



The Coalition  
of Finance Ministers  
for Climate Action

# The analysis of climate impacts, adaptation costs, and adaptation benefits in the UK

Paul Watkiss Associates

Paul Watkiss

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**Topic:** Addressing the climate policy questions facing Ministries of Finance: the economic and fiscal impacts of adaptation and resilience

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In the United Kingdom there is a statutory requirement, as set out in the Climate Change Act 2008 (HM Government, 2008), for the Government to undertake an assessment of the risks to the UK of the current and predicted impact of climate change every five years. The UK has now completed three rounds of this policy cycle, which provide valuable lessons on the integration of economic analysis into national risk assessment and adaptation planning.

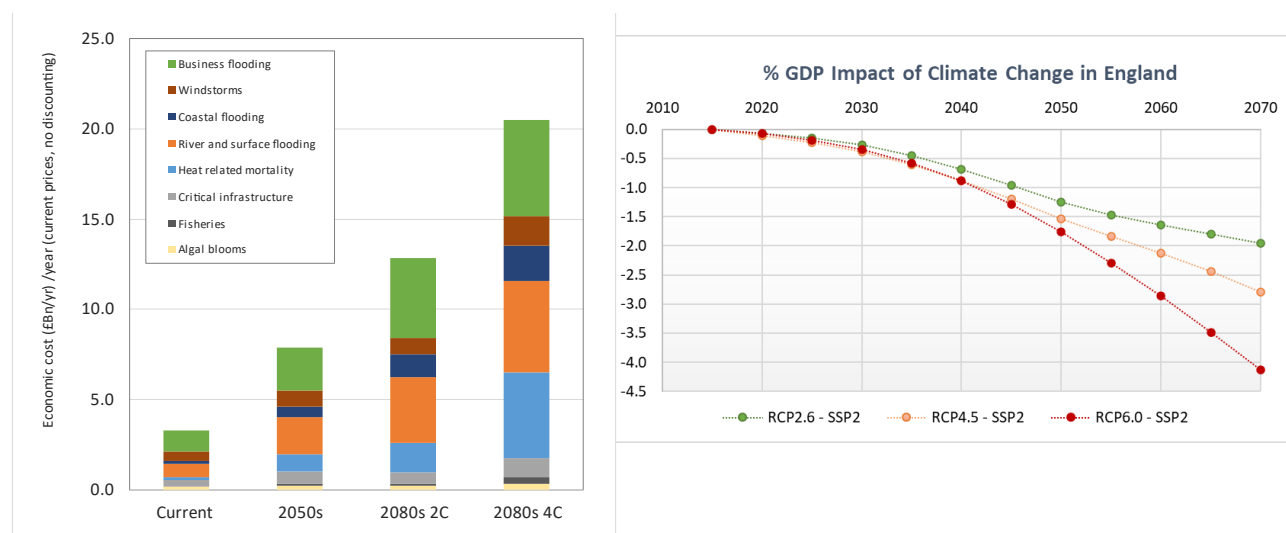
The Third Climate Change Risk Assessment (CCRA3) was undertaken from 2017 to 2021, with the technical report published in 2021 (CCC, 2021a,b) and the CCRA3 Government report published in 2022 (HM Government, 2022). The technical report focused on 61 risks and opportunities, assessing the potential magnitude of these risks, as well as the urgency for adaptation, using a three-step method (Watkiss and Betts, 2021). The CCRA3 seeks to identify where action is most urgently needed over the next five-year period, to directly inform adaptation planning, based on the following three questions:

- What are the current and future levels of risk/opportunity?
- Is the risk/opportunity being managed, based on Government commitments and other adaptation actions?
- Are there benefits to further action in the next five years, over and above that already planned?

To help inform the three steps, an economic analysis of the magnitude of risks and an analysis of the costs and benefits of further adaptation actions were undertaken (Watkiss et al., 2021).

The analysis of the economic costs of climate change used a hybrid of complementary methods and evidence lines, using bottom-up approaches to individually assess the 61 risks and opportunities. It used sector models such as those to assess the physical impacts and economic damages from floods, plus expert elicitation to fill in the gaps (as only a limited number of sector models exist). The bottom-up analysis was complemented by a top-down approach that input the sectoral impacts into a macroeconomic model (i.e., a computable equilibrium model) to assess the headline impacts of climate change on GDP.

**Figure. 1. Left: estimated annual costs of climate change in the UK for a selection of risks. Right: net aggregate economic costs of climate change for warming scenarios (Representative Concentration Pathways [RCP] 2.6, 4.5 and 6.0) for England**



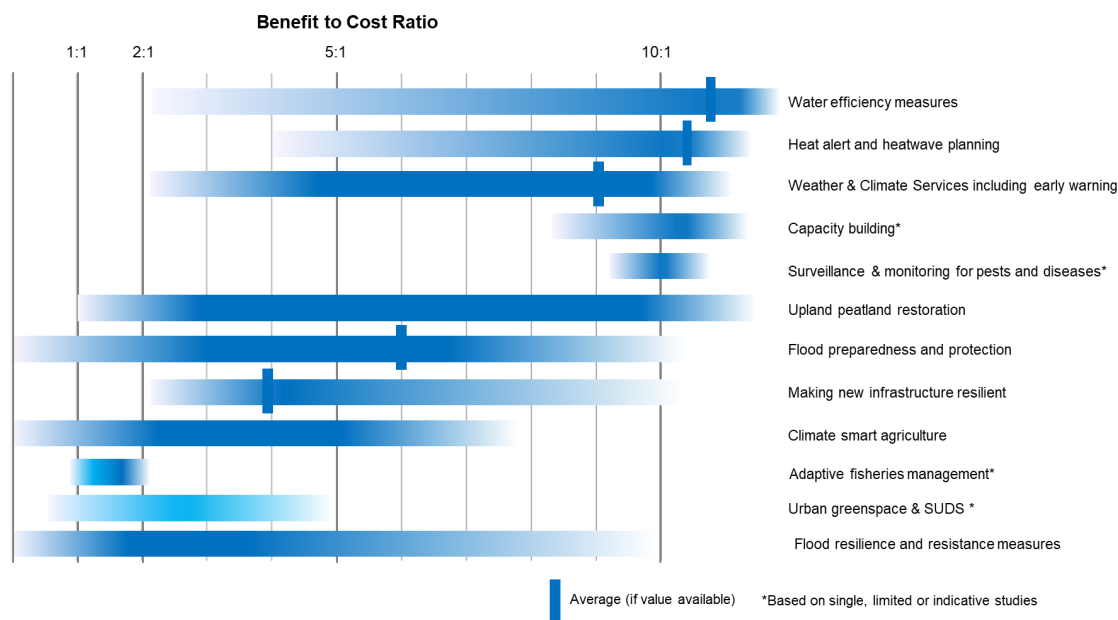
Sources: Author, based on Watkiss et al. (2021) (left); Author, based on COACCH project (Bosello et al., 2020) (right)

While there is some uncertainty over the size of these impacts, influenced by the approach and choice of model, a robust finding was that impacts in the UK will be significant. The studies carried out for CCRA3 also show that most of the physical changes from climate change over the next 20 years are already locked-in and can *only be reduced by adaptation* (the benefits of global mitigation are very high but come later).

Further work has been undertaken in the UK since the CCRA3, including a detailed economic and fiscal analysis of the potential impacts of climate change by the UK economic regulator, the Office for Budget Responsibility (OBR). This analyzed the GDP losses in the UK from climate change and also looked at the acute fiscal costs that could arise due to additional demands on emergency and other public services, damage to publicly owned infrastructure and other assets, and calls to compensate households and businesses for uninsured damage.

To help inform the third step of CCRA3, on the benefits of further action, the analysis also undertook a bottom-up review of the potential costs and benefits of adaptation for the 61 risks and opportunities. This found that many (but not all) early adaptation investments can deliver high value for money. A selection of these are summarized below (Watkiss et al., 2021, reproduced in CCC, 2021a). The 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.

**Figure 2. Benefit-cost ratios of a selection of adaptation measures included in the CCRA3**



Notes: the figure shows the indicative benefit-to-cost ratios (BCRs) and ranges for a number of adaptation measures. The vertical bars show where an average BCR is available, either from multiple studies or reviews. It is stressed that BCRs of adaptation measures are highly site and context specific and there is future uncertainty about the scale of climate change: actual BCRs will depend on these factors.

Source: Watkiss et al. (2021)

As part of its statutory requirements, there is also a duty for the UK Government to publish a national adaptation program after the CCRA, setting out how it will address these risks. In the UK, adaptation is devolved, and so England, Scotland, Wales, and Northern Ireland prepare their own adaptation programs.

The Third National Adaptation Programme (NAP3) was published in 2023 (Defra, 2023). This set out the Government’s proposed action over the following five years (2023–2028) to address the risks and opportunities identified in CCRA3. This includes 511 individual adaptation actions falling within the

scope of the UK Government's responsibilities in relation to England, and its non-devolved functions in relation to the rest of the UK.

Globally, many countries have now assessed the costs of their national adaptation programs, but almost none have assessed the economic benefits of these plans. This is a major gap. However, the analysis of the economics of adaptation is still at an early stage, and top-down and macroeconomic frameworks are unable to assess adaptation or can only consider adaptation in a highly stylized way (van Maanen, 2023). Bottom-up analysis is more widely used, but faces challenges because adaptation responses are risk, location, context, and time specific, and compounded by the high levels of uncertainty associated with future climate change. This means adaptation is not a simple linear cost-optimization exercise, but a process, which requires adaptive management and adaptation pathways.

An initial analysis of the potential costs of adaptation to deliver NAP3 (Watkiss, 2022) estimated that these could be £5 billion to £10 billion a year. Work is underway (under the ACCREU project)<sup>1</sup> to refine these estimates, and to estimate the economic benefits of NAP3. The current analysis splits adaptation costs into three main categories. First, climate resilience in planned programs and investments, where adaptation is a secondary objective, for example, the costs of including climate change in the design of the HS2 high-speed rail network under construction in England. Second, targeted adaptation programs and investments, where adaptation is the primary objective, for example, increased spending on coastal defenses to address sea-level rise, and third, sitting between these categories, investments where adaptation is one of a number of objectives, for example, investing in peatland restoration, which delivers multiple benefits, including enhanced climate resilience (both on- and off-site).

An adaptation analysis, similar to the approach taken by Bachner et al. (2019), is also underway to identify key risks (including flooding and heat) and assess the implications for GDP and for public finances using CGE models. Such studies can assess not only whether adaptation can reduce the macroeconomic disruption of climate change cost-effectively, but also whether it has net benefits for public finances—because even though it often requires higher public expenditures, it reduces negative impacts on revenues and increased spending.

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<sup>1</sup> <https://www.accreu.eu/>.

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