



HM Government

UK Climate Change Risk Assessment 2022

17 January 2022



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Executive summary

Climate change is happening now. It is one of the biggest challenges of our generation and has already begun to cause irreversible damage to our planet and way of life. We have clear evidence demonstrating the pace of warming in recent decades and the impacts we will face should this continue. As we redouble our efforts to achieve net zero, we must also continue to raise ambitions on adaptation to ensure the UK is resilient to the challenges of a warming world.

The extent of climate change will depend on our success in controlling global emissions over the coming decades. The average surface temperature in the UK has risen by 1.2°C since pre-industrial times, and further warming is predicted under all decarbonisation pathways set out by the Intergovernmental Panel on Climate Change¹. While we aim to limit warming to 1.5°C, the evidence shows that we must be prepared for warming up to 4°C.

As required by the Climate Change Act 2008, the UK government has undertaken the third five-year assessment of the risks of climate change on the UK, working closely with the Climate Change Committee (CCC). This has presented strong evidence that even under low warming scenarios the UK will be subject to a range of significant and costly impacts unless significant further action is taken now. Full details of the risk assessment are contained in [a series of reports published by the CCC](#) which are fully endorsed by both the UK government and devolved administrations.

The Technical Report for the third Climate Change Risk Assessment (CCRA3) identifies sixty-one climate risks cutting across multiple sectors of our society. It identifies a wide range of potential costly impacts of climate change including on health and productivity, affecting many of our households, businesses and public services. Impacts range from a deterioration in soil health and agricultural productivity to impacts on water availability and thereby our alternative energy supply. For example, unless we take further action, under a 2°C by 2100 warming scenario annual damages from flooding for non-residential properties across the UK is expected to increase by 27% by 2050 and 40% by 2080. At 4°C this increases to 44% and 75% respectively².

¹ Intergovernmental Panel on Climate Change Sixth Assessment Report Working Group I
https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf

² Technical Report for the CCRA3 <https://www.ukclimaterisk.org/independent-assessment-ccra3/technical-report/>

The Valuation Report for the CCRA3 estimates that, for eight of the risks identified by the CCC, economic damages by 2050 under 2°C could exceed £1 billion p.a. For thirty-six of the risks, damages could be at least £10 million p.a. Other sources of evidence suggest that, by 2045, the cost of climate change to the UK could be at least 1% of GDP³. The Technical Report also shows that in the majority of risk areas we need to take more action, and there are many actions we can take to improve resilience that would be good value for money, including many low cost ‘low regret actions’. The evidence shows that we must do more to build climate change into any decisions that have long-term effects, such as in new housing or infrastructure, to avoid often costly remedial actions in the future. And we must consider low probability but high impact events arising from, for example, high warming scenarios and interdependent or cascading risks.

The UK government and devolved administrations fully recognise the scale of the challenge of adapting to climate change, as set out in the CCRA3 and its underlying reports. We have made some progress as the CCC notes, but we must go much further and faster to truly prepare for the impacts of a warmer world. The UK government is committed to developing a third National Adaptation Programme (NAP3) for England which will set out how we will meet that challenge. Climate change is a devolved matter within the UK and as such the devolved administrations are committed to developing equivalent programmes for Northern Ireland, Scotland and Wales. The remainder of this report sets out the UK government’s third CCRA as well as some detail on current actions and plans to respond to the eight priority areas for action over the next two years, identified by the CCC at our request. This demonstrates that we recognise the risks due to climate change and are on the beginning of the journey to respond to those risks. The UK government and devolved administrations will set out further action in NAP3 and equivalent devolved adaptation programmes.

The UK government recognises there are many barriers to effective adaptation that we must overcome. These include limitations in information and awareness of climate risk, lack of clarity on ownership of risks and responses, and the complexity of adapting for a future which contains innate uncertainty. We recognise that government leadership is often required to ensure solutions are applied across the whole system and to avoid maladaptation of individual assets.

The UK government and devolved administrations accept we must mainstream adaptation throughout government policy in a much more holistic way. This will include accounting for the synergies between adaptation and mitigation. To achieve net zero, we must integrate adaptation action into mitigation efforts. Successful mitigation will in turn ensure adaptation remains achievable. This includes the need to ensure our increasingly electrified power system, nature-based solutions and other low carbon infrastructure are resilient to future climate impacts.

This CCRA3 also highlights the international nature of many climate risks which can cause cascading effects across borders and sectors with significant impacts on the UK. The UK government is building on the discussions and key messages from COP26, wherein adaptation was a focal point championed by the UK Presidency as a core priority. We will continue learning from others about how to adapt, while also building capacity and sharing

³ COACCH (2020). Macro-economic costs of climate change. CO-designing the Assessment of Climate CHange costs. <https://www.coacch.eu/>

knowledge as we progress towards our 'Global' goal of investing \$100bn in climate finance by 2023.

The UK government is also considering the approach to the fourth Climate Change Risk Assessment, with the aim to scale up the level of ambition compared to previous CCRA's. Our aim is to provide an enhanced spatial perspective to risk assessment that will provide better support to action at a local level, where this is appropriate.

The UK's Third Climate Change Risk Assessment

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 current and predicted impacts of climate change.

This third UK Climate Change Risk Assessment (CCRA3) report to Parliament outlines the UK government and devolved administrations' position on the key climate change risks and opportunities that the UK faces today. This is based on [the Independent Assessment of UK Climate Risk](#), the statutory advice provided by the Climate Change Committee (CCC), commissioned by the UK government and devolved administrations.

Legislative framework on climate change

The UK [Climate Change Act 2008](#) provides a legally binding framework to cut UK greenhouse gas emissions and build the UK's ability to adapt to a changing climate. Responsibility for climate change adaptation is split between the four countries of the United Kingdom. National governments in Northern Ireland, Wales and Scotland are responsible for their own respective adaptation programmes. In the case of Scotland, there is a devolved statutory framework on adaptation set out through the Climate Change (Scotland) Act 2009. The UK government is responsible for climate change adaptation in England and for policy areas for which it has UK-wide competence such as security and foreign affairs.

The UK Climate Change Act established:

- The CCC itself, whose role on adaptation is to provide independent advice to the UK government and devolved administrations on the risks and opportunities faced from climate change. This includes a biannual appraisal of the UK government's National Adaptation Programme implementation through a report to Parliament, alongside advice to all governments on a 5-yearly basis.
- A UK-wide Climate Change Risk Assessment (CCRA) which must be undertaken by the UK government and devolved administrations every five years: [the first CCRA](#) was published in 2012 and [the second CCRA](#) in 2017.
- A programme for adaptation to climate change every five years to address risks and to deliver resilience to climate change on the ground, delivered by the UK government. This National Adaptation Programme (NAP), which covers England and reserved matters, must set out the UK government's objectives, proposals and

policies for responding to the risks identified in the CCRA. In the past decade two such programmes have been published. In response to the first CCRA, [the first NAP](#) was published in 2013, and similarly [the second, current NAP](#) was published in 2018. This continues to be valid until publication of the third NAP in 2023, in response to CCRA3. Northern Ireland, Wales and Scotland develop their own respective adaptation programmes.

- The 'Adaptation Reporting Power' (ARP) which gives the UK and Welsh governments the discretionary power to require relevant bodies to report on their climate preparedness. A third round has just been completed at the end of 2021 with voluntary contributions from over 90 organisations.
- A review of UK government progress in adapting to climate change must be undertaken every two years by the CCC. The most recent report on [Progress in Adapting to Climate Change](#) was published in 2021⁴, which the UK government [recently responded to](#).

The Third Climate Change Risk Assessment

To fulfil the UK government's statutory requirements, we and the devolved administrations commissioned the CCC to deliver a risk assessment. This was an extensive evidence-driven exercise undertaken over the five-year statutory reporting cycle engaging with government officials and external experts across climate risk areas. The CCC's Independent Assessment of UK Climate Risk was delivered in summer 2021 in the form of:

- [The Technical Report](#) which covers underlying analysis and assessment of the level of risk or opportunity across seven technical chapters, considering climate risks to the natural environment, infrastructure, human health, the built environment, business and international. The report contains latest understanding of current and future climate change in the UK, and the CCRA methodology.
- [The Advice Report](#) which summarises the UK-wide conclusions of the Technical Report and highlights eight priority risk groups where additional action is recommended in the next two years (Table 1).
- [National Summaries](#) which consider the particular risks and opportunities that England, Northern Ireland, Scotland and Wales face from climate change. These reports will form the key evidence base for the devolved administrations' future adaptation planning.
- [Sector Briefings](#) which summarise how different sectors have been assessed for the Independent Assessment and what actions would be beneficial in the next five years in a manner most useful to stakeholders within the relevant areas.

Risks and opportunities to the UK from climate change

The Technical Report for the CCRA3 identifies sixty-one UK-wide climate risks and opportunities cutting across multiple sectors of the economy. For each risk and opportunity, an assessment of the urgency of further action has been conducted, considering three questions, in the context of a 2°C and 4°C global warming scenario:

⁴ Climate Change Committee's 2021 Report to Parliament - Progress in adapting to climate change <https://www.theccc.org.uk/publication/2021-progress-report-to-parliament/>

1. What is the current and future level of risk or opportunity? This was developed alongside [a valuation report](#) which seeks to estimate in monetary terms the societal costs and benefits of each risk and opportunity.
2. Is the risk or opportunity being managed, taking account of government action and other adaptation?
3. Are there benefits of further action in the next five years, over and above what is already planned?

Based on these considerations, each of the sixty-one risks or opportunities have been ranked by expected impact and assigned an urgency score in four categories. The risk assessment concludes that thirty-four of sixty-one risks are ranked as '*more action needed*', meaning that new stronger or different government action is required in the next five years over and above those already planned. Of these, eight are considered as of 'very high' impact by 2050s, ten, by 2080s on a 2°C warming pathway, and 12 by 2080s on 4°C scenario. For seven of sixty-one risks, further action is not recommended – see Tables below.

The analysis set out below is at a UK-wide level. However, it should be noted that the CCC's assessments of risk urgencies and magnitudes vary somewhat across the United Kingdom, and nation-specific scorings can be found in the relevant National Summary reports (see link above).

The evidence indicates that the *costs of climate change to the UK are high and increasing*. For eight of the sixty-one climate risks, UK-wide economic damages by 2050 under 2°C are estimated to exceed £1 billion p.a. (up to 15-20 risks if we assume a higher warming scenario). The number of risks that fall into this 'very high' damage category has risen since a similar assessment in CCRA1 a decade ago, which found only three risks this large. For thirty-six of the risks, UK-wide damages will be at least £10 million p.a. The 'very high' damage risk areas include risks to natural carbon stores and carbon sequestration due to the high costs of climate change; risks to infrastructure networks (water, energy, transport, ICT) from climate hazards which cause cascading failures across sectors, risks to health and wellbeing from high temperatures particularly amongst the vulnerable; risks to productivity due to overheating in places of work; risks from flooding; risks to financial markets, and risks associated with climate change overseas.

The risk assessment also includes a review of costs and benefits of adaptation policies. A conclusion is that many *early adaptation investments are highly effective and deliver high value for money with benefit-cost ratios typically range from 2:1 to 10:1* – i.e., every £1 invested in adaptation could result in £2 to £10 in net economic benefits. This includes investments in heatwave alerts and plans, surveillance and monitoring for pests and diseases, early warning systems, climate smart agriculture, climate resilient infrastructure, and upland peatland restoration. Adaptation also often leads to important co-benefits, so as well as reducing potential losses from climate change, it often generates direct economic gains, or leads to social or environmental benefits.

Some key high-level messages emerge from an economic perspective on adaptation:

Even if the Paris Goals are achieved, large economic costs of climate change in the UK over the next 20 years can only be reduced with adaptation: Recent international modelling work estimates the economic costs to the UK could be from 1 to 1.5% of GDP/year by 2045 (central estimate). The benefits of the Paris Agreement (and net zero) are only really seen after 2040 in avoiding high warming pathways with large economic costs after mid-century.

A small shift in the average climate can lead to major changes in extreme events: A small change in the average climate can drive unprecedented weather events, because it shifts the distribution. For example, what used to be a 1-in-100-year flood event can become a 1-in-10-year event. A further example is heat, where the small average change in the climate experienced to date is already driving the probability of extremely hot summers. Unprecedented weather and climate related events can lead to high economic costs, including indirect and macroeconomic costs which can be larger than the direct damage. Modelling of what could happen if a major flood hit London demonstrates this further⁵.

There is a strong case for acting now – not later – especially in three key areas: First, the UK already experiences large economic costs from climate extremes, and these are growing. There are therefore large net economic benefits today from reducing these with low- and no-regret actions, which have high benefit to cost ratios. Second, there are areas where, if action is not taken now, we commit (lock-in) to large future impacts. This is particularly the case in areas that involve decisions or investment that are very difficult to reverse, for example with new housing and infrastructure. Finally, there are some extremely low-cost preparatory actions that can be taken to improve future decisions⁶. This involves developing adaptive management plans, especially for decisions that have long lead times or involve major future change in the future that is uncertain.

Climate change will also present some opportunities for the UK – there is a role for government to help fully realise these: This includes some areas of trade, where the UK may gain a comparative advantage, either because the climate becomes more suitable in the UK, or because climate change impacts are greater in competitor countries. These include, for example, tourism and some agricultural exports. These opportunities can help strengthen the case for political engagement in adaptation but will only be fully realised with the right enabling environment.

The economic magnitude of each risk has been assessed for both a 2°C and 4°C warming scenario. The following are the UK-wide magnitude categories where the cost of damage (economic) or forgone opportunities are represented in ranges to reflect the uncertainty in the evidence base:

- Very High (VH) is over £1 billion per annum.
- High (H) is over £ hundreds of millions per annum
- Medium (M) is over £ tens of millions per annum

⁵ Crawford-Brown, D., Syddall, M., Guan, D., Hall, J., Li, J., Jenkins, K. and Beaven, R. (2013) Vulnerability of London's economy to climate change: Sensitivity to production loss. *Journal of Environmental Protection*, 4, 548-563.

⁶ Green Book Supplementary Guidance: Accounting for the Effects of Climate Change 2020 <https://www.gov.uk/government/publications/green-book-supplementary-guidance-environment>

- Low (L) is less than £ ten million per annum

Table 1: ‘More action needed’ risks and opportunities

Based on the urgency scoring exercise, the following thirty-four risks are assessed as ‘more action needed’ at a UK-wide level. This means that new stronger or different government action is required in the next five years over and above those already planned.

Potential costs and damages are denoted with a negative sign e.g. - VH while possible opportunities are denoted with a positive sign e.g., +VH. Where uncertainty exists over the category, the range has been indicated e.g. – L to – VH. For some of the risks and opportunities, there are both potential costs and benefits.

Risk or opportunity	2050s, 2/4°C	2080s, 2°C	2080s, 4°C
N1 Risks to terrestrial species and habitats from changing climatic conditions and extreme events, including temperature change, water scarcity, wildfire, flooding, wind, and altered hydrology	Not known	Not known	Not known
N2 Risks to terrestrial species and habitats from pests, pathogens and invasive species	Not known	Not known	Not known
N4 Risk to soils from changing climatic conditions, including seasonal aridity and wetness	- H	- H	- H
N5 Risks and opportunities for natural carbon stores, carbon sequestration and GHG emissions from changing climatic conditions, including temperature change and water scarcity	- VH	- VH	- VH
N6a Risks to and opportunities for forestry productivity from extreme events and changing climatic conditions (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind and saline intrusion).	- L to - H	- L to - H	- L to - H
N6b Risks to and opportunities for agricultural productivity from extreme events and changing climatic conditions (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind and saline intrusion).	- H + H	- VH + VH	- VH + VH
N7 Risks to agriculture from pests, pathogens and invasive species	- M	- H	- H
N8 Risks to forestry from pests, pathogens and invasive species	- M	- M	- H

N11 Risks to freshwater species and habitats from changing climatic conditions and extreme events, including higher water temperatures, flooding, water scarcity and phenological shifts	- H	- H	- H to - VH
N12 Risks to freshwater species and habitats from pests, pathogens and invasive species	- L	- L	- M
N14 Risks to marine species, habitats and fisheries from changing climatic conditions, including ocean acidification and higher water temperatures	- M	- M	- H
N16 Risks to marine species and habitats from pests, pathogens and invasive species	- M	- M	- M
N17 Risks and opportunities to coastal species and habitats due to coastal flooding, erosion and climate factors	- M	- M	- M
I1 Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	- VH	- VH	- VH
I2 Risks to infrastructure services from river, surface water and groundwater flooding	- H to - VH	- H to - VH	- VH
I5 Risks to transport networks from slope and embankment failure	- M to - H	- M to - H	- H
I8 Risks to public water supplies from reduced water availability	- H	- H	- H
I12 Risks to transport from high and low temperatures, high winds, lightning	- M to - H	- M to - H	- M to - H
H1 Risks to health and wellbeing from high temperatures	- VH	- VH	- VH
H3a Risks to people, communities and buildings from river and surface flooding	- VH	- VH	- VH
H3b Risks to people, communities and buildings from coastal flooding	- H	- H	- H
H4 Risks to people, communities and buildings from sea level rise	- L	- L	- M
H6a Risks and opportunities from winter household energy demand	+ VH	+ VH	+ VH
H6b Risks and opportunities from summer household energy demand	- H	- VH	- VH
H8 Risks to health from vector-borne diseases	- L to - M	- M	- M
H11 Risks to cultural heritage	Not known	Not known	Not known
H12 Risks to health and social care delivery	Not known	Not known	Not known

H13 Risks to education and prison services	Not known		Not known		Not known	
B1 Risks to business sites from flooding	- VH		- VH		- VH	
B2 Risks to business locations and infrastructure from coastal change from erosion, flooding and extreme weather events	- M		- M		- M	
B6 Risks to business from disruption to supply chains and distribution networks	Not known		Not known		Not known	
ID1 Risks to UK food availability, safety, and quality from climate change overseas	- VH	+ VH	- VH	+ VH	- VH	+ VH
ID4 Risks to the UK from international violent conflict resulting from climate change on the UK	- M		- M		- H	
ID5 Risks to international law and governance from climate change overseas that will impact the UK	Not known		Not known		Not known	
ID7 Risks from climate change on international trade routes	- M		- H		- VH	
ID9 Risk to UK public health from climate change overseas	- L		- M		- M	
ID10 Risk multiplication from the interactions and cascades of named risks across systems and geographies	Not known		Not known		Not known	

Table 2: ‘Further investigation’ risks and opportunities

Twenty risks are assessed as requiring ‘further investigation’ at the UK-wide level. This means more evidence is urgently needed to fill significant gaps or reduce the uncertainty in the current level of understanding in order to assess the need for additional action.

Risk or opportunity	2050s, 2/4°C	2080s 2°C	2080s 4°C
N3 Opportunities from new species colonisations in terrestrial habitats	Not known	Not known	Not known
N9 Opportunities for agricultural and forestry productivity from new/alternative species becoming suitable	+ H	+ H	+ VH
N10 Risks to aquifers and agricultural land from sea level rise, saltwater intrusion	Not known	Not known	Not known
N15 Opportunities to marine species, habitats and fisheries from changing climatic conditions	Not known	Not known	Not known

N18 Risks and opportunities from climate change to landscape character	Not known		Not known		Not known	
I3 Risks to infrastructure services from coastal flooding and erosion	- M		- M		- M	
I4 Risks to bridges and pipelines from flooding and erosion	- M		- M		- M	
I6 Risks to hydroelectric generation from low or high river flows	- M	+ M	- M	+ M	- M	+ M
I7 Risks to subterranean and surface infrastructure from subsidence	- M		- M		- M	
I9 Risks to energy generation from reduced water availability	Not known		Not known		Not known	
I10 Risks to energy from high and low temperatures, high winds, lightning	- H to - VH	+ H to + VH	- H to - VH	+ H to + VH	- H to - VH	+ H to + VH
I13 Risks to digital from high and low temperatures, high winds, lightning	- M		- M		- H	
H2 Opportunities for health and wellbeing from higher temperatures	+ VH		+ VH		+ VH	
H5 Risks to building fabric	- H		- VH		- VH	
H7a Risks to health and wellbeing from changes in air pollution	- L		- L		- L	
H7b Risks to health and wellbeing from changes in aeroallergens	Not known		Not known		Not known	
H9 Risks to food safety and food security	- L		- L		- L	
H10a Risks to health from water quality	- H		- H		- H	
H10b Risks to health from household water supply	Not known		Not known		Not known	
B3 Risks to businesses from water scarcity	- H		- H		- H	
B5 Risks to business from reduced employee productivity due to infrastructure disruption and higher temperatures in working environments	- M		- M		- H to - VH	
B7 Opportunities for business from changes in demand for goods and services	+ VH		+ VH		+ VH	

Table 3: ‘Sustain current action’ risks and opportunities

The following four risks were assessed as ‘sustain current action’ at the UK-wide level. This means that current or planned levels of activity are appropriate, but continued implementation of these policies or plans is needed to ensure that the risk or opportunity continues to be managed in the future.

Risk or opportunity	2050s, 2/4°C		2080s 2°C		2080s 4°C	
N13 Opportunities to freshwater species and habitats from new species colonisations	+ L		+ L		+ M	
I11 Risks to offshore infrastructure from storms and high waves	- H to - VH	+ H to + VH	- H to - VH	+ H to + VH	- H to - VH	+ H to + VH
B4 Risks to finance, investment and insurance including access to capital for businesses	- VH		- VH		- VH	
ID8 Risk to the UK finance sector from climate change overseas	- VH		- VH		- VH	

Table 4: ‘Watching brief’ risks and opportunities

Finally, three risks were assessed as ‘watching brief’ at the UK-wide level. This means that the evidence in these areas should be kept under review, with continuous monitoring of risk levels and adaptation activity (or the potential for opportunities and adaptation) so that further action can be taken if necessary.

Risk or opportunity	2050s, 2/4°C	2080s 2°C	2080s 4°C
ID2 Opportunities for UK food availability and exports from climate impacts overseas	+ H	+ H	+ H
ID3 Risks and opportunities to the UK from climate-related international human mobility	- L	- L	- L
ID6 Opportunities from climate change (including arctic ice melt) on international trade routes	+ M	+ H	+ VH

Priority risk areas requiring urgent action

Given the scale of the adaptation challenge, in order to focus our efforts, the UK government asked the CCC to identify priority areas for action in the next two years, in advance of the next NAP. These eight priority risk areas are of growing importance across the UK and have identifiable opportunities to act in the next two years. Table 6 provides a summary.

Table 6: Eight priority risk areas that require the most urgent UK-wide action over the next two years. The magnitude in risk over time has been assessed for the highest scenario assessed in the Technical Report for the relevant risks for that theme.

Priority Risk Area	Magnitude of Risk	Key policy areas
Risks to the viability and diversity of terrestrial and freshwater habitats and species from multiple hazards.	High	Biodiversity Soil and water protection and restoration Environmental land management Sustainable farming and forestry Net Zero Green finance
Risks to soil health from increased flooding and drought.	Medium but will increase to high by 2050.	Biodiversity Soil and water protection and restoration Environmental land management Sustainable farming and forestry Net Zero Green finance
Risks to natural carbon stores and sequestration from multiple hazards leading to increased emissions.	Medium but will increase to high by 2050.	Biodiversity Soil and water protection and restoration Environmental land management Sustainable farming and forestry Net Zero Green finance
Risks to crops, livestock and commercial trees from multiple hazards.	Medium but will increase to high by 2050.	Biodiversity Soil and water protection and restoration Environmental land management Sustainable farming and forestry Net Zero Green finance
Risks to supply of food, goods and vital services due to climate-related collapse of supply chains and distribution networks	Medium but will increase to high by 2050.	Public procurement Business resilience Environmental land management Trade
Risks to people and the economy from climate-related failure of the power system	High	Infrastructure Energy Net Zero
Risks to human health, wellbeing and productivity from increased exposure to heat in homes and other buildings	High	Building regulations and strategies Planning reform
Multiple risks to the UK from climate change impacts overseas	High	National resilience Overseas aid Research and capacity building

The UK government and devolved administrations' approach to climate adaptation

Along with assessing future climate change for the whole of the UK, the Independent Assessment of UK Climate Risk 2021 Report also provides National Summaries for the devolved administrations of Northern Ireland, Scotland and Wales (as well as for England) which provide overview of the risk assessment specific to these nations. The UK government and each of the devolved administrations fully accept and endorse the findings in the Independent Assessment overall and in their respective National Summary.

An overview is provided below of the approach each government is taking to manage these risks.

The UK government's position on English and reserved matters

Having undertaken our third Climate Change Risk Assessment, the UK government is committed to significantly increasing efforts to respond to those risks and opportunities. In the statutory cycle set out in the Climate Change Act 2008, the next key milestone is the National Adaptation Programme (NAP3) in 2023. The UK government's ambition for NAP3 is to have a clear set of objectives for adaptation, and a systematic and robust set of policies, programmes and investments to meet those objectives, with measurable metrics, timelines and progress indicators, all linked to the sixty-one risks set out in our risk assessment.

We understand that adapting to climate change and fulfilling the requirements of the 2008 Climate Change Act is a whole-of-society challenge, requiring a collaborative, joined-up approach. A range of government departments will lead on responding to different risks, engaging with multiple actors in local authorities and the private and voluntary sectors. As we detail below, we are taking actions to adapt to climate change. However, we recognise that, given the challenge, we must raise our efforts. This report to Parliament is inviting all society to engage in this challenge.

To support the development of NAP3, the UK government is conducting an internal exercise to establish ownership of risks, review the extent to which existing policies will tackle those risks, and address the policy gap to treat the residual risks. Alongside this internal exercise, the UK government plans to engage with external stakeholders to inform the development of its objectives in relation to adaptation to climate change, and the detail of policies contained within NAP3.

A range of tools have been developed to help our partners assess climate risk and develop and deliver a policy response that affects real change, and we encourage them to make use of these. They include:

- [The UK Climate Projections](#), which provide up-to-date assessment of how the UK climate may change in the future, which are available at 2.2km resolution (UKCP18) for local risk assessment.
- The [UK Climate Resilience Programme](#) which uses UKCP18 to build the evidence on climate risks, adaptation and services in the UK. It has delivered several high impact outputs to date, including [climate risk indicators](#) to support climate risk assessments and [FUTURE-DRAINAGE](#), providing estimates of changes in rainfall for use in drainage design.
- The [Green Book supplementary guidance on Accounting for the Effects of Climate Change](#) and [Enabling a Natural Capital Approach](#) which provides guidance on how to account for climate and environmental factors in policy development.
- A policy development tool developed by our partners, Frontier Economics and Paul Watkiss Associates, that helps policy makers develop the case for action and identify appropriate options, underpinned by economic and analytical methodologies. In 2020, this has been successfully used to strengthen action in some parts of 6 of our climate risks.
- Reports provided under the UK Climate Change Act's Adaptation Reporting Power, which provide valuable information on the infrastructure sectors' preparedness for climate change, and promote effective integration of climate risk management and action planning into the work of the organisations involved.
- Adaptation communications. In December 2020, the UK became one of the first countries in the world to fulfil a key commitment of the Paris Agreement by publishing its first [Adaptation Communication](#). This sets out what the UK is doing to prepare for the effects of climate change at home, and support those facing impacts overseas. Aims include to increase the visibility and profile of adaptation and its balance with mitigation, and enhance learning and understanding of adaptation needs and actions. The UK government provided a [short update](#) in October 2021, to signal its ongoing commitment to transparency on the adaptation action we are taking.
- 'Ten Principles of Adaptation', as set out in the CCC's advice. These overarching principles relate to having a clear vision for a well-adapted UK (1st principle), and putting in place suitable funding, resourcing, metrics and research to support this vision (10th). They make clear that robust adaptation is reliant on understanding the implications of different climate projections and the uncertainty inherent to them - different emission scenarios (3rd), the impact of unpredictable extremes (5th) and the inclusion of threshold effects (7th) should be considered. To make the best use of the available science on climate projections it is important that the effects of climate hazards are communicated, and knowledge shared on how risks could interact across sectors (6th). Integrating adaptation based on this knowledge with other policies (2nd) allows for inequalities to be addressed (8th), lock-ins avoided (4th), and opportunities identified (9th).

- A strong research programme. Further details are set out in the Annex below. The key aims will be to respond to the research gaps identified in our risk assessment, which include continued development of our understanding of the science of climate, improved access to the science to help decision-makers understand risk better, more localised climate risk assessment, and improved measurement of adaptation enabling us to monitor progress better.
- An ambitious Climate Change Risk Assessment (CCRA4). Our aims for this include:
 - Spatial considerations which distinguish risk by area, including regional and localised mapping to understand how risk varies by location.
 - Use of a modelled approach which considers each risk from the bottom-up rather than rely on a synthesis of available evidence as in CCRA3.
 - More and integrated economic analysis woven through the risk assessment.
 - Stronger focus on understanding barriers to adaptation, with research driving towards resolving evidence gaps across societal and behavioural sciences.
 - A new framework of indicators which will include metrics to monitor what we invest and how we undertake adaptation as well as the outputs of those adaptation activities.

The UK government welcomes the eight priority risk areas identified by the CCC. In Annex 1 – the UK government’s approach to the eight priority risk areas we discuss these urgent risk areas as well as two additional more action needed risk areas. In this discussion we outline recent actions we have taken to limit these risks and describe our priorities going forward.

The UK government accepts that to date our actions have not been sufficient in meeting the increasing risks from climate change. Since the publication of the CCC’s Independent Assessment in 2021 we have been working at pace to mainstream adaptation to climate change in policy planning across government. This prioritisation and raised ambition will continue up to and beyond NAP3.

The Northern Ireland Executive’s position

Under Section 60 the UK Climate Change Act 2008, the relevant Northern Ireland Department must produce an Adaptation Programme which responds to the risks of climate change as identified in the most recent UK Climate Change Risk Assessment. [Northern Ireland’s second climate change Adaptation Programme](#) (NICCAP2) was published, by the Department of Agriculture, Environment and Rural Affairs (DAERA), in September 2019 and is a cross departmental response to the risks identified in the 2017 Independent Risk Assessment.

Northern Ireland does not have its own bespoke climate change legislation but currently has two climate change legislation bills passing through the Northern Ireland Assembly. The introduction of Northern Ireland’s first climate change legislation will strengthen the requirements for adaptation action not only within Executive Departments but also within Local Government and Civil Society.

The Northern Ireland Executive recognises the importance of responding to climate change and the Outcomes Framework for the new Programme for Government, which is

currently in development, and is anticipated to be in place by Summer 2022 prioritises tackling climate change by including the dedicated outcome “We live and work sustainably – protecting the environment”.

Northern Ireland Executive Departments welcome and accept the findings and recommendations of the third Climate Change Risk Assessment. The categorisation and priority scoring of the risks will be used by Executive Departments as a basis for adaptation planning going forward. Executive Departments are now also preparing for the comprehensive mid-programme review of NICCAP2 which covers the period 2019-2024.

The third Adaptation Programme (NICCAP3), due to be published in 2024, will be a comprehensive cross-departmental response to the risk areas that were assessed. The programme will also build on the successful engagement with Local Government and Civil Society within NICCAP2 and include additional adaptation input from these sectors.

Northern Ireland Executive Departments recognise that the research and evidence base must be improved so that we can fully assess the potential impacts of climate change risks and develop the policies and plans to prepare for and respond to these impacts. This work is already underway and one such example is the collaborative work between DAERA and the Department for Infrastructure on developing an evidence base for coastal adaptation. The baseline coastal survey currently being undertaken will improve the knowledge base and understanding of the coastal environment. It will provide the Executive Departments responsible for the associated risks with the data to model potential coastal erosion and flooding impacts and in turn develop policies and plans which build resilience to these risks and impacts as necessary.

DAERA, as the department responsible for the majority of risks in the Natural Environment and Natural Assets sector, recognises the role that nature and ecosystems will have in responding to both climate change mitigation and adaptation. Currently, there are a number of strategies in development and programmes underway aimed at improving the state of our natural environment. Strategies currently in development include the Peatland Strategy, Environment Strategy, Air Quality Strategy, a number of Marine strategies as well as the over-arching Northern Ireland Executive [Green Growth Strategy](#) which DAERA is leading development of on their behalf. Programmes of work such as ‘Forests for Our Future’ which aims to plant 18 million trees by 2030, are progressing delivery of Green Growth outcomes, transforming to a society that is low carbon, nature rich with a sustainable economic foundation.

The Scottish Government’s position

The Scottish Government accepts in full the assessment of climate risks and opportunities set out by CCC as the evidence base for this third Climate Change Risk Assessment.

Scotland’s devolved statutory framework on climate change, established through [the Climate Change \(Scotland\) Act 2009](#), includes strategic planning for climate change adaptation. The second such programme to date under the 2009 Act, [Climate Ready Scotland: Second Scottish Climate Change Adaptation Programme](#) (SCCAP2), was published in September 2019 in response to the 2017 CCRA2. The Programme sets out over 170 policies within an outcomes-based framework and takes a people-centric approach to climate change adaptation in Scotland over the period to 2024. This cross-

cutting approach promotes co-benefits and integrates adaptation into wider Scottish Government policy development and service delivery. The seven high level outcomes – derived from both [the UN Sustainable Development Goals](#) and [Scotland's National Performance Framework](#) – cover community resilience and climate justice, the economy, infrastructure, the natural and marine environments and international partnerships. As an example of ongoing action under the current Programme, the Scottish Government has committed substantial additional resources to flood risk management and coastal change adaptation as part of wider support for a green recovery from Covid-19.

The Scottish Government reports annually to the Scottish Parliament on progress to its current statutory Adaptation Programme. Statutory independent assessments of Scottish Adaptation Programmes are also undertaken by the CCC on a regular basis, with the first independent assessment of the current Programme expected in Spring 2022.

To support Scottish public bodies' leadership role in adapting to climate change, [the Climate Change \(Duties of Public Bodies: Reporting Requirements\) \(Scotland\) Amendment Order 2020](#) sets out that bodies will be required from reporting year 2021-22 to provide annual information, where applicable, on what contribution the body has made to helping deliver Scottish Adaptation Programmes.

The devolved legislative framework on climate change in Scotland requires a new programme for adaptation to be published by Scottish Ministers in response to the risks identified for Scotland in each new round of statutory UK Climate Change Risk Assessment. In line with this framework and in response to this third CCRA, the Scottish Government is now beginning to prepare for its third statutory Adaptation Programme, alongside continuing to implement the actions set out in the current Programme.

As part of its initial response to the CCC's Independent Assessment of UK Climate Risk in June 2021, the Scottish Government welcomed the CCC's advice in full and recognised that more needs to be done to build resilience as part of Scotland's just transition to being a net-zero nation. Since that time, the Scottish Government has also:

- In July 2021, published an indicative [Nationally Determined Contribution](#), further setting out Scotland's contribution to the Paris Agreement and including integrated material on approaches to adaptation in Scotland.
- Hosted a National Climate Resilience Summit in the run up to COP26 - bringing together leadership from across the public, private and third sectors to raise collective ambition on adaptation
- Commissioned further advice from the CCC in the form of the first independent assessment of Scotland's current Adaptation Programme.

The evidence for Scotland from the CCC's Independent Assessment, along with the CCC's further advice on the current Scottish Adaptation Programme, the findings of the National Climate Resilience Summit and those of Scotland's Just Transition Commission and Climate Assembly, will all help to shape the development of Scotland's next statutory adaptation programme, which is expected to be published in 2024.

In the meantime, the Scottish Government will prioritise additional actions in response to the risks identified by the CCC as being the highest priority.

The Welsh Government's position

Under the Climate Change Act 2008, the Welsh Ministers are required to lay before the Senedd from time to time a report on objectives, actions taken and future priorities for climate change impacts.

In addition, [the Environment \(Wales\) Act 2016](#) provides for a number of significant policy developments that support climate adaptation in Wales, and for the associated governance and management of natural resources, flood and coastal erosion. [The Wellbeing of Future Generations Act 2015](#) also provides for the development of Wellbeing Assessments, Plans and progress reports, national indicators and the Future Trends Report, all of which incorporate climate change considerations. Public Service Boards are required to take the Climate Change Committee's Climate Risk Independent Assessment advice into account when developing their Wellbeing Plans.

The Welsh Government is continuing to deliver the policy measures set out its second five-year climate change adaptation plan, [Prosperity for All: A Climate Conscious Wales](#), published in December 2019. A number of strategic and interlinked policy developments have taken place as part of the current plan that will help to establish a robust framework for climate change adaptation in Wales. These include publication of the updated [National Development Framework](#), [Flood and Coastal Erosion Risk Management Strategy](#), [Water Resource Management Plans](#), [National Peatland Action Programme](#), Area Statements, and consultation on the proposed new Sustainable Farming Scheme for Wales. In addition, we have seen the launch of [the National Forest for Wales](#) and publication of [a specific adaptation plan for the historic environment sector](#).

The Welsh Government welcomes and accepts the comprehensive updated evidence and advice presented by the Climate Change Committee in its third Climate Risk Independent Assessment. This will inform the development of the next climate change adaptation policy for Wales. The Welsh Government is also reviewing its policies to identify any additional measures that may be required in the short term to address the most urgent areas of risk highlighted by the Climate Risk Independent Assessment.

Annex 1 – the UK government’s approach to the eight priority risk areas

Risks to the viability and diversity of terrestrial and freshwater habitats and species from multiple hazards (Priority Risk Area 1)

The Advice Report for CCRA3 provides compelling evidence of the benefits to society of the natural environment. It explains the threat climate change poses to UK biodiversity, at a time when it is already degrading rapidly – the abundance and distribution of UK terrestrial and freshwater species has declined by 13% since 1970. Increased temperatures and extreme events such as drought and wildfire pose the biggest threats while upland areas face particularly acute risks (75% of present-day upland species face a potential decline in climate suitability by 2100 under a medium level of warming).

The Advice Report recommends reducing pollution and creating suitable conditions for existing species. Active management of habitats can also improve their resilience. Such actions should be underpinned by enhanced monitoring and surveillance. The report advises that over the next two years, there is time-limited opportunity to build adaptation explicitly into policies to protect terrestrial and freshwater habitats and species through the review of environmental policy following EU Exit. We outline our current actions below and accept that to meet the increasing challenges to our natural environment we must raise ambition as we look toward NAP3.

[The Nature Compact](#) agreement at the G7 and the [Environment Act 2021](#) include a new, historic legally binding target to halt the decline in species abundance by 2030. Defra will set out our approach to delivering these commitments in the refreshed Environmental Improvement Plan due in 2023.

The [25 Year Environment Plan](#) committed government to establishing a [Nature Recovery Network](#) (NRN) - an expanded, improved and increasingly connected web of wildlife rich places across England. Establishing the NRN will support Defra's goals of halting biodiversity loss by improving and connecting habitats and species. In establishing the NRN, Defra will also provide wider benefits, such as landscapes more resilient to climate change through improved ecosystem function. Larger and less fragmented wildlife sites will improve the resilience of populations to fluctuating weather conditions and extreme events. Better connected habitat will also allow some species (or their genes) to spread across the landscape and colonise new areas that may be more suitable for them in a changing climate. Our overall goal for the NRN by 2042 is to expand the existing resource of wildlife-rich habitat by 500,000 hectares and progress our goal of restoring 75% of the area of protected sites to favourable condition.

Defra acknowledges the importance of monitoring and surveillance to ensure quantifiable results and impacts. Natural England is developing advice on a monitoring and evaluation

framework for the NRN. Evaluation will be informed by data gathered at a national and local level including funding, impacts and spatial data.

Defra recognises the importance of reducing water pollution and restoring the water environment. Statutory river basin management plans provide an overarching management framework for the water environment that addresses risks both to public health and water ecology. These integrated plans draw on action across a range of areas including Catchment Sensitive Farming, chemicals, physical modification, and Environment Agency oversight of the water sector.

A further £124m of new money for the Nature for Climate Fund has been announced to enable more opportunities for farmers and landowners to support net zero through land use change. This will ensure a total spend of more than £750m by 2025 on peat restoration, woodland creation and management, increasing the size and therefore resilience of the woodland resource and providing opportunities to implement adaptive actions in existing woodland.

Defra is working to limit the threat of invasive non-native species to UK biodiversity. The GB Invasive Non-Native Species Strategy sets out:

- A hierarchy of priorities to protect our terrestrial, freshwater and marine environments – including prevention, early detection (surveillance, monitoring and rapid response) and finally long-term management and control.
- The actions we are currently taking to raise awareness through the [Be Plant Wise](#), [Check Clean Dry](#) and [Invasive Species Week](#) initiatives
- The importance of strategic research.

Risk analysis and horizon scanning are also central to the strategy. These are used to identify non-native species that pose a potential threat to Great Britain – both of which consider the impact of climate change on the ability of a non-native to establish and cause adverse impacts.

The UK government is committed to protecting the UK's terrestrial and freshwater habitats and species and so we will scale up our actions on ecosystem restoration, the establishment of nature-based solutions and building resilience of species and habitats to climate change. Increasing the size, condition and number of protected sites while reducing fragmentation by habitat restoration, creation and management are important factors in helping ensure resilience and are at the heart of our approach. Defra's Nature Recovery green paper includes among other things, a broader exploration of our approach to site designation.

Risks to soil health from increased flooding and drought (Priority Risk Area 2)

The Advice Report for CCRA3 sets out the importance of well-functioning, fertile soils and how climate threats to UK soils can exacerbate existing human pressures on the environment. Soil health is critical for maintaining biodiversity, regulating water flows, ensuring water quality, recycling nutrients and providing multiple ecosystem services notably for agricultural and forestry production. The present-day costs of compaction and

the effects of soil erosion are already £470 million and £150 million per year respectively in England and Wales.

The report acknowledges that soil health features in all of the current national adaptation plans across the UK. However, it calls for a comprehensive soil monitoring strategy to understand and measure progress on climate change adaptation; and targeted interventions and land management strategies to improve soil health. Further actions the Advice Report recommends:

- Soil-friendly farming practices, including no-till and precision farming.
- Good water management on agricultural and forested land to keep soil moisture in balance.
- Invest in soil monitoring to understand the current condition of soils and the future success of adaptation actions.

The government accepts the importance of addressing risks to soil health. Existing regulations such as [Crop Residues \(Burning\) Regulations 1993](#) ([Environmental Protection Act 1990](#)), [Reduction and Prevention of Agricultural Diffuse Pollution \(England\) Regulations 2018 \(Farming Rules for Water\)](#), and [Agricultural Land \(Removal of Surface Soil\) Act 1953](#), all protect agricultural soil from specific degradation issues i.e., burning and therefore loss of soil organic matter, erosion and trampling through poor land management near water courses, and removal of surface soil. Defra understands that this legislation is not sufficient to meet this risk and that more action is needed. We outline our current priorities and actions below.

We are committed, as part of the [25 Year Environment Plan](#), to achieving sustainably managed soils by 2030. A [Written Ministerial Statement](#) in October 2021 set out Defra's commitment to a new Soil Health Action Plan for England. The Action Plan will provide a single strategic approach to soil health, taking a natural capital approach through considering the numerous biological, chemical and physical attributes of soil.

The Sustainable Farming Incentive is a key focus of the Action Plan and will reward farmers for actions to improve soil health. Two new soil standards will be rolled out from 2022. The Improved Grassland Soils and Arable and Horticultural Soils will promote actions that improve soil structure. This will include increasing soil capacity to absorb, hold and drain water and so improve soil resilience to the impacts of flood and drought.

Defra agrees with the recommendations on soil monitoring and under the Action Plan for Soil Health, is developing a Soil Health Monitoring Scheme for England to produce a new robust data baseline. A healthy soils indicator is being developed which will consider physical, biological and chemical soil properties as part of many key soil variables. The indicator will feed into the Soil Health Monitoring Scheme and inform future policy and land management practices as well as any future targets for soil health under the [Environment Act 2021](#).

Separately, a new Soil Structure Measuring and Monitoring Scheme is being developed to enable visual assessments to be carried out by farmers and land managers (citizen science) across all land use/soil types. Engaging farmers and land managers in the process will increase knowledge of the benefits of healthy soil structure. This will provide a user-friendly way of measuring long-term trends, support future incentive schemes and create a baseline that will feed into any future soil health target.

Defra has established the [Lowland Agricultural Peat Task Force](#) to recommend ways of improving the condition of England's lowland farmed peatlands. The Task Force is currently exploring new solutions including innovative ways to manage peatland water table levels and long-term opportunities for paludiculture. The Task Force will present its findings to government in summer 2022.

The government accepts that there have been gaps in preventing soil degradation and is committed to improving soil health. This will include conducting further research on agricultural and land management techniques and systems that improve soil health, understanding the complexity of the soil biome and how soils can be managed to optimise biodiversity and the applicability of agro-ecological forms of agriculture that promote soil health.

Risks to natural carbon stores and sequestration from multiple hazards, leading to increased emissions (Priority Risk Area 3)

The Advice Report for CCRA3 describes the pressure human activity is exerting on the UK's natural carbon stores and how this is being exacerbated by climate change. The Advice Report identifies UK peatlands as one of the most important terrestrial natural stores for carbon - with equivalent CO₂ storage which is 25 times larger than the UK's total current annual emissions and an order of magnitude higher than the carbon stored in trees. The effects of climate change alone could reduce the area of land suitable for peat-forming vegetation in the uplands by between 50% and 65% by the 2050s. Carbon stored in coastal and marine habitats, referred to as "blue carbon" is also thought to be a critical store, and the report calls for a baseline assessment of the total stock to be completed urgently.

Achieving net zero by 2050 is in part dependent on the removal of CO₂ from the atmosphere and reducing emissions by utilising nature-based solutions. The CCRA3 warns that losses from existing natural carbon stores would threaten this target. To avoid permanent losses the report recommends:

- Spatial targeting of land use policies to match changing conditions, including consideration of climate change impacts in decisions over species choice in tree planting programmes.
- The restoration of degraded peatlands and other wetlands.
- Soil carbon monitoring.

The government recognises that we must safeguard our natural carbon stores from climate related threats in order to meet net zero.

Defra plans to reduce the increased threat of fire and drought to peatland landscapes by restoring peatland, supporting Lantra accredited Vegetation Fire training modules and using wildfire management plans to mitigate and adapt to risk at both site and landscape scales. We will reduce the threat from flooding by enabling peatland to hold more water and to manage its flow better. The [England Peat Action Plan 2021](#) (EPAP) outlines the strategic framework for peatland protection, management and restoration, and has climate adaptation as part of its core objectives. An implementation plan for the EPAP is due to be

published in 2023 and will include a trajectory of restoration and responsible management over the next 20 years, which we will provide an update on in Summer 2022.

The government's new environmental land management schemes will provide the main delivery mechanism for peatland restoration after 2024-25. To further support peatland restoration, government is implementing a range of policies that will mobilise private investment. The Natural Environment Investment Readiness Fund has been launched and a package of reforms to the Peatland Code, including expanding it to cover more peatland types, will be implemented in 2022.

Defra recognises that blue carbon habitats also play an important role in preventing biodiversity loss and supporting adaptation and resilience to climate change, alongside carbon sequestration benefits. At present, 38% of UK waters are in [Marine Protected Areas](#), including the majority of saltmarsh and seagrass habitats. Defra has also committed to designating a number of pilot [Highly Protected Marine Areas](#) (HPMAs) in England, including areas containing important habitats for long term carbon storage. Ecological recovery within HPMAs will increase the resilience of the marine environment to climate change and enable it to adapt to climate change impacts.

Defra is continuing to build the evidence base for blue carbon including baseline information, such as the recently published report on blue carbon stocks and fluxes by the Centre for Environment Fisheries and Aquaculture⁷, which collated over 500 records of blue carbon measurements from coastal wetlands and the seabed. The report provides a new collation of UK based measurements and highlights where further scientific action should be focussed.

At COP26 the UK announced its intention to establish a new cross-administration UK Blue Carbon Evidence Partnership to progress the evidence base on blue carbon habitats in the UK, advancing our shared commitment to protecting and restoring blue carbon habitats. Through this partnership, UK Administrations will work together to address key research questions related to blue carbon policy, including working to identify and fill the evidence gaps that currently hinder the inclusion of saltmarsh and seagrass habitats into the UK Greenhouse Gas Emissions Inventory.

Defra accepts the Advice Report's conclusions on the importance of spatial targeting of land use policies. The Forestry Commission recently published a decision-making framework for peat protection and woodland establishment which provides guidance to protect peatland carbon stocks from inappropriate woodland planting. The [England Trees Action Plan](#) (2021) includes an action to develop new guidance that will help determine when afforested peat should be restored to bog, and to minimise impacts on peaty soils from tree planting. Additional commitments in the plan include developing metrics that allow decision-makers to assess the realistic costs of forest to bog restoration and improving land use decision-making through the new peatland map data (due to be completed in 2024).

The [UK Forestry Standard](#) (UKFS) is the national standard for sustainable forest management that requires consideration of climate change in woodland creation proposals, woodland management plans and contingency planning. This includes

⁷ Parker et al (2021) Carbon stocks and accumulation analysis for Secretary of State (SoS) region, Cefas Report for Defra project ME5439, 42 pp. Available at: <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=20754>

increasing resilience to the risk of wildfire by using a wildfire management plan approach which is based on the Forestry Commission's Practice Guidance and upskilling operators and managers using its Lantra accredited Vegetation Fire training modules. This will provide robust guidance on forest design and management to minimise wildfire risk at the site and landscape scale, working in partnership across the Defra group and landowners.

A new UKFS Practice Guide on Adapting forest and woodland management for the changing climate will be published in 2022. Additionally, the Nature for Climate Fund includes a suite of delivery mechanisms that will enhance the resilience of the overall woodland resource and provide opportunities for new native productive woodlands that are adapted to the future climate. The [English Woodland Creation Offer](#) is a recently launched woodland creation grant which includes scoring for climate change resilience.

The England Trees Action Plan recognises that while trees will be an important part of our efforts to reduce emissions, trees themselves are vulnerable to the impacts of climate change. It therefore commits government to the following actions:

- To support the Forestry and Climate Change Working Group in implementing its adaptation plan, to launch a climate change competition to highlight best practice and the need to adapt new and existing woodlands to the effects of climate change
- To maintain our membership of the European Forest Genetic Resources Programme to promote the conservation and sustainable use of forest genetic resources in Europe.

Defra will also produce a Woodland Resilience Implementation Plan to improve the ecological condition of our woodlands and increase their resilience to climate change, pests and diseases. Forestry England will develop a Forest Resilience Strategy, including specific and measurable actions and targets and a forest resilience indicator to monitor the resilience status and condition of the nation's forests. The forestry and woodland measures set out above equally apply to Priority Risk Areas 1 and 4.

UK soil contains around 10 billion tonnes of organic carbon. However, our latest data suggest that arable farmland soils have been losing carbon relative to levels measured in 1978. The government recently published [a Written Ministerial Statement setting out the government's commitment to produce a new Soil Health Action plan for England](#). A key action within the plan includes the development of a healthy soil indicator where soil carbon is being considered as one of many key soil variables. Further actions on soils can be found under Priority Risk Area 2.

The government is taking further action to meet this risk, to protect and restore precious nature-based solutions and unlock the many ecosystem services they provide. To ensure our ambition of restoring 25% of this peatland further research is required to explore new ways of managing water across lowland landscapes. The impact of new methods on domestic food production, water availability and flood risk will also need to be modelled and piloted.

Risks to crops, livestock and commercial trees from multiple climate hazards (Priority Risk Area 4)

The Advice Report for CCRA3 sets out how climate change will pose a direct threat to crops, livestock and commercial trees. The report details how the UK's agricultural and forestry productivity are essential for both future domestic food security and achieving net zero emissions by 2050. The productivity in these sectors is dependent on the health and diversity of terrestrial and freshwater ecosystems.

The Advice Report outlines how effective adaptation measures will depend on the development and establishment of new varieties of crops, technologies and management practices and warns that such developments can have significant lead times. The report recommends beneficial actions for the next five years which include better long-term seasonal forecasts for land managers, assessment of land use options given changing water availability and land use strategies that bring climate change mitigation and adaptation together.

It concludes that risk assessment and planning is more evident in the forestry sector than agriculture. It also highlights that there is an opportunity to improve climate resilience in forthcoming national and devolved policies for land management, net zero and nature protection.

Defra support the conclusions made in the Advice Report including that climate hazards pose an increasing threat to crops, livestock and commercial trees. We are working to address this risk and more detail is provided in the recently published Net Zero Strategy. This includes a total spend of over £750 million for the Nature for Climate Fund, and the Agricultural Transition Plan. Through the [schemes to support environmental land management](#), farmers and other land managers will be rewarded for delivering public goods, including adapting to climate change. Defra is also developing measures through the [England Trees Action Plan](#) to protect commercial trees. To help address risks to agriculture and forestry from pests and pathogens Defra will be publishing a new GB Plant Biosecurity Strategy in 2022.

Defra understands the importance of enhancing the productivity, sustainability and resilience of the main UK crops. We are supporting a major, long-term research platform, known as Genetic Improvement Networks (GINs), for the genetic improvement of arable crops and fresh produce. This includes work to increase the resilience of major UK crops to climate change and associated pest and disease risks.

Each GIN includes internationally renowned scientists in crop genetic improvement, undertaking work to identify and characterise pre-breeding resources with improved productivity and resilience to major biotic and abiotic stresses. Defra currently funds four GINs, focussing on oilseed rape, vegetables, wheat and pulses which share a common governance structure in the form of the '[Defra Crop Genetic Improvement Platform](#)' to bring the research together more effectively in this space. Defra awarded £5.5 million over the five-year period (2018 to 2023) towards the GINs.

Defra is also expanding the scope of our breeding work to increase the sustainability and resilience of a wider range of agricultural products. This includes an ongoing project to scope the potential for a forage crop network, and a recently launched competition for a

similar scoping study on soft fruit. Following recent consultation, Defra will be taking a step-by-step approach to amending regulations to enable the development and innovation of new genetic technologies including gene editing. Gene editing could unlock crops and animals that are more resilient to the impacts of climate change, such as extreme weather and certain pests, by speeding up changes that could have occurred more slowly via traditional breeding methods.

Defra continues to support the [UK Research and Innovation \(UKRI\) Transforming Food Production \(TFP\) Initiative](#), which has already made a public investment of £90 million over four years to support the rapid development and deployment of [advanced precision agricultural solutions](#). This initiative is enhanced by an additional £14.5m of Defra funding to support collaborative agricultural research and development under the recently tendered [“Farming Innovation Pathways” Competition](#). Defra also announced the first £17.5m share of funding in our [Farming Innovation Programme](#), which will encourage collaborative farmer-led research and development to enhance productivity and improve environmental outcomes in England’s agriculture and horticulture sectors throughout the agricultural transition, as well as setting the sectors on the path to net zero. Defra is also working closely with the [Met Office Hadley Centre for Climate Science and Services](#) to better align our crop breeding work with pressures identified in their analyses of the effects of climate change on farming.

We agree that innovation in technologies to manage water and nutrient input is important. The Water Management sub-theme of the forthcoming Farming Transformation Fund is intended to support farmers by providing grant scheme funding for investments such as the construction of water storage reservoirs or abstraction or irrigation pumps. This will help support farmers during dry periods and bring benefits through more secure water supply, while helping to reduce peak requirements for water when agricultural and public demand for water is often at their highest. Defra aims to support projects which will reduce the environmental burden while increasing the resilience of public supply during dry weather.

The government is committed to supporting research and development to increase the sustainability and resilience of a wider range of agricultural products. Defra is currently refreshing our Agriculture and Food Climate Service in partnership with the Met Office to align the work more closely with challenges identified by the CCRA3 and to develop novel solutions to enhance resilience in agri-food systems.

There is a great deal of emerging policy targeted at achieving net zero, much of which - such as peatland restoration and tree planting – will contribute to climate change adaptation. Simultaneously, efforts are underway across Defra to support adaptation and resilience to climate change in the agricultural sector with resulting reductions in agricultural emissions. Defra will continue to develop evidence led policy to deliver climate mitigation and adaptation benefits, principally through our environmental land management schemes. This will be supported by our new Agri-innovation Minister portfolio.

Risks to supply of food, goods and vital services due to climate-related collapse of supply chains and distribution networks (Priority Risk Area 5)

The Advice Report for CCRA3 sets out how most products, including food, finished goods, components and materials, have complex – often international – supply chains. Extreme weather is already causing supply chain disruption and exposure to climate hazards is set to increase. Climate hazards can affect the supply of food, goods and vital services, as well as the infrastructure and routes by which these are transported. Adaptation actions involve the provision of better information, diversification of supply chain risks and building better capacity to manage, share and transfer risk. It highlights that there is an important role for new technology and infrastructure.

The report states that, although some action has already been taken by businesses, it is unclear whether action will keep pace with the increasing risk or how effective it will be specifically in managing climate or weather-related disruption. It concludes that enhancing supply chain resilience should be a priority for post-COVID recovery planning and should also be a factor in the development of new trade agreements as trade patterns change following EU-Exit. Businesses can be supported through ensuring information and advice is available, especially for smaller businesses, and by implementing stronger reporting requirements for businesses and infrastructure providers, such as ports and airports.

The government accepts that climate change is posing increasing risks to supply chains. We outline our current priorities below but understand more will be required in the next eighteen months to address this complex risk area.

The Department of International Trade (DIT) is examining risks to critical non-food supply chains including identifying risks from climate change and advising lead government departments on actions to improve resilience of those supply chains into the future. Such actions include:

- Exploring options to diversify the UK's supply chains to minimise disruption
- Working alongside international partners to support supply chain climate resilience and building domestic UK capability in key sectors
- Promoting the UK as a centre of resilience and risk expertise, with a focus on speciality insurance underwriting, green investment financing, and environmental advisory services including consultancy and standards assurance
- Working with the insurance specialty market and other related resilience services to help build capacity in developed and emerging markets and develop and build commercial opportunities for UK firms in the finance, insurance and infrastructure sectors
- Contributing to the government's response to risks to finance, led by HM Treasury

The government also agrees that insurance can play a critical role in transferring or mitigating the risks that climate change poses to supply chains. The Business of Resilience campaign, an initiative by the DIT in partnership with City of London Corporation, has been created to promote the UK as a global hub for Insurance Resilience Solutions to international buyers. This will have the eventual result of increasing exports of UK speciality insurance and resilience services as well as promoting the attractiveness of

the UK as an investment destination for speciality insurers and resilience service providers.

HM Treasury supports the development of global sustainability disclosure standards, including the work of the International Financial Reporting Standards Foundation to create an International Sustainability Standards Board to develop a global baseline corporate reporting standard for sustainability. Further, in recognition of rising private sector interest and action on the financial materiality of nature-related considerations, the government committed to working with international partners to catalyse a market-led coalition on nature-related financial risks and reporting in its [2019 Green Finance Strategy](#). Supported by the government from its inception, [the Taskforce on Nature-related Financial Disclosures](#) will provide a framework for corporates and financial institutions to report and act on evolving nature-related risks to support a shift in global financial flows away from nature-negative outcomes and toward nature-positive outcomes.

Domestically, in November 2020 the Chancellor announced the UK's world-leading intention to make disclosure requirements aligned with [the Task Force on Climate-related Financial Disclosures \(TCFD\) recommendations](#) fully mandatory across the UK economy by 2025. Since that announcement, the government and regulators have made significant progress towards implementing the TCFD. In July 2021, the Chancellor announced that the UK would go further, with new disclosure requirements to elicit decision-useful sustainability-related information. In October 2021, the government published [Greening Finance: A Roadmap to Sustainable Investing](#) setting out details of new, economy-wide Sustainability Disclosure Requirements that will require companies, asset managers, asset owners and investment products to disclose their sustainability-related risks, opportunities and impacts.

The government accepts that climate hazards will cause increasing threats to our supply chains through our infrastructure and transport routes. Consideration will need to be given to the potential vulnerabilities for the transport system including rail, roads, ports and airports. The Department for Transport (DfT) is currently drafting an internal Climate Change Adaptation DfT strategy. The strategy will explore potential action against all risks identified by the CCC, expectations, interdependencies, standards, and scenario planning across policy areas and with industry and operators.

Defra supports the report's conclusions which are consistent with the recently passed [Agriculture Act \(2020\)](#) which includes a requirement to regularly report to Parliament on the subject of food security. The Food Security Report considers both global and domestic food security, including global food availability, UK food sources, UK food chains, household security, and consumer safety and confidence. Data is drawn from both national and international data sources, including UK National Statistics as well as data from the Food and Agricultural Organisation of the United Nations. The UK Food Security Report will inform future policy on UK food security, and [was first published in 2021], with subsequent reports to be produced at least every three years.

Further policies impacting the food system will be set out in the forthcoming government Food Strategy, which will support the development of a food system that is sustainable, resilient and affordable, that will support people to live healthy lives, and that will protect animal health and welfare.

The government understands that the risks to UK food availability, safety and quality will increase throughout this century. We also acknowledge how it is often difficult to quantify that risk. Defra is exploring what additional research and analysis is required to create effective performance indicators to quantify food supply adaptation and understand the impacts of existing policies and where they conflict with adaptation, to support better policy development and inform decision making.

Risks to people and the economy from climate-related failure of the power system (Priority Risk Area 6)

The Advice Report for CCRA3 describes how, as the UK becomes more dependent on electricity as our dominant energy source, people and the economy will be increasingly exposed and vulnerable to electricity system failures.

BEIS recognises that risks from climate-related hazards will become more common as our dependence on electricity grows and the variability of our weather increases. As noted in [the Net Zero strategy](#), low carbon power, mostly from intermittent renewable generation, is expected to become the predominant form of energy in 2050. It will account for approximately 50% or higher share of final energy consumption, up from 10% in 2019, as light transport vehicles and domestic heating electrify.

The report recommends that the government works with the regulator (Ofgem) and the industry to review the approach to electricity system design and risk assessment in the context of the more central role of electricity in the UK's future energy system. Climate resilience must also be reflected in the wider energy system governance and in planning conditions for new infrastructure. The report concludes that the risks can be managed, but that ensuring the UK has a power system that is resilient to future climate impacts is now an urgent issue.

Guaranteeing that homes and businesses have the certainty of secure energy supplies they can rely on now and in the future is an absolute priority. The government supports these recommendations and is committed to improving and maintaining the resilience of UK energy infrastructure, networks and assets in the face of future system changes and climate risks. BEIS is working with the energy industry, regulators and other stakeholders to reduce vulnerabilities and ensure an effective response to actual or potentially disruptive incidents to ensure security of supply.

The government accepts that climate resilience must be reflected in the wider energy system governance. [The Heat and Building Strategy](#), sets out the principle of taking a 'whole-building' and whole-system approach to building decarbonisation, considering the interventions most appropriate for the whole building, as well as local and regional suitability and how best to manage system-level impacts.

The government acknowledges the climate risks of an increasingly renewable-based electricity system, particularly from offshore wind. Alongside working with Ofgem and National Grid ESO to manage these risks, BEIS is currently considering how to ensure flexible demand and supply is taken into account and working to decarbonise flexible firm capacity to ensure when renewable output is lower, we have secure capacity which meets our net zero ambition.

Current work includes:

- Working to deliver a smart and flexible electricity system with Ofgem, that will underpin our electricity security and the transition to net zero in the [Transitioning to a net zero energy system: smart systems and flexibility plan 2021](#)
- Reviewing how the [Capacity Market](#) will need to align with net zero by bringing forward more low carbon capacity and better address emerging security of supply challenges.
- Investigating how [large-scale, long-duration electricity storage](#) could facilitate a net zero system and its role in the efficient and cost-effective delivery of security of supply

The government accepts that the decarbonisation of transport and the associated reliance on electricity needs to be considered. An internal Climate Change Adaptation DfT strategy is currently being drafted and more information can be found under risk area 5.

Risks to human health, wellbeing and productivity from increased exposure to heat in homes and other buildings (Priority Risk Area 7)

The Advice Report for CCRA3 outlines the significant risks of overheating in buildings as UK temperatures increase and heatwaves become more common. As well as risk to life, high temperatures will lead to productivity losses for UK workers. The report highlights that exposure to heat in homes will increase if the tendency for people to work from home because of the Covid-19 pandemic is adopted by businesses and workers permanently. There will also be implications for the future delivery of health and social care if as trends indicate there is a continued move to more home-based care rather than hospitals.

Building designs and technology are available that can greatly reduce occupant exposure to heat while ensuring high levels of thermal efficiency. Beneficial adaptation actions include the updating of building regulations and other policy measures to address overheating through passive cooling measures like better shading, reflective surfaces and green cover. The report warns that with 300,000 homes due to be built each year across the UK there is a major risk of lock-in if they are not planned and built to address overheating alongside energy efficiency and low-carbon heating.

Overheating in buildings has been highlighted as a key risk for the health and productivity of people in the United Kingdom. We have outlined our current priorities below and will develop these further as we produce the next NAP.

The Department of Levelling Up, Housing and Communities (DLUHC) have introduced a new requirement on overheating into the Building Regulations to ensure that new residential buildings are built for a warming climate. The new requirement prioritises addressing overheating through passive measures including reducing solar gains and sufficient removal of heat. [Statutory guidance](#) has been produced to accompany the new requirement.

The Department for Health and Social Care (DHSC) is working with its arms' length bodies and other stakeholders in the health and care sector to ensure the health system is better adapted to an increase in the frequency and severity of extreme weather events. The UK

Health Security Agency is currently developing the Single Adverse Weather and Health Plan which aims to mainstream adaptation activity. This work includes:

- Exploring steps that can be taken to improve the resilience of health and care settings to hot weather
- Raising awareness of actions that can be taken by the public and the health and care workforce to protect themselves and vulnerable people in a heatwave.
- Reducing the evidence gap around the costs of extreme weather events and adaptation in the health and social care sectors.

The NHS owned Third Health and Social Care Adaptation Report [due for publication in autumn 2021] assesses health sector vulnerability to existing and future climate risks and opportunities in the Advice Report, including overheating. The fourth iteration of the Health Effects of Climate Change Report in the UK is due in 2023 and will include an update of the evolving risks for health under UKCP18. This report will feed into the development and delivery of a programme of research on how climate change will affect health.

The government has undertaken research to examine the overheating risk and impacts in existing buildings to inform our approach to managing this risk. In September 2020 BEIS published [Cooling in the UK report](#), a research project led by AECOM consulting that assesses potential future cooling needs in buildings, and [the Energy Follow Up Survey \(EFUS\) Reports](#), led by the Building Research Establishment (BRE). This report primarily focused on winter heating patterns, energy consumption and thermal comfort, but also included work by Loughborough University on summer overheating. Last summer the government also launched the new £5 million [‘Climate Services for a Net Zero Resilient World’ research programme](#) led by a consortium of some of the leading authorities in environmental science such as University College London and the UK Centre for Ecology & Hydrology. This work will help the UK adapt and become more resilient to the impacts of climate change, including overheating, and will also engage with local authorities on local climate action plans, by equipping them with information on how to help households cope with extreme temperatures and helping them to identify low-cost, low-carbon measures.

In October the government published [The Heat and Buildings Strategy](#) which sets out the government’s plan to decarbonise the UK’s 30 million homes and workplaces. Within the Strategy the government commits to considering current and possible future scenarios, including overheating risk and indoor air quality risk when developing future policies to future-proof buildings. BEIS plans to undertake further research in this area, while developing the detailed policy framework underpinning the strategy.

The [England Trees Action Plan](#) published in May 2021 includes actions to enhance urban tree cover to protect urban populations from overheating by providing shade and reducing the urban heat island. Actions include extending the [Urban Tree Challenge Fund](#) to support the planting and establishment of trees in urban and peri-urban areas and working to publish guidance for local authorities to develop their own local tree and woodland strategies. Further actions related to urban planning include changes to the [National Planning Policy Framework](#), which stipulates that planning policies and decisions should ensure that new streets are tree-lined, that opportunities are taken to incorporate trees elsewhere in developments, that appropriate measures are in place to secure the long-term maintenance of newly-planted trees, and that existing trees are retained wherever possible to make clear the expectation that trees, such as community orchards, should be incorporated in new developments and that streets should be tree lined. The National

Model Design Code, published in July 2021, highlights the importance of planting trees and other landscape features to provide habitats, shading, cooling, air quality improvements and carbon sequestration, as well as being a vital component of attractive places.

Multiple risks to the UK from climate change impacts overseas (Priority Risk Area 8)

The Advice Report for CCRA3 sets out how extreme weather events in the UK and globally can create cascading risks that spread across sectors. The report recommends updating the current model of conventional risk governance in the UK to include cascading climate risks.

The government understands that the potential for cascading risks is growing through a more inter-connected world, where risks can spread across sectors and in doing so lead to system-wide consequences. The [Integrated Review](#) has committed the government to publish a Resilience Strategy which will detail how the UK can improve its resilience to the effects of a wide range of risks, including climate change impacts. By 2030, the government aims to have improved its ability to assess and understand the risks we face. The government will use its systems, infrastructure and capabilities to better prepare for, respond to and recover from risks in all parts of the UK at a local, regional and national level.

The UK government has committed to align our aid, or Official Development Assistance, with the goals of the Paris Climate Agreement and to ensure our spend is nature-proofed. Within the Foreign, Commonwealth and Development Office (FCDO) this includes using appropriate carbon price in bilateral programming, routine assessment of climate and environment risk and alignment with partner countries' long-term climate and environment strategies (as set out in HMG's 2019 Green Finance Strategy).

The government is securing commitment from multinational partners and fellow bilateral donors to align assistance they provide with the goals of the Paris Agreement and do more for nature. This has already resulted in a timebound commitment from the World Bank to align all new operations with the Paris agreement by July 2023 and increase the percentage of support that has climate co-benefits for people and planet, with 50% for adaptation and resilience.

The government understands that climate hazards abroad can produce cascading effects in the UK and has committed to doubling the UK International Climate Finance (ICF) to £11.6 billion between 2021-25. [The UK Biennial Finance Communication to the UN Framework Convention on Climate Change](#), under Article 9.5 of [the Paris Agreement](#), set out our approach to delivering ICF programmes, including aiming for a balance between mitigation and adaptation spend. The forthcoming ICF Strategy will expand further on this approach.

BEIS is currently reviewing the approach to climate risk assessment used for ICF programmes in light of the UK commitment to align all ODA spend with the Paris Agreement. ICF delivery partners already have measures in place to consider the risks posed to mitigation investments by climate impacts. ICF seeks to maximise adaptation co-benefits where feasible. For example, the Climate Leadership in Cities Programme

provided technical assistance to megacities in Asia and South America to develop Paris-aligned climate action plans addressing both mitigation and adaptation in an integrated way.

Beyond ICF, the government will continue to champion action to advance adaptation alongside mitigation internationally, helping to build global resilience, drive action to protect those who are most vulnerable to climate change, and learn from others around the world as we tackle these shared challenges together. There is a clear opportunity to integrate our approach to climate mitigation, adaptation, and other environmental policies, to maximise co-benefits and minimise trade-offs. The 2030 Strategic Framework for International Climate and Nature Action, currently under development for publication in 2022, will be the UK's first international strategy to do this, seeking to advance global adaptation and resilience as an international priority, including through co-beneficial mitigation and nature actions.

Increasing international action and finance for adaptation has been a key focus of the UK's COP26 Presidency, recognising that globally, adaptation attracts considerably less finance than mitigation. Since 2011 the UK's ICF has directly supported 88 million people to cope with the effects of climate change and mobilised £5.2 billion of public and £3.3 billion of private finance for climate change purposes in developing countries.

The transnational nature of many climate-linked risks means that no single government can address them alone; the UK Government will continue our work with international partners, recognising that a resilient UK is crucial to global resilience and vice versa. Additionally, the scale of the adaptation gap internationally means that UK-funded action on climate adaptation and resilience measures internationally depends in part on our fellow G7/G20 partners contributing alongside us for maximum effectiveness, including in meeting international spend targets such as the \$100 billion/year in climate finance and stepping up to meet the commitment made at COP26 to double 2019 levels of adaptation finance by 2025. While good progress has been made, the effectiveness of actions on tackling climate change and biodiversity loss, and enhancing countries' abilities to adapt to their effects, will remain dependent on the policy and spending choices of others. By establishing initiatives such as the Adaptation Action Coalition and Adaptation Research Alliance, the UK is bringing countries together to co-develop solutions and innovations for some of the most challenging impacts of climate change and in doing so, helping embed best practice on adaptation into policy decisions.

The government has a proven track record in delivering research into climate change risk and adaptation, through the Global Challenges Research Fund and Newton Fund-funded programmes such as those delivered by the Met Office, UKRI, the UK Space Agency and the National Academies. However, the government accepts that we need further research to fully understand the direct and indirect links between action taken overseas to improve adaptation and how that impacts the UK's own climate resilience.

The government understands the need to reduce underlying vulnerabilities overseas alongside its work to respond to disasters and has increased support for disaster risk preparedness, including capacity building. The UK announced £120 million in new funding at the G7 this year to protect those most at risk and help reduce losses and damage to communities, infrastructure and livelihoods caused by climate change.

Furthermore, the UK recognises the myriad of ways that climate and environmental change can impact on public health systems and global health more widely. We need to learn from the challenges in the climate-environment-health nexus and from the global covid pandemic. Health systems are on the frontline of protecting populations from the health threats of a changing and more variable climate such as: food and water insecurity; extreme weather; flooding; heat stress; reduced air quality (including increasing ground level ozone); increased land pressure from a landscape changing; vector-borne diseases and zoonoses, amongst others. With UK leadership, over 50 countries committed to build more resilient and low-carbon sustainable health systems at COP26. Working with international partners, we will support mechanisms to help implement these commitments, aiming to increase access to finance, technical assistance and capacity building and knowledge, for the development of climate-sensitive health systems that can effectively respond to increased and new health risks and emergencies. We will pursue a One Health approach, working with partners across government, to ensure lessons from the current and previous pandemics translate into greater pandemic preparedness. We will seek to strengthen our evidence base to explore further efforts to address the challenges in this nexus, and link health more firmly to climate objectives.

The Department for International Trade accepts the need to embed resilience into UK supply chains if sustainable and resilient growth is to be achieved. The current gap in adaptation capability is partly due to a historic focus on efficiency in supply chains and as such, DIT is considering future policy that will help address this. DIT has established the Global Supply Chains Directorate to improve the resilience of the UK's critical supply chains against shocks, including climate change. We understand that there are limits to what the UK government can do alone to control vulnerability factors globally.

Additional More Action Needed Risks

The underlying Technical Report for the CCRA3 highlighted eighteen additional risks where more action will be necessary in the next five years, but which are not included in the priority risk areas. A comprehensive response to each of the sixty-one risks will be included in NAP3. We consider two additional risk areas below: flooding and coastal erosion (6 risks) which we discuss here due to its high valuation costs in Table 1 and public health and other social services (4 risks) due to the difficulty in evaluating the cost of these risks.

More action needed risk area: flooding and coastal erosion

The 2017 Independent Assessment for the CCRA2 set the risks of flooding and coastal change to communities, businesses and infrastructure as a priority risk area. Although the latest Advice Report for the CCRA3 does not include the effects of flooding and coastal change as a priority risk area the government fully recognises that flood risk to people from rivers, surface water and coastal flooding remains high both now and in the future.

The government's [policy statement](#) published in July 2020, alongside the [National Strategy](#) on flood and coastal erosion, sets out our ambition to create a nation more resilient to future flood and coastal erosion risk and includes over 40 actions which will accelerate

progress to better protect and better prepare the country against flooding and coastal erosion.

As part of this, the government is investing a record £5.2 billion to build 2,000 new flood defences. This investment will better protect 336,000 properties from flooding and coastal erosion. In addition, the government is providing £200 million 'to inform future approaches to improving resilience to flooding and coastal erosion in communities across the country. Within the programme 25 local areas will take forward wider innovative actions that improve their resilience to flooding and coastal erosion including natural flood management, property flood resilience and community engagement. The programme will also support four areas across the country to help plan future investment in flood and coastal resilience by adopting a long-term adaptive pathways approach.

Surface water is the most widespread form of flooding in England, with around 3.2 million properties at risk. Managing surface water flooding requires strong collaboration between a wide range of stakeholders, recognised in the government's [Surface Water Management Action Plan](#) which includes 22 actions to improve understanding and strengthen delivery. In July 2021 the government published an update [report](#) on progress to date with its Surface Water Management Action Plan and its response to the [independent review](#) into surface water and drainage responsibilities.

To help places better plan and adapt to future risks from flooding from rivers, the sea and surface water, the Environment Agency is working to produce a new national assessment of flood risk (NaFRA2) by 2024. As part of our reforms to the planning system, the government will consider what mechanisms and policy may be needed to ensure wider flood risk issues are considered during decision making. This includes future flood risk from rivers and the sea, surface water and ground water flood risk.

Using the power of nature is part of our solution to tackling flood and coastal erosion risks. The government is taking a holistic approach to flood risk management including encouraging more natural flood management where appropriate, alongside engineered defences. We have committed to double the number of government funded projects which include nature-based solutions to reduce flood and coastal erosion risk. We have committed to joining up our plans for trees, peat, soil and nature to secure multiple benefits including for flood risk, carbon sequestration and net gain. For example, the England Woodland Creation Offer provides 'Additional Contributions' in locations identified by Environment Agency as benefitting from natural flood management. We will continue to develop our evidence base and understanding of the effectiveness of these interventions.

Rising sea levels can cause both coastal flooding and coastal erosion. The government is committed to defending the coastline where this is sustainable and affordable to do so, and to let it function naturally in areas where it is not. The Environment Agency is currently working with coastal authorities on a £1 million refresh of Shoreline Management Plans to ensure that they are up to date, using the best evidence in their recommendations and focus attention on priority areas for investment and adaptation. Informed by this refresh of technical evidence supporting Shoreline Management Plans, we will review national policy for Shoreline Management Plans to ensure local plans are transparent, continuously review outcomes and enable local authorities to make robust decisions for their areas. As part of this we will engage with stakeholders, including the Environment Agency and

Coastal Protection Areas to consider the Committee's views that Shoreline Management Plans should be made statutory.

We will also review the effectiveness of existing planning policy on Coastal Change Management Areas. Many local authorities have adopted Coastal Change Management Areas policies that allow those at risk of losing their home through erosion within 20 years to get planning permission to replace the property and relocate at an appropriate distance inland and close to the coastal community from which the development was displaced.

Defra is working closely with DLUHC to ensure that our policies on coastal transition join up with wider government regeneration policies for coastal communities.

[The government's policy statement](#) sets out our commitment to ensure homes, communities and businesses are better prepared to manage flood risk. To achieve this, the government wants to accelerate uptake of Property Flood Resilience. The government will publish a roadmap by the end of 2022 to accelerate take-up of property flood resilience measures. This will ensure all relevant bodies are playing their part and that consumers can have assurance about the quality of products and their installation. We are also making a number of changes to [the Flood Re scheme](#) which further accelerate the uptake of Property Flood Resilience. This includes permitting Flood Re to offer additional funds above the cost of a claim to make flooded properties more resilience to future flooding (also known as Build Back Better).

To drive forward progress and ensure that actions taken to manage flood and coastal erosion risk work for the benefit of our communities to build resilience everywhere we have committed to develop a national set of indicators. This will enable government to monitor trends over time to better understand the impact of our flood and coastal erosion risk management policies.

More action needed risk area: public health and other social services

The Independent Assessment for the CCRA3 highlights the breadth of climate risks relevant to public health and social services including education and prison services. Cold weather spells, heatwaves and incidents of flooding can all have a harmful impact and often on the most vulnerable groups. The government will continue to consider the risks raised in the report as we prepare for NAP3 and have summarised our actions to date on public health, prison and education services below.

Health and social care delivery

DHSC is committed to working alongside the UK Health Security Agency (UKHSA), NHS England & NHS Improvement (NHSE&I) and partners across the health and social care system to develop the actions and commitments required for the forthcoming NAP3.

There are well developed warning systems in place to alert the public and emergency responders to imminent threats of flooding, heavy rainfall, strong winds and heatwaves. The Met Office issued a new Extreme Heat Warning service in June 2021, designed to work alongside [UKHSA's Heat-Health Alert system](#).

UKHSA is committed under NAP3 to develop a single adverse weather and health plan for England by 2023. Building on the existing [Heatwave](#) and [Cold Weather Plans for England](#), this will include updated guidance on hot and cold weather, drought, flooding and thunderstorm asthma to inform action across the health system and local communities and reduce the health impacts of adverse weather.

Under the Adaptation Reporting Powers of the Climate Change Act, the NHS and UKHSA [published the Third Health and Care Adaptation Report 2021] on behalf of the sector. This builds on the 2015 report and helps to ensure the NHS can continue to deliver a climate-smart, resilient health service. The Adaptation Report, [published in 2021,] outlines current and future policies that address risks to health and social care delivery. The report recognises the risks and opportunities in the Independent Assessment. It also assesses health sector vulnerability to existing and future climate risks and opportunities in the CCC's Advice, including overheating. The report will highlight actions to address any adaptation gaps between current policies and commitments.

Vector-borne diseases and climate change overseas

The government acknowledges the threat of vector-borne diseases (VBDs) to UK public health and there are currently effective policies in place to address this risk. However, in light of the increasing threat of VBDs driven by climate change, the government is considering additional actions to mitigate against this growing risk. UKHSA leads on conducting surveillance for a range of VBDs, working in collaboration with other government arms' length bodies, local authorities, and environmental NGOs.

Beyond surveillance, there is a cross government contingency plan for managing the detection of invasive mosquitos in the UK. In addition, UKHSA contributes to the production of specialist and national public health guidance on VBDs. Specialist guidance is in place for wetland practitioners on vector mosquitos and for clinicians on identifying and managing potential cases of exotic human infections. UKHSA also issues public advice, including tailored advice for travellers, on how to reduce the risk of acquiring infection.

The government is currently developing future policies and commitments to effectively mitigate the public health risk from climate change, including VBDs. This includes UKHSA's work with partners to contribute to the Health Effects of Climate Change report, due in 2023. This report will include a specific chapter on vector borne diseases, setting out in detail the current and future risk from VBDs and commitments to address them.

UKHSA is also working to establish a Centre for Climate, Environmental Change and Health. The Centre will lead the work to protect health from the effects of environmental and climate change by strengthening our understanding of the impact on health and outlining effective interventions to mitigate adverse impacts.

However, the government understands that there is a need to continue to strengthen our future resilience to VBDs. This includes ensuring that we have the capacity to detect, monitor and respond to emerging and zoonotic infections in the UK and abroad. This could be optimally enhanced by:

- Building and maintaining improved national serum/plasma archives for ongoing sero-surveillance purposes, working with external partners

- Strengthening links with the NHS tropical disease units to refer more samples of undiagnosed fevers to UKHSA Rare and Imported Pathogens Lab (RIPL) for testing, therefore increasing its sentinel functions
- Targeting surveillance by referring undiagnosed cases of fevers of infectious origin in patients in areas with a high vector prevalence for testing by UKHSA RIPL
- Enhancing laboratory diagnosis by expanding the repertoire of tests available and establishing international links to obtain clinical material to evaluate new tests.

The government has taken significant action to mitigate the risk of VBDs in the future and will continue to work closely with partners to address gaps going forward.

Prison Services

The Ministry of Justice (MoJ) published its [Preparing for Climate Change: A Climate Change Adaptation Strategy](#) in 2020 which outlines what is required to enable the MoJ to prepare for climate change. MoJ is now implementing this strategy.

The MoJ is committed to ensuring the effects of climate change are considered in key policies, programmes and projects including by:

- A Climate Change Risk Assessment of its estate and operations has been commissioned including detailing risks of over- and under-heating, drought and flooding
- Incorporating climate resilience into the design of MoJ's New Prisons construction programme
- Development of a detailed Climate Adaptation Action Plan which accounts for climate hazards

Education

In 2020/21 the Department of Education (DfE) commissioned the Resilient School Building study by leading Architectural and MEP design professionals to assess the range of design parameters affecting the resilience of school buildings to overheating, tested to 2°C and 4°C global warming scenarios, across English geographical locations.

The findings informed changes to the [S21 DfE Output Specification](#) which include:

- Requiring all designs for new and refurbished buildings funded by DfE to use Design Summer Years that match the IPCC 2°C and 4°C global warming scenarios.
- Higher floor to ceiling heights, plus the mandating of cross-flow or stack ventilation and increasing resilience to higher temperatures by passive means rather than active cooling.

Research continues on risks identified by the CCC while planning for a zero-carbon school estate. The risks DfE is actively mitigating also include flooding, increased rainfall and water shortages. DfE has trialled flood prevention and overheating amelioration measures and wider sustainability measures across several schools.

Annex 2 – research priorities

To plan effective adaptation and avoid maladaptation, the government is committed to first considering what the future climate of the UK may be like. This includes considering different future climate scenarios and unpredictable extremes. This aligns with the long-term support provided to Met Office Hadley Centre Climate Programme which has culminated in the recent [UK Climate Projections 2018](#) (UKCP18) which use cutting edge science to provide updated observations and climate projections out to 2100.

The government is considering the recommendations in the CCC's Independent Assessment for CCRA3. Several of these are linked to requirements for further research which the government has prioritised.

1. Adaptation planning must incorporate unpredictability and sudden shifts in the climate. [The Met Office Hadley Centre Climate Programme](#), funded by BEIS with input from Defra and other departments, continues to work on researching unpredictable extremes. Further understanding of potential unpredictable extremes and multiple future climate scenarios is needed to support the implementation of effective adaptation actions. Through [the UK Climate Resilience Programme](#), high impact scenarios and storylines are being explored.
2. There is a gap in the scientific literature around threshold effects. A threshold is the point when a 'non-linear' change in a system occurs because of change in a climate variable. Understanding such effects can inform when action is or is not needed and so more efficient investment. The Met Office Hadley Centre Programme is exploring "high-impact, low-likelihood" climate outcomes, to include extremes, tipping points and thresholds, including to what extent these outcomes feature in climate risk assessments.
3. Risks can interact producing knock-on effects which can cascade across a range of sectors while climate change is likely to exacerbate existing disparities through its disproportionate effects on disadvantaged groups. The government accepts there is a need to address the interdependency and inequality of risks, and this is a research priority area for the CCRA4.
4. The Technical Report for the CCRA3 describes that for many of the risks and opportunities adaptation actions can often take a long time to take effect but that there is often an absence of robust metrics or indicators and a lack long-term monitoring of such actions. In particular, the complexity of how systems respond to adaptation measures while also responding to other environmental and socio-economic pressures is not easily detangled. In preparation for the CCRA4 and the NAP3, the government has prioritised the research and development of methods to monitor and evaluate adaptation actions. Defra is engaged in work with the OECD and the CCC to identify and develop measurable, evidence-based indicators to monitor change over time.

Developing and implementing these indicators will strengthen our ability to understand the benefits of adaptation, and to communicate these to gain support from stakeholders across all sectors.

Further programmes of research and evidence building on adaptation are also undertaken in the devolved administrations. For example, the Scottish Government's SCCAP2 programme (for the period 2019 to 2024) includes an embedded set of research commitments around matters such as understanding climate impacts in Scotland on soil health and social care delivery.

Glossary

- ARP - Adaptation Reporting Power
- BEIS - Department for Business, Energy and Industrial Strategy
- CCC - Climate Change Committee
- CCRA - Climate Change Risk Assessment
- COP26 - 26th UN Conference of the Parties
- DAERA - Department of Agriculture, Environment and Rural Affairs
- Defra – Department of Environment, Food and Rural Affairs
- DfE - Department for Education
- DfT - Department for Transport
- DHSC - The Department for Health and Social Care
- DIT - Department of International Trade
- DLUHC - Department for Levelling Up, Housing and Communities
- EPAP – England Peat Action Plan
- GHG – Green House Gas
- GINs – Genetic Improvement Networks
- ICF – International Climate Finance
- INNS - invasive non-native species
- MoJ - Ministry of Justice
- NAP - National Adaptation Programme
- NHSE&I - NHS England & NHS Improvement
- NICCAP2 - Northern Ireland's second climate change Adaptation Programme
- NRN – Nature Recovery Network
- OECD - Organisation for Economic Co-operation and Development
- RIPL - Rare and Pathogen Laboratory
- SCCAP2 - Scottish Climate Change Adaptation Programme
- TCFD - Task Force on Climate-related Financial Disclosures
- TFP - Transforming Food Production
- UKCP18 - UK Climate Projections 2018
- UKFS – UK Forestry Standard
- UKHSA - UK Health Security Agency
- VBDs – Vector Based Diseases
- WRAP – Waste and Resources Action Programme



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Any enquiries regarding this publication should be sent to us at climate@defra.gov.uk

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