

Policy Brief

The Macroeconomic and Fiscal Effects of Climate Change and Adaptation in Europe and Globally

ACCREU (Assessing Climate Change Risk in Europe) is a Horizon Europe research project that aims to advance knowledge of the economics of climate change, on both impacts and adaptation.

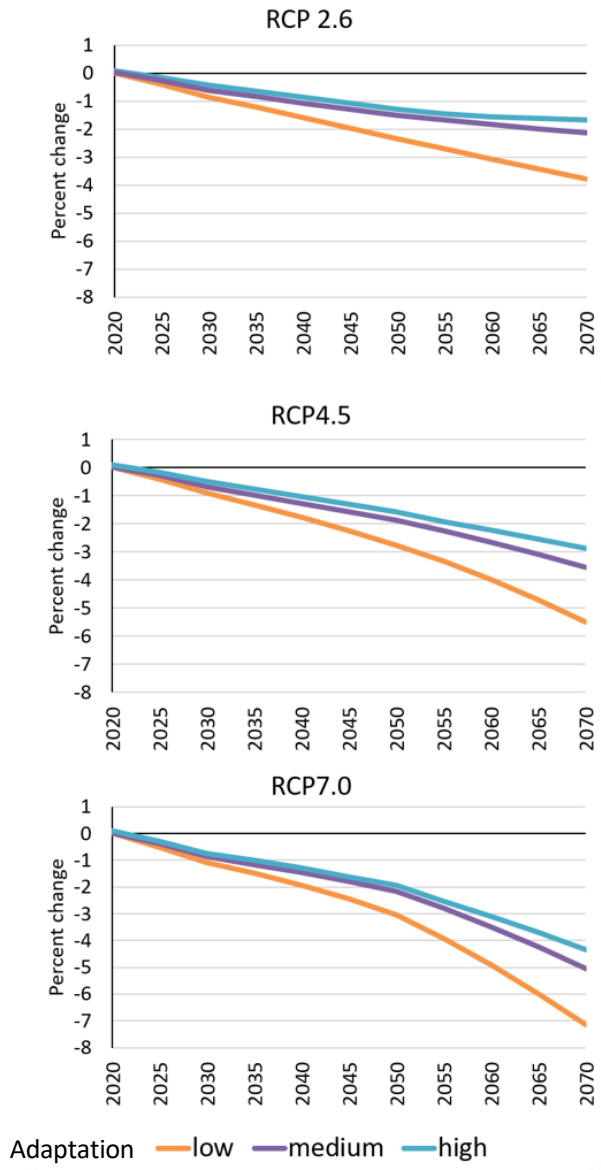
The project has developed new analysis of the impacts of climate change in Europe using a set of sector models. These results have then been integrated into two macroeconomic models, the ICES model and the COIN-INT model, to assess the overall economy-wide costs of climate change. The results of this analysis are summarised here, and the full findings are in the deliverables and the longer technical policy brief.

The results from the COIN-INT model are shown in Figure 1 over the page. This shows the **macroeconomic costs for Europe** for different warming scenarios, as well as for low, medium and high levels of adaptation, for the SSP2 scenario.

The first key message from this analysis is that climate change is projected to lead to large negative GDP impacts in Europe, with losses of up to 3 per cent of annual GDP by 2050 rising to almost 7 per cent by 2070, under the high warming RCP7.0 scenario.

The positive effects of global **mitigation** can be seen by looking at the RCP2.6 scenario, which is approximately consistent with the 2°C goal. Under this scenario (with low adaptation), impacts fall to 2.5 per cent of annual GDP in 2050 and just over 3.5 per cent by 2070, halving the long-term economic costs of climate change. However, this still leaves high residual damages, especially over the next few decades. The positive effects of **adaptation** can be seen by looking at the different adaptation ambition levels in each panel of Figure 1. Even taking account of its costs, adaptation delivers large macroeconomic benefits.

Figure 1. GDP climate change impact (%) for the EU and UK, Switzerland and Norway, for different RCPs and adaptation levels.



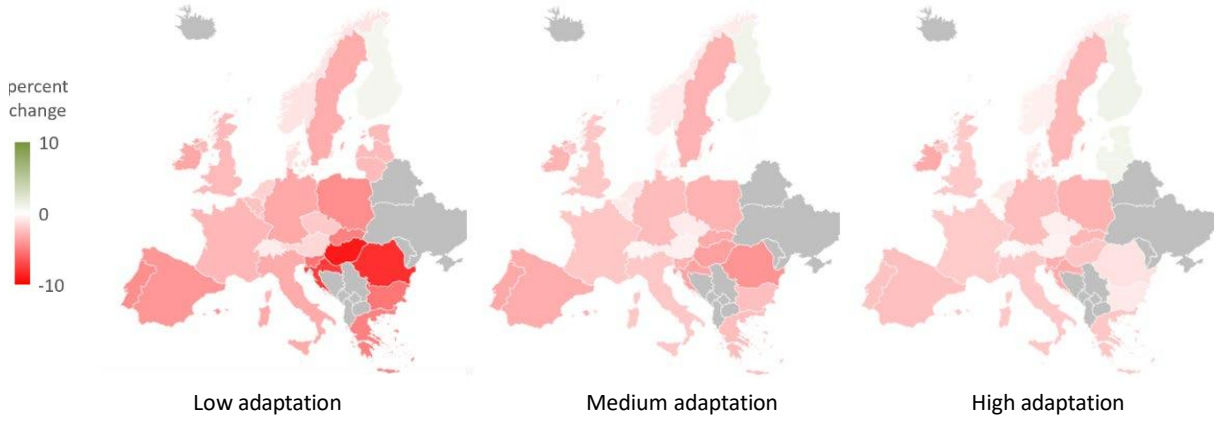
Under the RCP7.0 scenario, a high adaptation level could reduce impacts by around a third in 2050 (to 2 per cent of annual GDP) and by almost half by 2070 (to just over 4 per cent). Similar relative reductions are also seen with high adaptation scenarios for RCP2.6 and RCP4.5.

The results also indicate that a combination of both mitigation and adaptation is needed to achieve low levels of residual impact. This can be seen in the RCP2.6 panel (top blue line).

A second key finding is that there are strong distributional patterns to these impacts across Europe. This is shown in Figure 2 for RCP4.5. Central-Eastern and Southern Europe experience disproportionately higher macroeconomic costs under all warming scenarios. For example, in a medium-warming scenario (RCP4.5) GDP losses for Central-Eastern Europe could reach over 5 per cent by 2050 and 9 per cent by 2070. Impacts are lower but still strongly negative for Western and Northern Europe.

These losses are significantly smaller with higher levels of adaptation ambition (Figure 2, right). Indeed, all countries experience net GDP gains with high adaptation. However, residual damages remain even after adaptation. These residual impacts are more significant in absolute terms for Central-Eastern and Southern Europe, especially under higher warming scenarios.

Figure 2. GDP impact (%) for RCP4.5 in 2050 for different adaptation ambition levels.



Alongside the macroeconomic analysis, ACCREU has assessed the potential **fiscal impacts of climate change on the public finances in Europe**, and the benefits of adaptation in reducing these negative impacts.

COIN-INT model results, shown below, are aimed at assessing the impacts on public budgets from climate change in Europe. The model considers how climate shocks raise government expenditure and at the same time reduce tax revenues, from the combination of damage to capital, labour, health impacts and productivity losses. The analysis also considers government adaptation investment. Adaptation reduces these impacts, but it adds pressure from increased spending. In this case, a balanced budget is assumed, with spending on adaptation made possible by cuts elsewhere.

The results show the effects on revenues and expenditure, for RCP4.5 (2050) for the three adaptation levels. The expenditures include spending on adaptation (shown above the zero line). The net effects (red line) show whether the reduction in climate impacts is offset by higher adaptation costs.

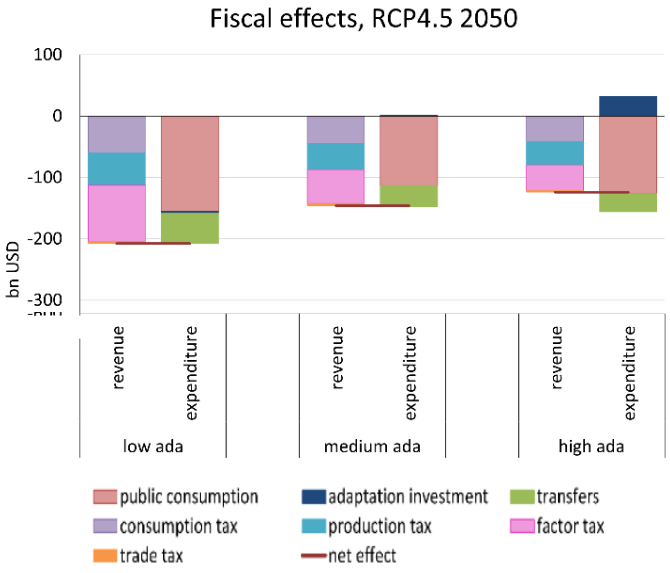


Figure 3. Fiscal effects for Europe (revenue and expenditure) for different adaptation levels in 2050 (RCP4.5)

The analysis finds that higher adaptation spending leads to net fiscal benefits, as shown by the lower level of net impacts with greater adaptation investment towards the right (though fiscal impacts remain even with adaptation).

In these scenarios, adaptation is front-loaded, so adaptation costs are higher in 2050 than in 2070 (not shown). Benefits, however, are larger in 2070, reflecting both the greater climate impacts later in the century and the large cumulative stock of adaptation already in place. The results show that adaptation can expand fiscal space, even with higher public spending.

These results hold true for all European countries, with adaptation increasing fiscal space in every case. However, the level of benefit varies. Countries in Western Europe have the highest return on investment, while many countries in Central-Eastern Europe experience smaller fiscal gains, because they have higher adaptation investment costs.

A deep dive was also undertaken for the UK, looking specifically at the fiscal effects of flood adaptation, and investigating differences in financing approaches, comparing a balanced budget with borrowing. The results show that the choice of financing approach does matter.

The ICES model, which has a high level of regional disaggregation (NUTS-2), was also used to investigate the economic costs of climate change. This projects larger economic impacts than the COIN-INT model (see the longer policy brief and deliverable).

A more detailed analysis with this model also shows that climate change increases inequality in Europe. The analysis found that a clear pattern emerges, with the GDP per capita gap widening as climate change intensifies. Southern and Central-Eastern regions lose the most in per capita terms, and poorer regions suffer disproportionally larger losses.

The ACCREU project has also used the new sector modelling and functions to look at the **global economic costs of climate change**, and to assess the potential role of mitigation and adaptation policy.

This analysis has been undertaken with integrated assessment models (IAMs). ACCREU has used three IAMs (REMIND, WITCH and MIMOSA) and run these using new impact and adaptation functions for sea-level rise, river floods and labour productivity.

At the global scale, the results show that under a scenario of no policies, climate change will lead to high economic costs, although the relative impacts vary across the world, with the highest relative impacts (as a % of GDP) in Africa and Asia.

The project has then assessed the effects of different combinations of mitigation and adaptation – and their costs and benefits - in reducing these damages, using optimisation analysis. The results are shown in Figure 4 below.

This finds that economic damage costs are reduced significantly by mitigation (MIT), and by adaptation (ADA), when these are implemented individually. However, larger reductions in impacts occur when mitigation and adaptation are combined together (MIT_ADA).

The analysis has also assessed the effects of the timing of policy. For example, in MIT_then_ADA, adaptation is optimised in a separate second stage, leading to the lowest damages, and is preferable to a scenario where mitigation comes later (MIT_late).

The ACCREU study has undertaken additional analysis to examine how lower adaptation effectiveness and potential limits to adaptation affect these results (see technical policy brief). This analysis finds that the assumptions on these factors have a very large effect on the overall results. This highlights that further research is needed to obtain better information on effectiveness, costs and limits of adaptation (including both soft and hard limits), and to bring these results into these modelling studies.

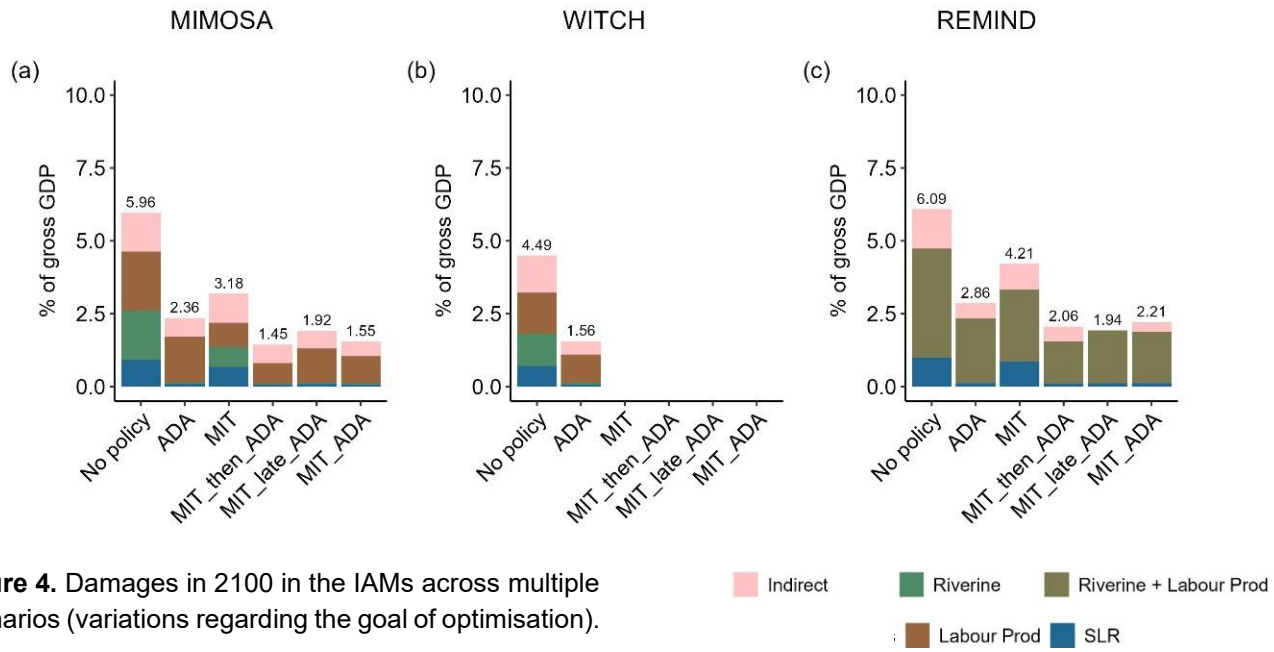


Figure 4. Damages in 2100 in the IAMs across multiple scenarios (variations regarding the goal of optimisation).

ACCREU, 2026. Cover photograph: I-Stock.
The ACCREU project is coordinated by Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC). To find out more about the project, please visit https://www.accreu.eu/

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