Climate Change Committee

The UK's independent adviser on tackling climate change

CCC Insights Briefing 6

Undertaking a climate change risk assessment

The Climate Change Act requires an assessment of the climate risks and opportunities facing the UK to be carried out every five years.

Adapting to the physical risks and opportunities posed by a changing climate is a key pillar of the UK Climate Change Act (2008). The Act imposes a legal obligation on the Government for a five-yearly assessment of the risks and opportunities facing the UK from current and future climate change, which the Climate Change Committee (CCC) provides advice on as part of its legal remit. Two national Climate Change Risk Assessments (CCRAs) have taken place to date. For the second (and forthcoming third assessment due in 2021) the Government has tasked the CCC with compiling the detailed independent report on the evidence of climate risks and opportunities, which forms its advice.

The CCRA is currently conducted largely based on an extensive review of existing literature. The assessment identifies a range of risks and opportunities that the UK faces and considers their magnitude and the extent to which they are being addressed by current policies and plans out to 2100. This process identifies where more action or further investigation is needed, or whether continuation of current action or monitoring is sufficient.

This briefing note discusses the value of including adapting to climate change within national climate legislation, the process of conducting a climate change risk assessment in the UK, and insights from the experience of conducting two CCRAs to date.

This briefing is structured in three sections:

- The need for risk assessment in national climate laws
- Conducting a climate change risks assessment
- The challenges of conducting an effective risk assessment

This briefing is one of a series on the workings of the UK Climate Change Act and the Climate Change Committee (CCC).

Box 1:
CCC 'Insights' Briefings

This briefing is part of a series of eight that document the work of the UK Climate Change Committee (CCC) under the Climate Change Act. The CCC is the UK's independent advisory body on climate change mitigation and adaptation tasked with providing regular advice to government on emissions targets and adapting to a changing climate. The CCC publishes annual assessments of progress towards meeting these targets, biennial assessments of progress in adapting to climate change, and supporting analyses on key emerging issues. These briefings are intended as a practical guide to give insights on the CCC's work and learnings over the twelve years since its foundation in 2008.

The briefings in this series are:

- UK Climate Change Act
- The Climate Change Committee
- The UK's Net Zero target
- Advising on the level of the UK's carbon budgets
- Monitoring progress in reducing the UK's greenhouse gas emissions
- Conducting a climate change risk assessment
- Monitoring progress on adapting to climate change in the UK
- Past Climate Change Committee reports

1. The need for risk assessment in national climate laws

Adaptation refers to actions that help increase capacity, and reduce the vulnerability and exposure of society and the natural environment to the impacts of climate change. It can also include actions to take advantage of new opportunities that climate change may bring. Adaptation is distinct from actions to reduce greenhouse gas emissions (known as mitigation), which reduces the future levels of 'hazard' by reducing the future global temperature rise and other climate changes. Both are needed together to address climate change.

Climate impacts are already happening and are set to increase. Policy and plans, developed on a timely basis, can help to address these risks.

There are several reasons for including adaptation within national climate laws and policy frameworks:

- **Climate change impacts are being experienced today.** Global average surface air temperature has already risen by more than 1°C above pre-industrial levels and is now emerging out of the range of temperatures seen over the last 10,000 years. Many regions are experiencing more warming than this. Clear evidence of changes in the patterns of weather and other climate-related events impacting human societies and natural ecosystems has been detected in many regions around the world.
- **Additional climate change is inevitable.** The future climate of a country (e.g. the UK) will depend on the global total emissions and not its own national emissions. A national plan to reduce greenhouse gas emissions is not, by itself, enough to limit future national climate change. In addition, even in scenarios that rapidly reduce global emissions to reach Net Zero early in the second half of this century, some amount of future warming over the next few decades is likely to be inevitable, increasing the frequency and intensity of many climate hazards. Depending on success in mitigation, there is also a wide range of possible future climate change in the second half of the century including very high levels of warming, over 3°C.
- **Government policy is necessary to help address the impacts of climate change.** There is an important role for policy making in addressing the risks and opportunities posed by the changing climate. Funding of research and advice services is important as decision makers cannot always easily access information on the future climate risks they may face. The costs of adapting often fall in the short-term whereas benefits are often realised over the long-term. Incentives or regulations may be required to ensure that future climate risks are factored in before an impact hits, for example in design of new homes to avoid overheating. There is also a role for public investment in public goods such as flood defences. More broadly, a large percentage of Government and societal goals, including those to reduce emissions, will only succeed where they are designed to work in the changing climate.

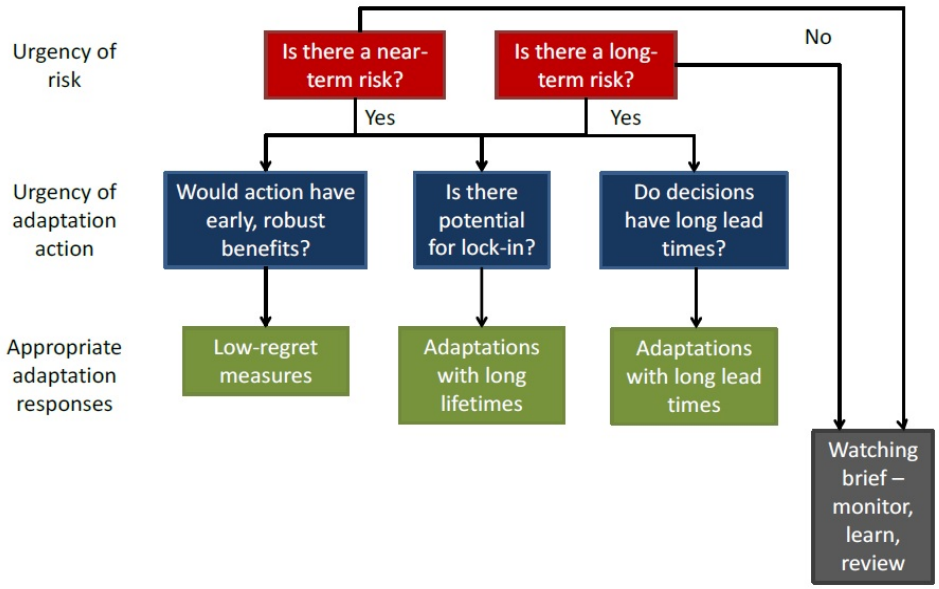
Understanding climate risks is particularly important for decisions with long-term implications, while some responses can address risks at minimal cost.

Understanding the expected future risks from a changing climate are immediately relevant to decisions being made today in several areas, in particular (see Fig. 1):

- **Low and no regrets actions to reduce vulnerability and exposure.** Some actions can help reduce national vulnerability and exposure to climate impacts whilst providing significant wider benefits and limited costs. For example, enhancing urban greenspace will help to reduce the risks from extreme heat and flooding, support biodiversity and improve health.

- **Decisions with long lead-times.** Some decisions take years to implement from planning to completion (such as wholesale changes to the healthcare system, land use change, or designing and building new reservoirs) which means that by the time the decision is implemented, the climate will have changed, and this needs to be considered from the beginning of the process.
- **Decisions with long lifetimes.** Much infrastructure being constructed today has an intended lifetime of centuries. Changes in the climate need to be considered to prevent the lock-in of long-lived infrastructure or buildings that are not resilient to a range of possible future climates (e.g. planning decisions regarding the location of new housing developments or power stations).

Fig. 1:
Adaptation-relevant decisions



Source: Watkiss, P. et al. (2013) *UK Climate Change Risk Assessment Evidence Report: Chapter 2, Approach and Context* adapted from Fankhauser, S. et al. (2013) An Independent National Adaptation Programme for England.

The inclusion of adaptation within national climate laws can help create the necessary legal and support frameworks required to factor a changing climate into policy decisions. A regular evidence-based process to identify the most important risks and opportunities in each sector is an essential part of this process.

2. Conducting a Climate Change Risk Assessment

The UK's climate change risk assessment is based on a detailed review of the latest evidence.

The UK Climate Change Act requires a regular five-yearly Climate Change Risk Assessment (CCRA) of the range of climate risks and opportunities facing the UK from current and predicted climate change. The first CCRA was completed in 2012, the second CCRA in 2017 and the third CCRA will be completed in 2022.

There are three elements to a CCRA under the UK Climate Change Act:

- A detailed Evidence Report on the range of risks and opportunities to the UK.
- Advice from the CCC to the Government on these risks and opportunities.
- A Government-produced report on their assessment of the risks and opportunities informed by the Evidence Report and the CCC's advice.

For the second and third CCRAs the Government has tasked the CCC with coordinating the CCRA Evidence Report, incorporating the CCC's independent assessment (so merging points 1 and 2 above). For this, the CCC appointed a consortium of experts to produce the technical assessment of risks in consultation with the CCC. This process took place over three years for the 2nd CCRA and involved two rounds of independent peer review producing over 6,000 comments on the draft, each one addressed by the author teams. It focused on a systematic review of the published literature on UK climate change, with a small amount of new research. The CCC commissioned several research projects to provide additional evidence focused on areas particularly relevant to the assessment.

The CCC uses this detailed Evidence Report to inform its statutory advice to the Government as part of the CCRA. In the 2nd CCRA this was presented as a 'Synthesis Report' published at the same time. In this advice, the CCC is free to offer its own view on the risks and opportunities facing the UK and summarise the conclusions that it has drawn from the independent Evidence Report.

The Third CCRA Evidence Report will be published in 2021, again incorporating input from hundreds of experts and thousands of review comments, similar to a dedicated country-level Intergovernmental Panel on Climate Change assessment of climate impacts.

Identifying risks and opportunities facing the UK

The key question that the CCRA aims to answer is: 'what should the priorities be in the next national and devolved adaptation policy programmes?' The UK assessment currently takes a sector-led, rather than a place-led approach, mainly due to resource constraints meaning that a detailed assessment of regional risks is not possible at present.

The first step in this approach is to identify a manageable set of risks and opportunities to consider. This 'risk listing' approach is done in close consultation with Government officials. For the first CCRA, an initial list of 700 potential risks and opportunities was summarised down to a shorter list of just over 100, which was then put through a standardised method to assess current and future magnitude in the absence of adaptation. As this CCRA was the first conducted for the UK, it took a broad look at all of the potential impacts from climate change that would arise directly from climate change in the UK.

The scope of the UK's climate risk assessments has increased over time.

For the second and third CCRAs, a shorter list of around 60 risks and opportunities has been identified, merging some of the previous list into broader categories. An important development between the first and second CCRA was the recognition that it was essential to consider climate risks to the UK from indirect and imported impacts from overseas to fully capture the range of important risks. The second and third CCRAs present evidence for the following sectors: natural environment and natural assets, infrastructure, people and the built environment, business, and international dimensions.

Assessing the urgency of climate risks

The risk assessment begins by considering the current and future level of each risk. It then asks whether current plans would manage the risk and whether more action would be beneficial in coming years.

The CCRA aims to identify where further adaptation is needed over the next five years. To do this it uses a defined methodology to produce an 'urgency' score for the risks facing the UK. This methodology is applied across the risks identified in the CCRA and is informed by the evidence base, expert judgements of the report authors, and of the CCC's Adaptation Committee.

There are three steps to this methodology:

- **What is the current and future level of risk/opportunity in the absence of further adaptation?** This step assesses risks and opportunities to the UK under the current and future climates (considering a range of possible climates and socio-economic outcomes – Box 2) for different time periods (e.g. present day, 2050s and 2080s). This assessment rates the magnitude of each potential risk as 'high', 'medium', 'low' or 'unknown', as well as the confidence ('high', 'medium', 'low') in the available evidence base. No further adaptation measures are assumed to be deployed except those in place today for this step.
- **To what extent is the risk/ opportunity going to be managed under current and expected plans?** This step assesses the extent to which future risks or opportunities would be reduced or realised by existing Government commitments for new adaptation measures (and adaptation that might reasonably be expected to happen unprompted).
- **Are there benefits to further action over the next five years?** This involves identifying if there are benefits (e.g. avoided costs, avoiding lock-in, substantial co-benefits) for additional action over the next five years in areas where current plans are expected to lead to adaptation shortfalls.

Box 2:
Dealing with uncertainty

Future climate change in the UK will depend on the level of future global GHG emissions, the global climate response to these emissions, and the specifics of how the changes in the UK differ from the global average. All of these factors contain uncertainties and need to be considered when assessing future national climate risks. There is an even greater uncertainty in future socio-economic developments that will affect the exposure and vulnerability to climate impacts. These potential futures are not well quantified, so qualitative methods such as storyline approaches are a useful way to consider the range of possible outcomes.

The CCRA aims to deal with this by sampling uncertainties across these dimensions:

- **Climate hazards:** Risks are assessed in futures stabilising at roughly 2°C or reaching 4°C above pre-industrial levels by 2100. This represents climate outcomes that are within the uncertainty range of scenarios that are consistent with best estimate global emissions under current policies. The assessment incorporates projections of how these global scenarios play out at the UK level. Other 'low probability, high impact' events are also considered separately (e.g. significant regional climate changes due to collapse in the Atlantic Meridional Overturning Circulation) to understand what impacts these outcomes could have in the UK, but are not formally used to assess the likely magnitude of each risk due to uncertainty about how likely these cases are to occur.
- **Changes in future vulnerability and exposure:** Similarly to climate, the CCRA considers scenarios of socioeconomic change where data is available (e.g. population) but also includes commentary on how unquantified socioeconomic change and climate change may interact to affect vulnerability and exposure.

Considering a range of outcomes can help make adaptation policies robust to fundamental uncertainties. The Committee recommends that adaptation planning today should be aiming to prepare for at least 2°C warming above pre-industrial levels and consider the possibility of 4°C warming above pre-industrial levels by 2100. This uncertainty is not a reason for not implementing adaptation actions today, but instead to make it resilient to what may be inevitable, and incorporating flexibility for a range of climate outcomes.

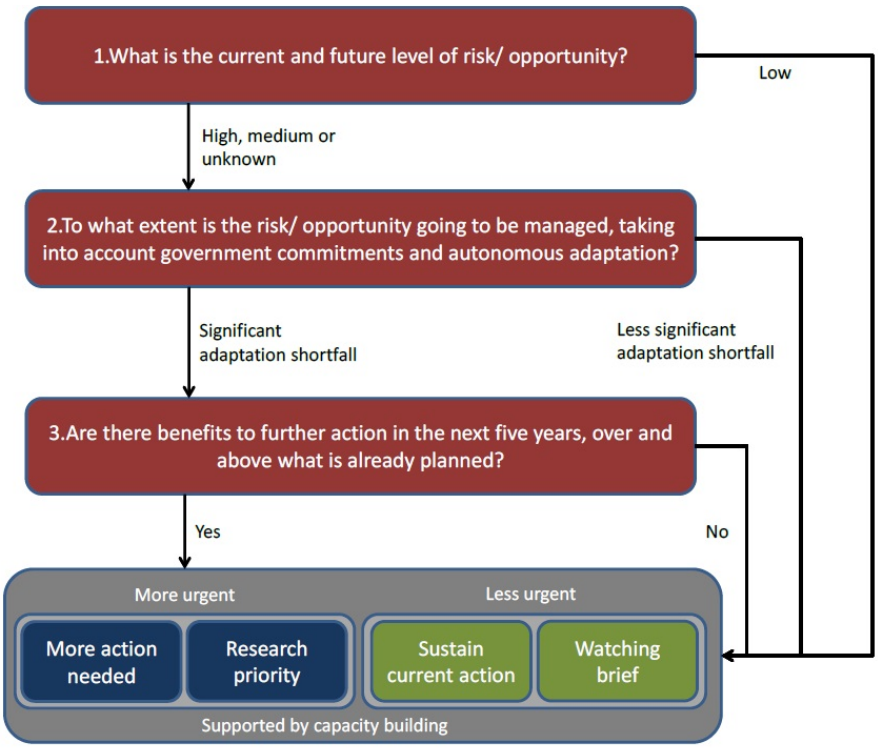
Risks are assigned across four urgency categories.

The three steps of this methodology allow each risk to be put into one of a set of urgency categories (Fig. 2):

- **More action needed:** New, stronger or different government policies or implementation activities– over and above those already planned – are needed in the next five years to reduce vulnerability to climate change.
- **Further investigation/Research priority:** Research is needed in the next five years to fill significant evidence gaps or reduce the uncertainty in the current level of understanding in order to assess the need for additional action.
- **Sustain current action:** Current or planned levels of activity are appropriate, but continued implementation of these policies or plans is needed to ensure that the risk continues to be managed in the future. This includes any existing plans to increase or change the current level of activity.
- **Watching brief:** The evidence in these areas should be kept under review, with long-term monitoring of risk levels and adaptation activity so that further action can be taken if necessary.

Risks with more urgency ('More action needed' or 'Further Investigation') are those that are highlighted to be addressed by Government policy over the next five years.

Fig. 2:
Categories of risks considered by the UK Climate Change Risk Assessment



Source: Watkiss, P. et al. (2013) *UK Climate Change Risk Assessment Evidence Report: Chapter 2, Approach and Context.*

3. The challenges of conducting an effective CCRA

The UK approach balances different evidence qualitatively.

The UK is now in its third cycle of undertaking a national climate change risk assessment and has evolved its approach to deal with various analytical and resourcing challenges over that time.

Key challenges that have emerged over this time period include:

- **Collating evidence from a disparate evidence base.** The UK approach centres on an assessment of the level of risk or opportunity under different assumptions on the level of climate change, socioeconomic development and adaptation ambition. The CCRA's approach to scoring each risk or opportunity has evolved into a criteria-based framework based on urgency (Fig. 2), rather than using a single quantitative assessment of magnitude based on climate projections, which was done in the first CCRA. This newer method allows for more evidence with different underlying assumptions to be included, as well as evidence with a range of uncertainties.
- **Treatment of risk and uncertainty.** Challenges in quantifying the tails of probability distributions for future climate hazards in a robust way means that the CCRA approach cannot rely on a classical 'probability x consequence' approach to assessing risk.

  An alternative definition of risk: 'the potential for consequences where something of value is at stake and where the outcome is uncertain' is

instead used in the CCRA. Risk is assessed at global warming levels of 2°C and 4°C, and for different levels of future adaptation effort. A separate exercise is carried out to consider distributional effects, interactions between risks and changes that fall outside of the likely range of global warming levels provided. These broader factors are included in the Adaptation Committee's advice to Government on the priorities for adaptation over the next five-year period.

The CCC acts as the project manager for the UK climate change risk assessment.

- **Running a large programme.** Large teams of experts are required to compile the CCRA Evidence Report, and the end result runs to several thousand pages that must then be summarised for decision makers. A well-established governance framework is used to effectively manage the process, with clear decision-making structures. The CCC acts as the central coordinating body for this work to make sure that it proceeds to plan. A Customer Group of the main Government bodies that will use the CCRA advises on what they require, and comments on outputs as they are produced to ensure they are fit for purpose. The CCC uses three independent review groups; technical peer reviewers, government reviewers, and other external experts, to ensure the Evidence Report outputs are robust. This also ensures that CCC is well acquainted with the evidence and any qualitative judgements when it comes to writing its own synthesis report.

Climate Change Committee

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