natural resilience and adaptability, as well as recognising its potential role in letting us make changes to our infrastructure and ways of working to cope with the impacts of climate change.

1. Introduction

This report fulfils the requirement of the Climate Change Act 2008 for the Government to lay before Parliament a five-yearly assessment of the risks for the UK of the current and predicted impacts of climate change.

The purpose of this second *UK Climate Change Risk Assessment* report to Parliament is to outline the UK and Devolved Governments' views on the key climate change risks and opportunities that the UK faces today. These views have been informed primarily by an independent assessment of the available evidence on climate risks and opportunities, which was commissioned by the UK and Devolved Governments from the Adaptation Sub-Committee of the Committee on Climate Change. The Adaptation Sub-Committee's *UK Climate Change Risk Assessment 2017 Evidence Report* sets out six priority areas needing urgent further action over the next five years. The next two sections of this report provide the UK and Devolved Governments' views on each of those six urgent priority areas. Further action to address these risks will be considered as we develop the next National Adaptation Programme, covering England and non-devolved matters, and due to be published in 2018. The Devolved Governments each have their own policy and implementation framework and these are set out in Section 3 along with their views on the specific risks that affect them.

In general, the UK Government and the Devolved Governments endorse the conclusions of the *Evidence Report* prepared by the Adaptation Sub-Committee, with the exception of some of the conclusions on food security.

1.1 Legislative framework on climate change

The Climate Change Act 2008 provides a legally binding framework to cut UK greenhouse gas emissions and a framework for building the UK's ability to adapt to the changing climate.

In terms of adaptation, the Act requires:

- A UK-wide assessment of the risks and opportunities for the UK arising from climate change. This must take place every five years; the first assessment (*UK Climate Change Risk Assessment: Government Report*) was published in January 2012.
- A programme for adaptation to climate change to address the identified risks so as to deliver resilience to climate change on the ground. This must be put in place and reviewed every five years, and must set out the UK Government's objectives, proposals and policies for responding to the risks identified in the Risk Assessment. The first *National Adaptation Programme: Making the country resilient to a changing*

climate, covering England and devolved matters, was published in 2013 and many of the actions are ongoing.

- Adaptation Reporting Powers (not applicable in Northern Ireland) which enable the Secretary of State to direct ‘reporting authorities’ to prepare climate change adaptation reports. A second round of reporting has taken place, with around 80 organisations submitting voluntary reports during 2016.

The Climate Change Act 2008 also established the Adaptation Sub-Committee of the Committee on Climate Change. Its role is to provide independent advice on the preparation of the UK Climate Change Risk Assessment, to report to Parliament on the UK Government’s progress in the implementation of the National Adaptation Programme and to provide advice to the Devolved Governments, as required.

1.2 The UK Climate Change Risk Assessment 2017 Evidence Report

To underpin both the first and second UK Climate Change Risk Assessments, the Government commissioned independent expert studies of the available evidence.

The *Evidence Report* underpinning the Government’s first report in 2012 was produced by a consortium funded by the Department for Environment, Food and Rural Affairs (Defra) and the Devolved Governments. It provided a benchmark assessment of the risks and opportunities of climate change to the UK.

The *UK Climate Change Risk Assessment 2017 Evidence Report* was commissioned from the Adaptation Sub-Committee, which was asked to address the following question:

‘Based on the latest understanding of current, and future, climate risks/opportunities, vulnerability and adaptation, what should the priorities be for the next UK National Adaptation Programme and adaptation programmes of the devolved administrations?’

In order to assess climate risks in a consistent way, and to facilitate action being focused on the most pressing risks, the Adaptation Sub-Committee took a three-step approach to assess the urgency of additional action for each climate risk and opportunity:

- considering the magnitude of the risk now and in the future
- taking into account policies and adaptation plans already in place to manage the risks
- considering the potential benefits of further action.

Figure 1 sets out the four ‘urgency categories’ used to assess each of the 56 individual climate risks and opportunities considered by the Adaptation Sub-Committee. A full description of the method for assigning urgency scores can be found in Chapter 2 of the *Evidence Report*.

Figure 1: Urgency categories used in the UK Climate Change Risk Assessment 2017 Evidence Report



Source: Committee on Climate Change (2016) *UK Climate Change Risk Assessment 2017 Synthesis Report*, www.theccc.org.uk/uk-climate-change-risk-assessment-2017/synthesis-report/

The *UK Climate Change Risk Assessment 2017 Evidence Report* also goes further than the first in considering international climate risks that could have consequences for the UK, as well as the interdependencies between the various climate risks.

The Adaptation Sub-Committee's full *Evidence Report* comprises an overarching *Synthesis Report*, which summarises the conclusions of eight technical chapters and highlights six groups of priority risks where additional action is recommended in the next five years (Figure 2). The six priority risk areas encompass most of the individual risks that are identified as needing 'more action' in the underpinning technical chapters. The full list of risks and their assigned urgency scorings is provided in Figure 3.

Figure 2: The Adaptation Sub-Committee’s assessment of the top six areas of inter-related climate change risks for the UK



Note: The individual risks that make up these six risk areas may score differently in the *Evidence Report*, but contribute to the overall urgency assessment of that group of risks. Future magnitude is based on a combination of climate change and other drivers of risk (eg demographic change), taking into account how current adaptation policies and plans across the UK are likely to reduce risks.

Source: Committee on Climate Change (2016) *UK Climate Change Risk Assessment 2017 Synthesis Report*, www.theccc.org.uk/uk-climate-change-risk-assessment-2017/synthesis-report/

Figure 3: Urgency scores for each of the 56 individual risks and opportunities identified in the UK Climate Change Risk Assessment 2017 Evidence Report

MORE ACTION NEEDED	RESEARCH PRIORITY	SUSTAIN CURRENT ACTION	WATCHING BRIEF
Ne1: Risks to species and habitats from changing climate space	Ne3: Changes in suitability of land for agriculture & forests	Ne9: Risks to agriculture, forestry, landscapes & wildlife from pests/pathogens/invasive species	Ne14: Risks & opportunities from changes in landscape character
Ne2: Opportunities from new species colonisations	Ne7: Risks to freshwater species from high water temperatures	Ne10: Extreme weather/wildfire risks to farming, forestry, wildlife & heritage	In7: Low/high riverflow risks to hydroelectric generation
Ne4: Risks to soils from increased seasonal aridity and wetness	Ne13: Ocean acidification & higher water temperature risks for marine species, fisheries and marine heritage	Ne11: Saltwater intrusion risks to aquifers, farmland & habitats	In8: Subsidence risks to buried/surface infrastructure
Ne5: Risks to natural carbon stores & carbon sequestration	In5: Risks to bridges and pipelines from high river flows/erosion	In13: Extreme heat risks to rail, road, ICT and energy infrastructure	In10: Risks to electricity generation from drought and low flows
Ne6: Risks to agriculture & wildlife from water scarcity & flooding	In11: Risks to energy, transport & ICT from high winds & lightning	In14: Benefits for infrastructure from reduced extreme cold events	PB3: Opportunities for increased outdoor activity in warmer weather
Ne8: Risks of land management practices exacerbating flood risk	In12: Risks to offshore infrastructure from storms and high waves	PB13: Risks to health from poor water quality	PB12: Risks of food-borne disease cases and outbreaks
Ne12: Risks to habitats & heritage in the coastal zone from sea level rise; loss of natural flood protection	PB2: Risks to passengers from high temperatures on public transport	PB14: Risk of household water supply interruptions	Bu4: Risks to business from reduced access to capital
In1: Risks of cascading infrastructure failures across interdependent networks	PB6: Risks to viability of coastal communities from sea level rise	Bu3: Risks to business operations from water scarcity	Bu7: Business risks /opportunities from changing demand for goods & services
In2: Risks to infrastructure from river, surface/groundwater flooding	PB7: Risks to building fabric from moisture, wind, and driving rain	Bu6: Risks to business from disruption to supply chains	It7: Opportunities from changes in international trade routes
In3: Risks to infrastructure from coastal flooding & erosion	PB8: Risks to culturally valued structures and historic environment		
In4: Risks of sewer flooding due to heavy rainfall	PB10: Risks to health from changes in air quality		
In6: Risks to transport networks from embankment failure	PB11: Risks to health from vector-borne pathogens		
In9: Risks to public water supplies from drought and low river flows	Bu2: Risks to business from loss of coastal locations & infrastructure		
PB1: Risks to public health and wellbeing from high temperatures	Bu5: Employee productivity impacts in heatwaves and from severe weather infrastructure disruption		
PB4: Potential benefits to health & wellbeing from reduced cold	It2: Imported food safety risks		
PB5: Risks to people, communities & buildings from flooding	It3: Long-term changes in global food production		
PB9: Risks to health and social care delivery from extreme weather	It5: Risks to the UK from international violent conflict		
Bu1: Risks to business sites from flooding	It6: Risks to international law and governance		
It1: Weather-related shocks to global food production and trade			
It4: Risks from climate-related international human displacement			

KEY TO CHAPTERS:
Chapter 3: Natural environment and natural assets
Chapter 4: Infrastructure
Chapter 5: People and the built environment
Chapter 6: Business and industry
Chapter 7: International dimensions

Note: Individual risks and opportunities are presented in the order they are discussed in the chapters of the Evidence Report (not in priority order).

Source: Committee on Climate Change (2016) UK Climate Change Risk Assessment 2017 Synthesis Report, www.theccc.org.uk/uk-climate-change-risk-assessment-2017/synthesis-report/

2. The UK Government's assessment of priority risks and opportunities

The Government endorses the six priority areas identified by the Adaptation Sub-Committee in the *UK Climate Change Risk Assessment 2017 Evidence Report*. We agree with the urgency scores that have been assigned to each of the areas except for some elements of the area relating to food production. In this section, we provide a summary of each risk area and the Government's general approach. Detailed responses and actions will form the subject of the next National Adaptation Programme, due to be published in 2018.

Adapting to climate change is a government-wide issue with different departments leading on different risks. Defra works across government and with other partners to fulfil the requirements of the Climate Change Act 2008. Defra also leads on providing future UK Climate Projections, an important resource used widely by government, business, local government, civil society and communities to understand how the climate may change over the rest of the century. Defra has commissioned the Met Office Hadley Centre to produce an updated set of UK Climate Projections (UKCP18) in 2018 to ensure that organisations continue to have access to the latest science to inform their adaptation planning.

The *UK Climate Change Risk Assessment 2017 Evidence Report* highlights that climate risks will affect people differently, depending on their social, economic and cultural environment. Low-income households are particularly susceptible to climate change impacts, as these impacts disproportionately affect their resources. These groups also have lower capacity and resources to adapt. Evaluation of climate risks and actions must consider these distributional effects.

*The Green Book: Appraisal and Evaluation in Central Government*² was prepared by HM Treasury to promote effective government investment and ensure it aligns with government priorities and the expectations of the public. The guidance applies to all government departments and sets out how the risks of climate change should be considered in options appraisals whenever relevant, particularly for long-term planning and infrastructure projects, regulatory and planning frameworks, contingency planning and long-term policy frameworks. The guidance also states that an assessment should take into account social and distributional impacts where they are likely to be significant for particular groups in society. *The Green Book* is currently being updated, with a revised edition due for publication in 2017.

Below we address the six priority risk areas in turn.

2 HM Treasury (2011) *The Green Book: Appraisal and Evaluation in Central Government* can be accessed at: www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf

2.1 Flooding and coastal change risks to communities, businesses and infrastructure ('more action needed')

The *UK Climate Change Risk Assessment 2017 Evidence Report* presents compelling evidence that climate change may lead to increases in heavy rainfall and significantly increased risks from fluvial and surface flooding by mid-century. Rising sea levels may further increase the risk of flooding and erosion along our coastline. The *Evidence Report* recommends more ambitious approaches to adaptation, working with communities, businesses and other partners to meet this challenge by:

- ensuring there are long-term strategies in place to address projected risks to people, communities and buildings
- delivering more natural flood management and developing a more integrated approach in high-risk catchments, especially where there are likely to be co-benefits such as carbon storage, water quality and biodiversity benefits.

The Government supports these recommendations. Managing flood risk is already a key priority for the Government, and the report's recommendations are broadly consistent with our policies to intervene and invest effectively to manage flood risk. Our strategies are most effective when government, communities, local authorities and the private sector work together to ensure that we have a shared understanding of future risks and who is best placed to manage them. Together we need to make use of the full suite of measures and target them as effectively as we can, to make it less likely that flooding will occur and to reduce the impact when it does.

Our flood risk investment programme will drive down the overall risk of flooding and coastal erosion to ensure that we will better protect over 300,000 homes from flooding by 2021. These investments are based on a well-developed national flood risk assessment and long-term investment scenario modelling developed by the Environment Agency, which already factors in climate change predictions and continually evolves to take account of new climate change evidence and risks. The long-term investment scenario modelling considers differing investment scenarios in the face of pressures such as climate change and asset deterioration and takes into account total levels of investment, not just government investment. The *UK Climate Change Risk Assessment 2017 Evidence Report* recognises that current levels of investment are consistent with an optimal investment strategy.

The *National Flood Resilience Review*³ was published in September 2016 and sets out actions to improve our readiness for flooding in the short term, to reduce the impacts and the consequent costs and disruption to communities, businesses and our economy. This includes working with infrastructure operators to improve the resilience of locally important assets at risk of flooding. The review will also inform our consideration of long-term investment needs and funding options.

3 HM Government (2016) *National Flood Resilience Review* can be accessed at: www.gov.uk/government/publications/national-flood-resilience-review

We believe the installation of property-level resilience measures (those that prevent flood water entering a property or that speed the recovery process if it does) can play an important role in making people and their property less vulnerable to the physical and mental impacts of flooding. In September 2016, we published Peter Bonfield's *Property Flood Resilience Action Plan*⁴ which was developed in collaboration with the commercial sector with Government support. The Action Plan explores barriers to the use of flood resilience measures and identifies how, collectively, business and government can facilitate better uptake of such measures for residential and commercial properties at high flood risk.

We engage with and support local authorities in their responsibilities for managing local flood risk. National planning policy on the provision of sustainable drainage systems in developments has been strengthened. The Housing and Planning Act 2016 introduces a new requirement for the Secretary of State to carry out a review of planning legislation and planning policies for sustainable drainage in relation to the development of land in England.

Incorporating natural flood management measures is key to our approach and we encourage such schemes as part of large capital projects. Natural flood management demonstration projects, including at Pickering in Yorkshire and Holnicote in Somerset, have demonstrated that these types of measures can be effective in helping to manage flood risk at a catchment scale, slowing the flow of water and reducing local impacts when carefully incorporated into a wider suite of catchment measures. In November 2016, we announced £15 million specifically for natural flood management projects in England, which will build the evidence base further.

Increasingly, we are seeking to empower and enable local communities to understand their risks and to develop catchment-based strategies. These integrate traditional, innovative and natural flood management measures to provide multiple benefits. An example of a local partnership approach is the Cumbria Flood Partnership. These types of local partnerships will be further strengthened in the context of the 25 Year Environment Plan.

Looking ahead, we will continue to develop our longer-term strategies on investment, providing local communities with the framework and tools they need to manage flood risks effectively.

2.2 Risks to health, well-being and productivity from high temperatures ('more action needed')

The *UK Climate Change Risk Assessment 2017 Evidence Report* shows that warming UK temperatures, combined with demographic change, may lead to an increased risk of overheating. It projects that the number of heat-related deaths in the UK could more than

4 P Bonfield and Defra (2016) *Property Flood Resilience Action Plan* can be accessed at: www.gov.uk/government/publications/improving-property-level-flood-resilience-bonfield-2016-action-plan

double by the 2050s from a current baseline of around 2,000 per year. The *Evidence Report* states that urgent action is needed in the next five years across a range of policy areas to address overheating in homes and public buildings and to reduce the impacts of the urban heat island effect through urban design and planning. Research is recommended into the impacts of overheating on employee productivity.

Research is also recommended into the influence of climate change on ground-level ozone and other outdoor air pollutants (especially particulates), and how climate, temperature and other factors (eg individual behaviour) affect indoor air quality.

The *Evidence Report* also notes some potential opportunities associated with higher temperatures. Outdoor activities may become more attractive, with perhaps an increase in active transport, such as cycling, and walking leading to benefits for health and well-being, as well as climate change mitigation from reductions in car use. However, these benefits need to be set against the potential for greater exposure to the risks from sunlight, ultraviolet radiation and air pollution. Warmer winters could also lead to fewer cold-related deaths, which currently account for a greater number of excess deaths than periods of very hot weather.

The Government recognises the importance of reducing the risks and impacts of overheating. Overheating is a complex issue that cuts across a number of policy areas, including health, planning, transport, energy and environment. Responsibility for different aspects of planning, commissioning and funding improvements is shared across a range of organisations. Government departments and public and private entities are working together to deliver improvements in these areas.

A number of different policies and plans will affect how risks to health, well-being and high temperatures can be managed in future. For example, Public Health England publishes the *Heatwave Plan for England* to manage risks to public health. This document is recognised in the *Evidence Report* as a key component of emergency planning that provides advice for professionals, organisations and individuals to enable them to plan for and respond to hot weather. An independent evaluation of the *Heatwave Plan* is under way. In May 2016, Public Health England also published a new poster and leaflet to support the public to stay safe in hot weather, and a checklist for identifying and managing high indoor temperatures in homes. A checklist specifically for care home staff is under development.

Looking forward, we will consider where additional policy interventions are necessary to address overheating risks as part of the National Adaptation Programme. For example, the Government is commissioning research into how overheating risks can be identified and mitigated. In the first instance, this will focus on new housing developments in England, building on work undertaken by the former Zero Carbon Hub. We will also explore whether there are better methods for understanding overheating risks in hospitals.

2.3 Risks of shortages in the public water supply, and for agriculture, energy generation and industry, with impacts on freshwater ecology ('more action needed')

The *UK Climate Change Risk Assessment 2017 Evidence Report* sets out how climate change combined with population growth may put greater pressure on water availability. By the 2050s, many catchments across the UK will need to manage water deficits and competing demands for water for public supply, industry, agriculture and the environment. The *Evidence Report* recognises that the policy framework for managing these long-term risks exists. It recommends continued action in the next five years that is flexible enough to take account of the high degree of uncertainty about future projections of seasonal rainfall and therefore the frequency and intensity of water shortages and drought.

The Government is committed to more action on these risks and recently published *Creating a great place for living: Enabling resilience in the water sector*,⁵ a roadmap setting out how we will enhance our policy framework to secure the long-term resilience of the water sector. The roadmap covers a wide range of areas, including the long-term challenge to the public water supply and other water users from the greater extremes in weather that are expected.

We have also issued guidance to water companies that their next round of water resource management plans should take a long-term, strategic approach to protecting and enhancing resilient water supplies. Water companies are required to embed climate change impacts as well as population and economic growth in their long-term plans, so as to ensure that they are fully able to meet future water demand/supply balances. As a result, there is already a well-recognised need for future investment in both demand-side and supply-side measures to mitigate the risks from climate change. In turn, these actions will help create a freshwater environment capable of supporting the biodiversity it contains and the ecosystem services it provides.

We are aware that the current water abstraction system (set up in the 1960s) is not flexible or modern enough to respond to pressures on the environment, farm and other business requirements, and the needs of our public water supply. We are therefore committed to reform the system by the early 2020s to create a better, fairer, more modern and flexible approach that will support business resilience, investment and growth, and manage the pressures of a growing population and climate change.

Reform includes many elements that will lead to better protection of the environment and that will be adaptive over time. For example:

- we will ensure that all abstractors are proportionately controlled at low flows to protect the environment, while recognising essential water users

5 Defra (2016) *Creating a great place for living: Enabling resilience in the water sector* can be accessed at: www.gov.uk/government/uploads/system/uploads/attachment_data/file/504681/resilience-water-sector.pdf

- all abstraction conditions on permits will be reviewable when there is evidence of environmental risk being caused by abstraction.

2.4 Risks to natural capital, including terrestrial, coastal, marine and freshwater ecosystems, soils and biodiversity ('more action needed')

The *UK Climate Change Risk Assessment 2017 Evidence Report* identifies significant threats to our natural capital and the goods and services it provides, from timber, food and clean water to pollination, carbon storage and the cultural benefits of landscapes and wildlife. The *Evidence Report* shows that direct impacts on the distribution of UK biodiversity and the composition of terrestrial, coastal, marine and freshwater ecosystems are already being observed. There is clear evidence of northwards shifts in species distributions and the timing of seasonal events due to climate change.

The *Evidence Report* highlights important links between climate change impacts on natural capital and the other risk areas. For example, the natural environment plays an integral role in the quality and availability of our water and on the magnitude of flood events. It provides the backdrop to the movement of pests and diseases, and can play a role in addressing overheating through urban trees and green spaces.

The report also identifies potential opportunities for agriculture and forestry in the form of extended growing seasons, increased productivity and new crop varieties that would have potential benefits for domestic food production. In order for these opportunities to be realised, however, action is needed to manage the negative impacts from reduced soil quality and water availability and the increase in flooding and pests and diseases.

The *Evidence Report* concludes that, while good progress is being made, strengthened action is needed over the next five years to reduce existing pressures on the environment. More flexible and integrated approaches to managing natural capital need to be adopted and priority research undertaken into the changing suitability of land for different uses and the climate risks to marine ecosystems.

The Government supports the *Evidence Report's* conclusions. Various policies are already in place to address climate risks to natural capital. For example, increased efforts to restore the hydrology of wetland habitats are under way as part of Countryside Stewardship, and the Forestry Commission is working to protect, improve and expand woodlands on the Public Forest Estate. We also note potential areas for improvement, for example better use of policy levers such as the successor to the EU Common Agricultural Policy.

The Government recognises that reducing other pressures is a priority for increasing the resilience of our natural capital to climate change. We have already made good progress in restoring Sites of Special Scientific Interest to 'favourable' or 'recovering' condition, in making land available for the creation of priority habitat and in establishing Marine Protected Areas. Alongside reducing pressures, we also recognise the other clear message of the report – that we need to accommodate change, such as through coastal

realignment and ensuring sufficiently good habitat condition and connectivity to allow species to migrate with the climate.

Following the decision to leave the EU, we are undertaking a fundamental review of our whole environmental policy framework. This will support our 25 Year Environment Plan, which will have natural capital considerations at its heart and will be informed by the findings of the *UK Climate Change Risk Assessment 2017*. It will also be informed by the work of the Natural Capital Committee, which is working closely with the Adaptation Sub-Committee.

2.5 Risks to domestic and international food production and trade ('more action needed')

The *UK Climate Change Risk Assessment 2017 Evidence Report* sets out how extreme weather can affect international food production, trade and supply chains. Longer-term incremental changes in climate will affect agricultural productivity in regions that are important for food production. At the same time, climate change will present risks and opportunities for domestic production, with the resilience of UK food systems dependent on the stewardship of natural resources including soils and responses to international markets. The *Evidence Report* concludes that there is a need for policy intervention over the next five years to manage the potential impacts of these risks on food prices in the UK.

The Government recognises that climate change will present significant risks to the availability and supply of food in the UK. Food supply has been identified as one of the 13 UK Critical National Infrastructure sectors and we work closely with industry to ensure the security and resilience of supply. The resilience of food supply chains is regularly tested by severe weather and other events, and consistently performs well. The *Evidence Report's* recommendation that new policy is needed to manage risks to UK food prices therefore does not align with the findings from our own research, including that carried out for the UK Food Security Assessment in 2009 and reviewed in 2012. The Government takes a more optimistic view of the levels of resilience that are achieved through functioning markets and diverse sources of supply.

The Government recognises that UK food security is built on access to a wide variety of markets, including through a rules-based world trading system operating alongside food production in the UK. When the UK held the chair of the G20 Agricultural Markets Information Systems (AMIS) in 2014/15, we agreed a protocol with key partner countries to improve the response to price spikes. We will continue to support this initiative by improving transparency and accountability and introducing robust evaluation of the protocol.

We agree with the Adaptation Sub-Committee that food production and security is a clear research priority. The Government has already carried out research into the risks to food supply from extreme weather events, including the potential impacts of tidal flooding on supply chains through seaports and the energy dependency of food chains. Looking forward, Research Council funding, together with our Centres for Agricultural Innovation,

will help to improve understanding of the risks to the resilience of our food system. We will be reviewing the UK Food Security Assessment during the course of this Parliament, and are currently scoping the priority areas on which to concentrate.

2.6 New and emerging pests and diseases, and invasive non-native species, affecting people, plants and animals ('research priority')

The *UK Climate Change Risk Assessment 2017 Evidence Report* describes how new and emerging pests and diseases – including invasive non-native species – have the potential to cause severe impacts on people, animals and plants. It concludes that there is an urgent need for research in the next five years to improve our understanding of how climate change will affect the threat of pests and diseases and the best approaches to monitor, detect and manage outbreaks and develop resilience to disease (eg through developing new crop varieties and breeding techniques). It finds that the evidence is not yet clear as to what extent surveillance is effective in identifying risks, or whether resources are prioritised towards those vectors and pathogens that pose the biggest challenge in the changing climate. Research is also needed to improve the evidence about the impact of endemic diseases in a changing environment.

The Government supports the conclusions of the *Evidence Report* and is already undertaking investigations into the impacts of climate change on plant health and the potential for climate change to increase the risk from pests. This work will lead to improvements in our risk assessments to ensure that we target the pests and diseases that pose the greatest risks. The UK Plant Health Risk Register, accessible through the new UK Plant Health Information Portal,⁶ compares risks posed by different plant pests and pathogens and prioritises actions. We carry out collaborative horizon-scanning and information-sharing activities with international organisations, such as the European and Mediterranean Plant Protection Organisation, to provide early warning of new pest threats.

The UK has a proven system in place for monitoring international disease threats to human and animal health. As an example, Public Health England undertakes invasive mosquito surveillance with 30 seaports and airports and at key goods importers and motorway service stations leading away from ports of entry in south-east England. We work collaboratively with industry to assess and manage pest risk, as demonstrated by our work on Bluetongue disease and the Schmallenberg virus. We also produce an international forward look to improve forecasting of outbreaks by seeking to identify links between meteorological data and geophysical impacts, and public and animal health threats.

Horizon-scanning is also carried out for new invasive non-native species likely to pose a significant risk if they arrive in the UK. These threats are formal assessments using a comprehensive risk framework that takes climate change into account.

6 The UK Plant Health Information Portal can be accessed at: <https://planthealthportal.defra.gov.uk/>

3. Assessment of priority risks and opportunities for the Devolved Governments

The risks and opportunities from climate change will vary across the UK because of geography and the policy frameworks that exist in the different countries. In addition to summarising the priorities for the UK, the *UK Climate Change Risk Assessment 2017 Evidence Report* identifies the priorities for each of the countries in the UK in separate national summaries.⁷ These are based on the UK-wide assessment, but take account of the particular risks to each country and where urgent action is required. In this section, we describe the risks that are considered priorities for Scotland, Wales and Northern Ireland and the general approach being taken by the Devolved Governments to manage these.

3.1 Scotland

The Scottish Government will use and build on the assessment of the key areas of risk set out in the *UK Climate Change Risk Assessment 2017 Evidence Report* national summary for Scotland as it moves forward with implementing its Adaptation Programme. In most risk areas, the assessment for Scotland reflects similar issues elsewhere in the UK. Particular Scottish issues include:

Risk to species and habitats from the changing climate	More action needed
Risks to soils and natural carbon stores	
Risks to people, communities and buildings from flooding	Research priority
Risks to coastal areas from sea-level rise combined with extreme weather	
Risks to marine species from ocean changes	
Risks to health and well-being	

Scotland has its own climate change legislation: the Climate Change (Scotland) Act 2009. Scotland's *Climate Change Adaptation Framework* (2009) was replaced by Scotland's first statutory Adaptation Programme in May 2014 (*Climate Ready Scotland: Scottish Climate Change Adaptation Programme*). Two annual reports on the Adaptation Programme were published by the Scottish Government in May 2015 and May 2016. The *UK Climate Change Risk Assessment 2017 Evidence Report* national summary for Scotland was published in July 2016 and the first independent assessment of progress under

⁷ The *UK Climate Change Risk Assessment 2017 Evidence Report* national summaries can be accessed at: www.theccc.org.uk/uk-climate-change-risk-assessment-2017/national-summaries/

Scotland's Adaptation Programme,⁸ commissioned by the Scottish Government under the 2009 Act, was published by the Adaptation Sub-Committee in September 2016.

The Scottish Government has been developing and improving its adaptation response, for example with new indicators and reporting duties on public bodies and the new National Centre for Resilience. The Scottish Government will continue to develop its approach based on the evidence, advice and recommendations of the Adaptation Sub-Committee, both in the next annual report on the Scottish Climate Change Adaptation Programme (to be published in May 2017) and the next Adaptation Programme (to be published in 2019).

3.2 Wales

The Welsh Government endorses the conclusions of the *UK Climate Change Risk Assessment 2017 Evidence Report* national summary for Wales. Some 49 risks and opportunities have been identified, with the most important risks to Wales summarised as follows:

Risks to infrastructure (from all sources of flooding)	More action needed
Risk to public water supplies from drought and low flows	
Risks from 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 priority
Risks to infrastructure, business and buildings from high river flows, erosion and extreme weather	
Risks and opportunities from changes to agriculture and forestry productivity	
Risks to people's health and well-being and associated service delivery from high temperatures, flooding and extreme weather	

The Welsh Government's actions on climate change adaptation are described in the *Climate Change Strategy for Wales: Adaptation Delivery Plan* (2010). The actions in this plan will be reviewed in light of the new evidence, with a view to publishing a new delivery plan in 2018. The Welsh Government will work with the UK and other Devolved Governments where there is common interest, and will be engaging the academic community for support in addressing research priorities.

8 *Scottish Climate Change Adaptation Programme: An independent assessment* can be accessed at: www.theccc.org.uk/publication/scottish-climate-change-adaptation-programme-an-independent-assessment-for-the-scottish-parliament/

At a local level, there are statutory requirements under the Well-being of Future Generations (Wales) Act 2015 for Public Services Boards in Wales to reference the UK Climate Change Risk Assessment when assessing well-being in their area.

3.3 Northern Ireland

Due to geographical differences and variation in the projected changes to the Northern Ireland climate, the priority risks identified in the *UK Climate Change Risk Assessment 2017 Evidence Report* national summary for Northern Ireland are not all the same as those identified for the UK more generally.

The national summary for Northern Ireland identifies a number of areas where stronger action and further research are needed in the next five years, and these are summarised below. These findings and recommendations and the categorisation of the risks have been adopted by executive departments as a basis for adaptation planning. There are no areas of dispute or issues within the summary that are contentious.

Risks to soils, farming, natural carbon stores, species and coastal habitats	More action needed
Flooding risk to (interdependent) infrastructure (sewers, transport networks)	
Potential benefits to people from reduced cold	
Risks to international food production and trade	
Changes in agricultural and forestry productivity and land suitability and impacts on freshwater and marine ecosystems	Research priority
Risks to infrastructure services from coastal flooding and erosion	
Risks to people from high temperatures, changes in air quality, health and social care delivery and vector-borne pathogens	
Risks to communities and businesses from flooding	
Risks to business from reduced employee productivity due to infrastructure disruption and higher temperatures	
Risks to historic environment and buildings	
Risks and opportunities in global food production	

Detailed responses and actions to the findings and recommendations in the Northern Ireland summary will contribute to the development of the second Northern Ireland Climate Change Adaptation Programme, to be published in 2019.

4. Next steps

The first National Adaptation Programme, published in 2013, sets out over 370 actions for the UK Government, businesses, councils, civil society and academia to address the findings of the first *UK Climate Change Risk Assessment: Government Report* and to build the nation's resilience to climate change. The most recent review of the National Adaptation Programme⁹ by the Adaptation Sub-Committee in 2015 found that 109 of the actions have been completed and 215 are on track. We continue to monitor progress and the Adaptation Sub-Committee will issue its next report on progress in summer 2017.

Adaptation to climate change is an integral part of policy across all levels of the UK Government. Defra has its own significant interest, tackling some of the highest priority risks such as those relating to flooding, water security, food production, environment and biodiversity. Other departments, such as the Department for Communities and Local Government, the Department for Business, Energy and Industrial Strategy and the Department of Health, are working together to address risks to health, well-being and productivity due to increasing temperatures.

The second National Adaptation Programme will respond to the risks set out in this *UK Climate Change Risk Assessment* and is due to be published in 2018. In developing the programme, we will continue to work with business and industry, identifying where UK Government action can support their resilience and how they themselves can take adaptation forwards.

9 Committee on Climate Change (2015) *Progress in preparing for climate change: 2015 Report to Parliament* can be accessed at: www.theccc.org.uk/wp-content/uploads/2015/06/6.736_CCC_ASC_Adaptation-Progress-Report_2015_FINAL_WEB_070715_RFS.pdf

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