



Annual Review 2024

# Preparing for Ireland's Changing Climate

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CLIMATE  
CHANGE  
ADVISORY  
COUNCIL

# Annual Review 2024: Preparing for Ireland's Changing Climate

Submitted to the Minister for the Environment, Climate and  
Communications on 6 September 2024

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## Summary for All

In this sixth part of the 2024 Annual Review, the Climate Change Advisory Council emphasises the urgent need for climate adaptation and increased resilience in Ireland. Climate adaptation refers to taking action to prepare for and adjust to both the current and future impacts of climate change.

Globally, and for the first time, over the full period from July 2023 to June 2024, surface temperatures were at least 1.5°C warmer than in pre-industrial times. Many notable extremes of heat and flooding have occurred around the world over the past 18 months. In 2023, Antarctic sea ice levels hit a substantial record low.

Ireland's climate is also changing, with impacts for people, places and nature: 2023 was the warmest and wettest year on record. An extreme marine heatwave off the west coast in June 2023 resulted in unprecedented sea surface temperatures, increasing mortality risks for key marine species. Between autumn 2023 and spring 2024, heavy rainfall caused significant disruption to farming activity and storms severely eroded coastlines, damaging roads and properties in Wexford and north Dublin. Both the heavy winter/spring rainfall and the flooding in Midleton in October 2023 were made more likely and more severe because of climate change.

Proactive adaptation is urgently needed to prepare for the rapidly emerging climate risks in Ireland, as well as the global climate risks that can impact Ireland (e.g. through trade or food production). Adapting to climate change will require significant investment but will save money and offer multiple co-benefits over time. Sectoral adaptation plans are key for enhancing resilience in communities, infrastructure and nature and have additional benefits for water, soil and air quality, but to date these have not been adequately implemented, evaluated or resourced.

### Key recommendations

- ▶ Government departments and agencies leading on the development of sectoral adaptation plans should:
  - ▶ allocate and ringfence funding within annual budgets for measures to build resilience to climate change,
  - ▶ ensure that new sectoral adaptation plans are ambitious, effective, costed and include indicators to allow progress to be measured.
- ▶ Commercial semi-state agencies and regulators need to budget for and prioritise projects that enhance the resilience of critical infrastructure such as ports, railways, the electrical grid and key roads.
- ▶ The Government should immediately develop and implement a coastal management plan to build resilience in coastal areas and communities against climate impacts, including sea level rise and coastal erosion.
- ▶ Greater capacity for climate adaptation action is required across all areas of national and local government. A clear programme for staff resourcing and training to build this capacity is needed by the end of 2025.
- ▶ The National Adaptation Steering Committee should address cross-cutting policy issues, including coastal management, health impacts and disaster risk reduction.
- ▶ Relevant Government departments and agencies should work together to create a national climate damage risk register to track the costs and impacts of extreme events across Ireland and improve policy responses.
- ▶ The Government must ensure that sufficient resources are dedicated to conservation initiatives that increase the resilience of nature to climate change.

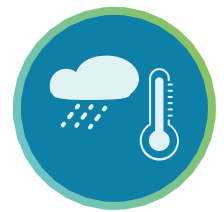


## Abbreviations

AMOC	Atlantic Meridional Overturning Circulation
CARO	Climate Action Regional Office
CMIP	Coupled Model Intercomparison Project
COP	Conference of the Parties
DECC	Department of the Environment, Climate and Communications
DPENDR	Department of Public Expenditure, NDP Delivery and Reform
EPA	Environmental Protection Agency
EUCRA	European Climate Risk Assessment
FIF	Future Ireland Fund
GDP	gross domestic product
ICNF	Infrastructure, Climate and Nature Fund
LA CAP	local authority climate action plan
NAF	National Adaptation Framework
NCCRA	National Climate Change Risk Assessment
NPWS	National Parks and Wildlife Service
RCP	representative concentration pathway
UNFCCC	United Nations Framework Convention on Climate Change
WWA	World Weather Attribution



Acknowledgements	iii
Summary for All	iv
Abbreviations	v
Contents	vi
<b>1. Ireland's Changing Climate</b>	<b>1</b>
Key observations	2
1.1. Introduction	3
1.2. Latest scientific evidence for observed climate change	3
1.2.1. State of the global climate	3
1.2.2. State of Ireland's climate	4
1.2.3. Attribution studies – linking climate change and extreme events	6
1.3. Future climate projections, monitoring and impacts in Ireland	7
1.3.1. Projections	7
1.3.2. Monitoring	8
1.3.3. Climate impacts for Ireland	9
<b>2. Adaptation Progress in Ireland</b>	<b>11</b>
Key observations	12
Key recommendations	12
2.1. Introduction	14
2.2. Science and policy context	15
2.2.1. International	15
2.2.2. European	16
2.2.3. National	17
2.3. Key themes of focus	17
2.3.1. Policy framing, capacity and coherency	17
2.3.2. Economic impacts and costs	18
2.3.3. Financing for adaptation	19
2.3.4. Status of flood preparedness	21
2.3.5. Communities and coasts	21
2.3.6. Local adaptation planning and action	22



2.4. Adaptation Scorecard monitoring	23
2.4.1. Scorecard updates on 2023	23
2.4.2. Methods	24
2.4.3. Results	24
2.4.4. Key findings	26
2.5. Key overall gaps	27
2.5.1. Adaptation financing	27
2.5.2. Adaptation targets and indicators	27
2.5.3. Systemic consideration of cross-cutting issues	28
2.5.4. National climate damage risk register	28
2.5.5. Land use planning	28
References	29



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# 1.

## Ireland's Changing Climate







## Key observations

- ▶ The year 2023 was the warmest and wettest on record for the island of Ireland, replacing 2022 as the previous warmest year on record.
- ▶ For the first time, the global average temperature breached 1.5°C above pre-industrial levels for the 12 consecutive months to June 2024, while Antarctic sea ice reached record low extents in 2023. The severe effects of climate change seen across many parts of the world over the 12 months to June 2024 are a stark warning of how the future will be with long-term warming over and above the 1.5°C threshold.
- ▶ Human-induced climate change is making heavy rainfall, which caused flooding across Ireland and the UK between October 2023 and March 2024, about 20% more intense, and the high-impact Middleton flooding event in October 2023 was made more likely and more severe because of climate change. These findings are from climate attribution studies carried out by the World Weather Attribution group.
- ▶ The high volumes of autumn, winter and spring rainfall had profound effects on livestock and tillage in Ireland during 2023 and the first half of 2024. Fields were flooded and farmers faced difficulties in gaining access to them to plant spring crops and to put animals out to graze.
- ▶ In June 2023, the Atlantic Ocean west of Ireland and around the UK was impacted by a marine heatwave that was classified as 'extreme' and in some areas 'beyond extreme', with sea surface temperatures up to 5°C above average. The marine heatwave increased the mortality risks for kelp, seagrass, fish and oysters in Irish waters.
- ▶ Significant impacts from sea level rise and coastal erosion arising from storm events are increasing in Ireland. Severe continued coastal erosion was reported in Wexford and in Portrane in County Dublin during storm events in 2023 and 2024, resulting in the loss of coastline and damage to access roads and properties.



### 1.1. Introduction

This chapter summarises the most recent developments in the understanding of Ireland's changing climate in the context of broader global climate changes. It examines how the climate is currently changing and considers projected future changes. This information highlights the urgency of both adaptation and mitigation actions in global and Irish contexts. It is based on recent developments and information sources, including international and national 'state of the climate' reports and other relevant research.

### 1.2. Latest scientific evidence for observed climate change

#### 1.2.1. State of the global climate

The report on the state of the global climate in 2023 by the World Meteorological Organization showed that records were again broken in 2023 for greenhouse gas levels, surface temperatures, ocean heat and acidification, sea level rise, Antarctic sea ice cover loss and glacier retreat.<sup>[1]</sup> Key statistics from the 2023 report are that:

- ▶ 2023 was the warmest year on record, with an average temperature of 1.45°C above the pre-industrial average.
- ▶ Ocean heat content reached its highest level in the 65-year observational record.
- ▶ Global mean sea level reached a record high, and the rate of sea level rise has more than doubled in the past 10 years (2014–2023) compared with the first decade of the satellite record (1993–2002).
- ▶ Antarctic sea ice extent reached an absolute record low in February 2023, with the annual maximum extent about 1 million km<sup>2</sup> below the previous record low maximum extent.

Europe is recognised as the fastest warming continent, with extreme heat becoming more frequent and downpours and other precipitation extremes increasing in severity.<sup>[2]</sup> The *European State of the Climate 2023*, a joint publication (for the first time) between the Copernicus Climate Change Service and the World Meteorological Organization,<sup>[3]</sup> provides an analysis of changing climate conditions, including extreme events and their impacts, as well as a discussion of climate policy and action with a focus on human health. Key findings from the report are as follows:

- ▶ A record number of days with 'extreme heat stress' were recorded across Europe in 2023. There is an increasing trend in the number of days with at least 'strong heat stress' across Europe.
- ▶ In June 2023, the Atlantic Ocean west of Ireland and around the UK was impacted by a marine heatwave that was classified as 'extreme' and in some areas 'beyond extreme', with sea surface temperatures up to 5°C above average.
- ▶ During 2023, Europe experienced approximately 7% more precipitation than average.
- ▶ In 2023, one-third of the European river network saw river flows exceeding the 'high' flood threshold and 16% exceeding the 'severe' flood threshold.
- ▶ According to preliminary estimates from the International Disaster Database, flooding in 2023 affected an estimated 1.6 million people in Europe and caused around 81% of the year's economic losses due to climate impacts on the continent, amounting to more than €92 billion in damages.<sup>[4]</sup>



Data and reports from the Copernicus Climate Change Service during 2024<sup>[5]</sup> further showed that the global average temperature breached 1.5°C above the pre-industrial level for the 12 consecutive months up to June 2024 for the first time. The severe effects of climate change seen across many parts of the world over the 12 months to June 2024 are a stark warning of a future with long-term warming over and above the 1.5°C threshold. Extreme weather events continued to lead to severe socio-economic impacts:

- ▶ Unprecedented wildfires were experienced in Canada in the summers of both 2023 and 2024.<sup>[6]</sup>
- ▶ Hurricane Beryl, fuelled by exceptionally high sea surface temperatures and the earliest recorded category 5 hurricane in the Atlantic basin, wreaked havoc in the Caribbean in July 2024.<sup>[7]</sup>
- ▶ Major heatwaves affected southern Europe and North Africa in the summer of 2023.<sup>[1]</sup>
- ▶ Intense tropical cyclones were experienced. Tropical Cyclone Freddy was one of the world's longest-lived cyclones and had major impacts in Australia, Mozambique and Malawi. Tropical Cyclone Mocha was one of the most intense cyclones ever observed, displacing 1.7 million people, mainly in India, Bangladesh, Sri Lanka and Myanmar.<sup>[1]</sup>
- ▶ Severe drought in southern Africa prompted five countries in the region to declare a national disaster by July 2024.<sup>[8]</sup>

### 1.2.2. State of Ireland's climate

Met Éireann's *Provisional State of the Irish Climate Report 2023*<sup>[9]</sup> revealed the following:

- ▶ 2023 was the warmest year on record for Ireland by a large margin at an average of 11.20°C, which is 1.65°C above the 1961–1990 long-term average and 0.35°C warmer than 2022. This makes 2023 the second consecutive warmest year on record.
- ▶ 2023 was also the wettest year on record nationally. March 2023 was the wettest March on record, and July 2023 was the wettest July on record.
- ▶ Eleven named storms affected Ireland in 2023, with storm force winds reported during Storm Noa in April and Storm Fergus in December. Storm Babet brought high rainfall, significant flood damage and reports of coastal erosion in October.<sup>a</sup>

According to Met Éireann's monthly weather statements<sup>[10]</sup> and climate statement for spring 2024,<sup>[11]</sup> similar trends continued in 2024, with the exception of January, when below average rainfall and temperatures were experienced in most parts of Ireland. Spring 2024 was the second warmest on record, and provisional gridded rainfall data suggest that spring 2024 was the sixth wettest on record. Three named storms (Storms Isha, Jocelyn and Kathleen) directly affected Ireland between January and April 2024, bringing high winds and heavy rainfall. May 2024 was the warmest May in Ireland on record with an average temperature of 13.08°C, which is 1.74°C higher than the 1991–2020 long-term average.<sup>[12]</sup> This is only the second time that the May average temperature has exceeded 13°C. Research published in 2024 has found a significant increase in the prevalence of

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**a** Research published in February 2024 observes that the open-endedness of the fifth category of the hurricane wind scale is becoming increasingly problematic in a warming world. In their paper the researchers consider an extension to a sixth category of the Saffir–Simpson wind scale to communicate that climate change has caused the wind speeds of the most intense tropical cycles to become significantly higher.<sup>[13]</sup>



extreme temperatures in Ireland: the study reports that a temperature of 33°C recorded at Dublin's Phoenix Park has gone from being a 1-in-180-year event in 1942 to a 1-in-9-year event in 2020.<sup>[14]</sup>

Rainfall associated with storm events continues to become more intense. Notable events in 2024 include 45.3 mm of rain recorded on 1 March at Dublin airport (highest ever daily rainfall for March on record), 36.4 mm of rain recorded on 8 February at Johnstown Castle, Wexford, and 36.2 mm of rain recorded on 21 January at Claremorris, Co. Mayo, during Storm Isha. Although rainfall was below average in most places in June 2023, intense thunderstorm activity occurred from 13 to 20 June on consecutive days and again on 25 June. This resulted in flash flooding events, notably in Dublin and Kerry, with operations at University Hospital Kerry in Tralee being severely impacted as a result of flooding. Significant flooding and extensive damage also occurred in Midleton, Co. Cork, in October 2023 as a result of Storm Babet.<sup>b</sup> The high volumes of autumn, winter and spring rainfall had profound effects on livestock and tillage in Ireland during the second half of 2023 and the first half of 2024. Fields were flooded and farmers faced difficulties gaining access to them to plant spring crops and to put animals out to graze.

### Case study: marine heatwaves

As climate change continues, global average sea surface temperatures will continue to increase. One consequence of this is an increased intensity of marine heatwaves; an increased number of days in which a marine heatwave occurs and the possibility that the entire globe will reach a permanent state of marine heatwave.<sup>[15]</sup> The extreme marine heatwave that occurred off the west coast of Ireland in June 2023 led to sea surface temperatures of almost 4°C above average<sup>[15]</sup> (and almost 5°C above average across Irish and UK waters), and Met Éireann indicated that the elevated sea surface temperatures may have been linked to the extreme precipitation and thunderstorms experienced in the summer months. This prompted warnings of increased mortality risks for kelp, seagrass, fish and oysters in Irish waters.<sup>[16]</sup> Marine heatwaves are likely to have wide-ranging, severe and irreversible additional impacts, including ecological disruption, change in species distribution and threats to aquatic life, as well as economic impacts on fisheries and tourism.

Sea level rise and coastal erosion from storm events are becoming increasingly critical. Current evidence suggests that Ireland will be affected by sea level rise that will reach up to 1 metre by the year 2100 because of climate change<sup>[17]</sup> and that this will lead to increased risks from storm erosion and flooding with considerable localised impacts. Importantly, faster increases in sea level arising from low-confidence processes associated with the rate of loss of the Greenland and Antarctic ice sheets cannot be ruled out.<sup>[18]</sup>

Severe continued coastal erosion was reported in Wexford<sup>[19]</sup> and in Portrane in County Dublin<sup>[20]</sup> during storm events in 2023 and 2024, resulting in the loss of coastline and damage to access roads and properties. There is a need to develop management responses to address this vulnerability beyond the coastal protection measures supported through the Office of Public Works' Minor Flood Mitigation Works and Coastal Protection Scheme. The need for national coastal erosion hazard

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**b** Further details of the Midleton flooding in County Cork are included in *Section 2.3*.



mapping is identified in the report of the Inter-Departmental Group on National Coastal Change Management Strategy,<sup>[17]</sup> and it is noted that this should include an assessment of the potential impact of a range of sea level rise scenarios on coastal erosion rates to ensure that areas at highest risk of erosion due to climate change can be identified.

Volume 1 of Ireland's Climate Change Assessment,<sup>[21]</sup> launched in January 2024, sets out the state of knowledge of the physical science basis of climate change, both globally and nationally. The main findings for Ireland can be summarised as follows:

- ▶ Annual average temperatures are now approximately 1.0°C higher than they were in the early 20th century. Sixteen of the top 20 warmest years since 1900 have occurred since 1990.
- ▶ Median annual precipitation was 7% higher in the period 1991–2020 than in the 30-year period 1961–1990. Overall, when aggregated, there has been an increase in heavy precipitation extremes across a range of indicators.
- ▶ Consistent with global open ocean changes, Irish marine waters have experienced long-term acidification due to the uptake of anthropogenic atmospheric carbon dioxide.
- ▶ In Irish waters, there have been substantial changes in marine ecosystems, including changes in the seasonality and abundance of many species, including phytoplankton and zooplankton at the base of the food web. Many of these changes are consistent with a changing climate.
- ▶ Global climate changes have been modified in Ireland by proximity to the North Atlantic and by internal climate system variability, mainly, but not exclusively, related to variations driven by the North Atlantic. Most notably, the Atlantic Multidecadal Variability explains successive multidecadal periods when Ireland has warmed or cooled relative to global trends.<sup>c</sup>

### 1.2.3. Attribution studies – linking climate change and extreme events

The field of event attribution science – linking climate change and individual extreme events – continues to evolve. Three significant studies were undertaken on this issue in Ireland and the UK in 2023/24 to ascertain if climate change made certain extreme events more severe and more likely to occur and, if so, by how much. Attribution analysis of three events was carried out: the storm rainfall across Ireland and the UK between October 2023 and March 2024,<sup>[22]</sup> the flood event that occurred in Midleton, Co. Cork, in October 2023,<sup>[23]</sup> and the climate change signal emerging in temperature and precipitation extremes experienced across Ireland.<sup>[24]</sup>

The study on seasonal precipitation by the well-respected World Weather Attribution (WWA) team found that human-induced climate change made the heavy storm downpours that caused flooding across Ireland and the UK between October 2023 and March 2024 about 20% more intense.<sup>[21]</sup> Rainfall associated with storms is becoming more intense and more likely in many parts of the world as a result of global warming. Across the UK and Ireland, storms as intense as those that occurred in the 2023/24 season occurred about once every 50 years in the pre-industrial climate. However, in today's climate, similarly intense storm rainfall is expected to occur about once every 5 years. Climate change has also increased the amount of rainfall in these storms. Models agree on the direction of change: combining observations and models indicates that average precipitation on stormy days has increased by about 20% as a result of human-induced climate change.

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<sup>c</sup> The Atlantic Multidecadal Variability, or Atlantic Multidecadal Oscillation, is the variability in the surface temperature of the North Atlantic Ocean over a period of several decades.



The same study found that climate change also had a strong influence on autumn and winter total rainfall, which led to major agricultural impacts. In the cooler, pre-industrial climate, wet periods such as the October 2023 to March 2024 season occurred at most once every 80 years. But, in today's climate, they have become at least four times more likely and are expected to occur about once every 20 years. The study estimates that climate change contributed to increasing the amount of total rainfall by about 15%. If warming reaches 2°C, similar periods of rainfall that can saturate soils and cause large agricultural losses will become much more common and will be expected to occur about once every 13 years.

The second attribution study was undertaken by the WWA group, Maynooth University and Met Éireann.<sup>[22]</sup> In October 2023, Storm Babet brought record rainfall amounts to south-west Ireland, with 2 days of intense rainfall falling on soils that were already saturated by above average rainfall over the preceding 3 months. Midleton in County Cork was severely impacted by flooding, and the attribution study assessed to what extent human-induced climate change altered the likelihood and intensity of the heavy precipitation that caused these impacts. It found that over County Cork the likelihood of 2-day October rainfall at least as high as that which occurred on 17 and 18 October 2023 has more than doubled and the intensity has increased by around 13% compared with pre-industrial levels because of global warming. This result has high confidence, with agreement between models and observations. At 2°C of warming, there is also high confidence of further increases in the likelihood and intensity of such events. Analysis of the main drivers of flooding in Midleton showed, overall, that changes in extreme rainfall due to anthropogenic climate change drove more intense flooding in October 2023 and that such changes are likely to continue with further warming. Critically, the study highlighted how, by chance, the floodwaters coincided with a spring low tide, which avoided an even worse outcome for the town of Midleton. Future events at Midleton or elsewhere around Ireland's coast may occur at high tide and/or be associated with a storm surge, leading to far worse outcomes. The study examined the catchment response upstream of Midleton at the flood's peak. It also assessed land use change in the catchment, which was found to have made a minor contribution to the flooding relative to climate-related factors. However, the extent of increased run-off in the town was not assessed.

The third study examined the emergence of a climate change signal in long-term Irish meteorological observations.<sup>[23]</sup> It found that an emerging climate signal is discernible for Ireland. Analysis of weather station-based observations and evaluation indices identified the largest changes in annual mean temperature. Increases in annual rainfall totals are unusual relative to the early industrial climate recorded at western stations. Large increases in winter totals are apparent, indicating an increased flood risk with continued warming.

## 1.3. Future climate projections, monitoring and impacts in Ireland

### 1.3.1. Projections

The partnership between the EC-Earth consortium and Met Éireann continues to be pivotal in expanding Met Éireann's modelling portfolio to develop and maintain an Intergovernmental Panel on Climate Change-class Earth system modelling capability. Met Éireann is also continuing its partnership with the Irish Centre for High-End Computing, improving EC-Earth's representation of the North Atlantic climate system and studying the impact of changes in this system on Ireland's climate as part of a 4-year research programme.



In 2023, Met Éireann released the findings of the TRANSLATE project, providing standardised, accessible and bias-corrected climate projections for Ireland for the first time. TRANSLATE uses an ensemble of existing models and draws on both international best practice and the expertise of leading scientists in Ireland to provide users with a robust set of future projections. These include uncertainty arising from both the level of future emissions and the climate system's response to those emissions. TRANSLATE provides high-resolution climate data for Ireland to support national and local stakeholders. These initial standard projections provide the most comprehensive picture of Ireland's future changes in temperature and precipitation to date, across a range of scenarios up to the end of the century. For the first time in Ireland, climate information on threshold-based global warming levels (1.5°C, 2°C, 2.5°C, 3°C, 4°C) has been provided. TRANSLATE is freely and easily accessible to all users to ensure that the standardised data can be used across the country and across user skill levels.

The next phase of TRANSLATE will update the background climate models to take advantage of the latest available climate models and new standardised future scenarios (shared socio-economic pathways). Building on the first iteration, it aims to include additional variables such as wind, humidity and solar radiation to support the needs of its growing user base. This new phase of TRANSLATE, which is currently under way, aims to address impacts and risks as well as generating data, largely in the form of creating climate storylines for Ireland.

At the European level, coordinated experiments to undertake regional downscaling continue under the auspices of EURO-CORDEX.<sup>d</sup> These model runs are freely available and are downscaled from the broad range of driving Earth system models that participated in the Coupled Model Intercomparison Project (CMIP) phases 5 and 6.

The CMIP is a collaborative framework designed to improve knowledge of climate change. CMIP phase 7 is the latest development phase, which has been designed to support specific user needs, including supporting the needs of the Intergovernmental Panel on Climate Change Seventh Assessment Report assessment cycle, and will help to further refine understanding of past, present and future climate changes.<sup>[25]</sup> The small, targeted, 'fast-track' sets of experiments, in addition to the growing number of model intercomparison projects, reflect extensive feedback from the modelling centres and wider user community.

### 1.3.2. Monitoring

Met Éireann, in collaboration with partners, continues to improve Ireland's climate observation network. In October 2023, a new weather radar system was installed at Shannon airport.<sup>[26]</sup> This modern radar system now provides more accurate rainfall information to the weather forecasters, the public, and researchers. This new weather radar system is the first step in Met Éireann's strategic development plan to upgrade and expand the national weather radar network over the next 10 years. During this period, the number of radar systems will triple, from two to six, covering key areas across the country to ensure optimal coverage and forecasting accuracy.

In 2023, almost 80 climate monitoring stations throughout Ireland were automated. This is not just improving the resolution of climate information being monitored, but it is also providing near-real-time weather information to support emergency management, including the issuing of weather warnings.

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**d** EURO-CORDEX is the European branch of the international CORDEX initiative, which is a programme sponsored by the World Climate Research Programme to organise an internationally coordinated framework to produce improved regional climate change predictions for all land regions worldwide.



The Irish Global Climate Observing System group continues to review the monitoring status of essential climate variables for Ireland, ensuring alignment with international standards.

The Irish Soil Moisture Observation Network<sup>[27]</sup> coordinates soil moisture measuring networks in Ireland. Over the past year, further enhancements have been made to the network to improve the monitoring of soil moisture throughout Ireland. Soil moisture, an essential climate variable, plays a crucial role in environmental processes such as the water cycle, weather and climate, vegetation growth and groundwater availability.

Ongoing research funded by the Environmental Protection Agency (EPA) through the HydroDetect project is developing an updated reference hydrometric network for monitoring and detecting changes in river flows (floods, droughts, seasonal flows) across Ireland.<sup>[28]</sup> Other research being undertaken by the EPA- and Met Éireann-funded HydroDARE project is developing approaches for the attribution of changes detected in hydrological extremes to enhance the ability to discern a climate change signal in floods and droughts.<sup>[29]</sup>

### 1.3.3. Climate impacts for Ireland

The three warmest years on record in Europe have all occurred since 2020 and the ten warmest since 2007. The higher the annual global and European temperatures get, the greater the risk of exposure to potential climate tipping points. One example of such a tipping point risk for Ireland is changes in the circulation of the Atlantic Meridional Overturning Circulation (AMOC). This ocean circulation flows from south to north off Ireland's Atlantic coast. It helps to create Ireland's temperate climate. Scientific research is projecting that the AMOC may weaken significantly this century, and the potential for collapse is also supported within the range of estimates. If there were to be a collapse in the AMOC, winters would become considerably colder and summers warmer, and there would likely be an increase in storminess with potential implications for sea levels. Continued research is under way to try to provide more clarity on the likely future behaviour of the AMOC and its potential impact on Europe and Ireland.

Volume 3 of Ireland's Climate Change Assessment provides a synthesis of research on climate change impacts and progress on adaptation in Ireland.<sup>[30]</sup> Key messages from across each of the eight sectors<sup>e</sup> considered include the following:

- ▶ **Ecosystems: marine, terrestrial and freshwater.** Biodiversity in Ireland is declining, and continued biodiversity loss will undermine capacity to adapt to climate change across sectors. Without early and significant adaptation, climate change will result in severe impacts on many species and habitats.
- ▶ **Agriculture, forestry and land use.** Climate change is likely to impact all forms of agriculture. Changes in precipitation may result in increased nutrient leaching from land. Warming is expected to lead to an increase in growing season length; however, any productivity gains may be offset by increases in extreme rainfall events or in drought frequency, magnitude and duration.
- ▶ **Coastal environments.** Sea level rise and changes in storm surge levels present high risks of flooding for Ireland's coastal areas. Coastal adaptation responses can be categorised as (1) protect, (2) accommodate and (3) retreat. Appropriate actions depend on the nature of the

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<sup>e</sup> The eight sectors are (1) Ecosystems: marine, terrestrial and freshwater; (2) Agriculture, forestry and land use; (3) Coastal environments; (4) Water; (5) Built environment, heritage and rural communities; (6) Critical infrastructure; (7) Health and wellbeing; and (8) Business, industry and tourism.





impacts experienced, the local physical and social context, exposure and vulnerability,<sup>f</sup> and economic constraints.

- ▶ **Water.** Climate change impacts on the hydrological cycle are happening in the context of increasing water demands, decreases in water quality and a lack of resilience in Irish water supply infrastructure. Impacts are likely across multiple sectors, including critical infrastructure, settlements, biodiversity, land use and health, raising the importance of cross-sectoral collaboration for adaptation.
- ▶ **Built environment, heritage and rural communities.** Flooding from rainfall, rivers and the sea is a major hazard for the built environment. These types of flooding are expected to increase in future. Increases in rainfall intensity are expected, with implications for existing buildings and building design.
- ▶ **Critical infrastructure.** Significant damage costs are projected for the infrastructure sector without effective adaptation. The main hazards causing such damage in an Irish context are expected to be heatwaves, droughts and coastal flooding, as well as inland flooding.
- ▶ **Health and wellbeing.** Projected changes in extreme events are likely to have direct and indirect impacts for health and wellbeing. The number of people exposed and vulnerable to heatwaves will increase. Without adaptation, projected changes in floods and droughts and associated impacts on water quality are likely to impact public health.
- ▶ **Business, industry and tourism.** Climate change adaptation in business and industry in Ireland is very limited to date, and, without adaptation action, climate change is likely to bring increasing risks and substantial costs to the Irish economy. Tourism, a key sector in the economy, is highly exposed and vulnerable to climate risks and extreme events. While warmer summers are often held up as an opportunity for Irish tourism through increasing visitor numbers, without careful management this could create damaging and unsustainable pressures on sensitive heritage sites and environments. Careful and integrated adaptation planning that values heritage protection and ecosystem services is needed.

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**f** Exposure is the presence of people, livelihoods, species or ecosystems; environmental functions, services and resources; infrastructure; or economic, social or cultural assets in places and settings that could be adversely affected by climate change. Vulnerability encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.<sup>[49]</sup>



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# 2.

## Adaptation Progress in Ireland





## Key observations

- ▶ The impacts of climate change are already being felt and will increase in magnitude and frequency in the future with additional warming. Ireland needs to urgently build adaptive capacity and increase societal resilience to the impacts of climate change.
- ▶ There is a clear need for adaptation to be understood as proactive planning rather than reactive response. Adaptation refers to the actions that need to be taken to increase societal, environmental, ecological and economic resilience. It needs to be understood as a process leading to increased resilience.
- ▶ Sectoral adaptation plans have generally been characterised by limited levels of ambition and implementation and weak monitoring and evaluation, and have mainly focused on policy and enabling measures linked to adaptation planning rather than actual implementation of adaptation measures. The allocation of human and financial resources for adaptation in the majority of lead departments and agencies has been inadequate to date.
- ▶ The costs of adapting to the impacts of climate change in Ireland are significant and multifaceted. Substantive investment in adaptation measures will deliver savings over the long term and generate opportunities and multiple co-benefits across society and the economy.
- ▶ Ireland is highly vulnerable to climate impacts and risks occurring in other countries, such as those that affect food production, traded goods, and pests and diseases. These transboundary climate risks are expected to increase with further global warming and need to be considered in appropriate risk assessments.
- ▶ Biodiverse ecosystems and landscapes are key to providing greater resilience to climate change and extreme climate events and to improving water, soil and air quality. The Council therefore notes with concern the lack of progress observed in the implementation of the Biodiversity Climate Change Sectoral Adaptation Plan as per the findings of the 2024 Adaptation Scorecard.

## Key recommendations

- ▶ Lead Government departments and State agencies for sectoral adaptation plans should budget annually for measures that enhance resilience to climate change. The Department of Public Expenditure, NDP Delivery and Reform should ensure that the necessary funding is identified and ringfenced on an annual basis through the revised National Planning Framework and National Development Plan.
- ▶ Lead Government departments and State agencies for sectoral adaptation plans must ensure that the new plans, to be finalised by September 2025, contain ambitious targets, impactful, fully costed actions and measurable adaptation indicators.
- ▶ Commercial semi-state agencies and regulators must prioritise projects to enhance the resilience of critical infrastructure in their budgeting frameworks.



- ▶ The Department of Housing, Local Government and Heritage urgently needs to prioritise the immediate development and deployment of a coastal management strategy. This strategy is essential to deliver actions to increase the resilience of Ireland's coasts and communities to climate change impacts, including sea level rise and increased coastal erosion.
- ▶ By the end of 2025, the Government needs to have clearly defined and implemented a programme for staffing and training of staff across Government departments and commercial semi-state bodies to build capacity for climate adaptation action across the system.
- ▶ The Department of the Environment, Climate and Communications needs to immediately act through the National Adaptation Steering Committee to facilitate inter-sectoral dialogue and ensure that cross-sectoral issues are given systematic consideration in relation to adaptation action and are integrated across policies and plans as appropriate.
- ▶ The Central Statistics Office and Tailte Éireann, with support from the Office of Public Works and the Local Government Management Agency, should collaborate to ensure that a national climate damage risk register is established to monitor the financial and spatial impacts of climate extreme events in a uniform and standardised manner.
- ▶ The National Parks and Wildlife Service should ensure that adequate human and financial resources are dedicated to conservation and restoration initiatives that will enhance the resilience of habitats and species to climate change.



### 2.1. Introduction

Climate change impacts are occurring at an unprecedented pace and scale internationally, across Europe and in Ireland.<sup>[31,32]</sup> Immediate and sustained adaptation actions can yield substantial transformative benefits for health, wellbeing and biodiversity in Ireland, as well as reducing vulnerability to the adverse impacts of climate change.<sup>[33]</sup> Over the review period, Ireland experienced extensive flooding in Midleton, Co. Cork, caused by Storm Babet, as well as ongoing coastal erosion. Ireland also experienced one of the wettest and warmest springs on record,<sup>[34]</sup> causing significant challenges for and losses in the agricultural sector (further information can be found in the [2024 Agriculture and Land Use, Land Use Change and Forestry sectoral review](#)). A report undertaken in 2023 by the Irish Fiscal Advisory Council profiled the fiscal impacts of the compliance measures and transitional and physical risks linked to climate change.<sup>[35]</sup> It notes that costs due to extreme weather events have historically averaged about 0.1% of gross national income and have occurred once every 7 years or so and that these events appear to be becoming more frequent. Based on the European experience, damage costing closer to 0.2% of gross national income once every 3 years is not unprecedented.

The high-level message from the European Climate Risk Assessment (EUCRA), published in March 2024, is that Europe is the fastest warming continent in the world, and climate risks are threatening its energy and food security, ecosystems, infrastructure, water resources, financial stability and people's health.<sup>[2]</sup> According to this assessment many of these risks have already reached critical levels and could become catastrophic without urgent and decisive action.

In an Irish context, estimating the potential future costs of climate change can help to make a business case for proactive adaptation action. This also helps justify the investment needed to proactively address climate impacts and to capitalise on opportunities that would avoid significantly larger future impact costs if no action is taken. Taking a holistic view, including potential benefits for health and wellbeing as a result of adaptation, can provide an additional justification to act.

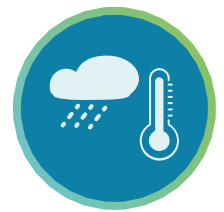
In Ireland, long-term planning is needed now to avoid significant future costs, and this iterative process will take time, human resources, coordination and foresight studies. A clear vision of what a climate-resilient Ireland looks like needs to be set and a pathway towards that vision needs to be developed. The second National Adaptation Framework (NAF), published in June 2024, provides definitions of both adaptation and resilience and also identifies the characteristics of a resilient Ireland. Box 1 provides these definitions, as they are set out in the NAF.

#### Box 1. Adaptation and resilience definitions

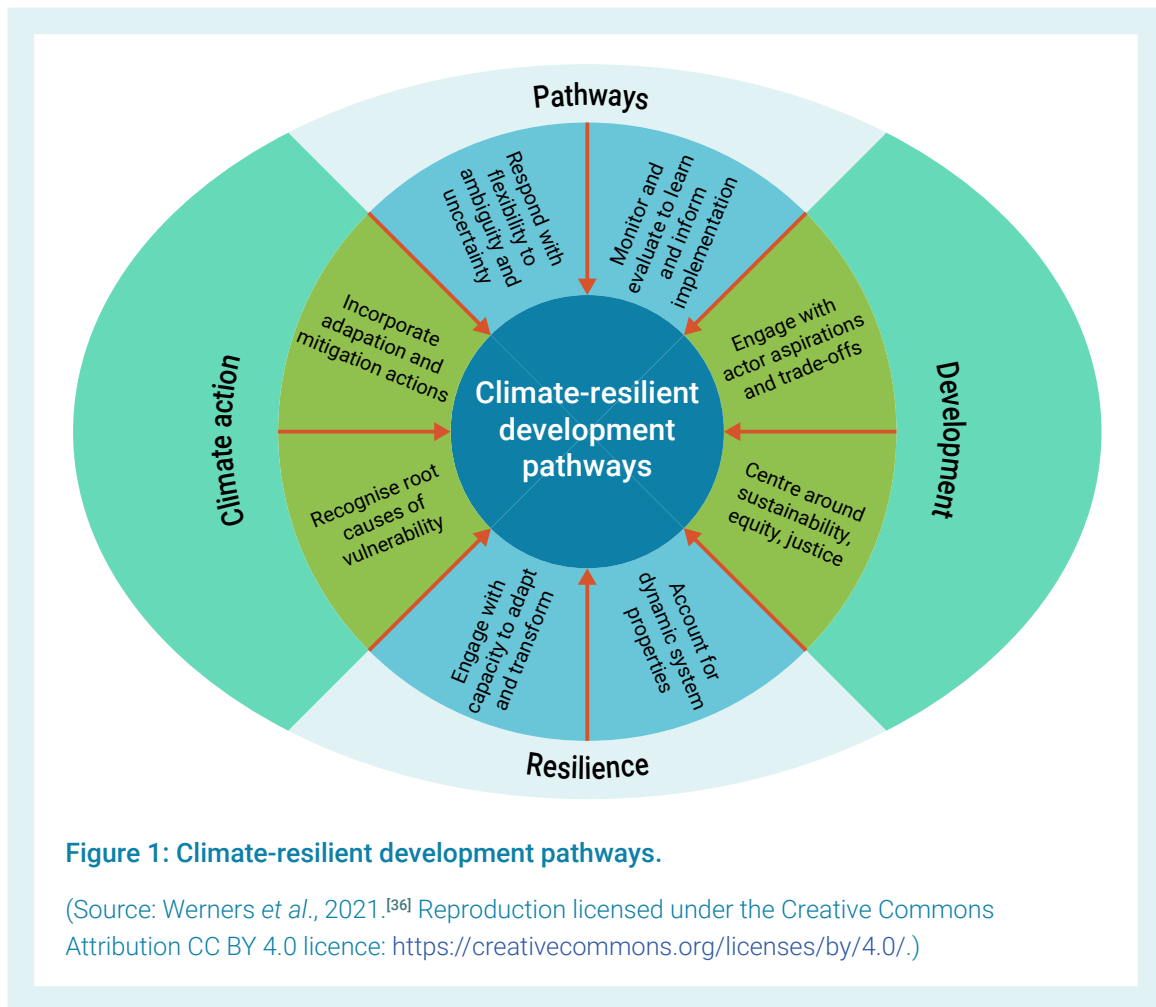
Adaptation is defined as a change in natural or human systems in response to the impacts of climate change. These changes moderate harm or exploit beneficial opportunities and can be in response to actual or expected impacts.

Resilience describes the ability of a social or ecological system to absorb disturbances, while retaining the same basic ways of functioning, and a capacity to adapt to stress and change.

In summary, adaptation refers to the actions that need to be taken to result in increased societal, environmental, ecological and economic resilience, while climate-resilient development pathways consolidate climate action (both mitigation and adaptation) to achieve long-term sustainable development (Figure 1). To increase awareness and understanding of adaptation and to realise a



climate-resilient Ireland among policymakers and the general public, it is recommended that both adaptation and resilience are a focus of the National Dialogue on Climate Action and related stakeholder engagements.



## 2.2. Science and policy context

### 2.2.1. International

An increased focus by the United Nations Framework Convention on Climate Change (UNFCCC) on adaptation since the Paris Agreement is generating political momentum for stronger implementation of adaptation actions at a national level. The United Arab Emirates Framework for Global Climate Resilience<sup>[37]</sup> was agreed at the 28th Conference of the Parties to the UNFCCC (COP28). It provides opportunities for improving the methods and monitoring of adaptation actions and for aligning the next round of sectoral adaptation plans with the United Arab Emirates Framework targets. The Sendai Framework for Disaster Risk Reduction<sup>[38]</sup> similarly offers opportunities to align adaptation-related indicators with international best practice and guidance.

The UNFCCC COP28 decision on the global stocktake states that by 2030 all Parties should have designed a system for monitoring, evaluating and learning from their national adaptation efforts.<sup>[39]</sup> This is an important consideration for the lead departments and agencies for sectoral adaptation plans, Department of the Environment, Climate and Communications (DECC) and Department of



the Taoiseach. The UNFCCC COP28 decision on the global stocktake further called on countries to collaborate to address transboundary climate impacts, prioritise national inventories of climate impacts and develop multi-hazard early warning systems by 2027. These are important areas for Ireland to prioritise to improve its preparedness for a range of climate hazards and extreme weather events.

### 2.2.2. European

The EU has increased its focus on regulations and frameworks around adaptation in recent years. The European Climate Law (2021)<sup>[40]</sup> establishes a 'duty' for Member States to adapt to climate change. It called for the European Commission to adopt an EU strategy on adaptation to climate change, which was subsequently adopted in 2021.<sup>[41]</sup> It obliges Member States to adopt and implement national adaptation strategies and plans, taking into consideration the EU strategy on adaptation, based on robust climate change and vulnerability analyses, progress assessments and indicators, and guided by the best available and most recent scientific evidence. Guidelines on Member States' adaptation strategies and plans were published in 2023 to support Member States in revising their adaptation strategies.<sup>[42]</sup> Ireland's new guidelines for sectoral adaptation plans should be harmonised with the EU guidelines for Member States' adaptation strategies and plans.

The EUCRA<sup>[2]</sup> identifies 36 major climate risks for Europe within five broad clusters: ecosystems, food, health, infrastructure, and economy and finance. More than half of the major climate risks identified in the report demand more action now, and eight of them are particularly urgent, mainly to conserve ecosystems, to protect people against heat, to protect people and infrastructure from floods and wildfires, and to secure the viability of European solidarity mechanisms, such as the EU Solidarity Fund.<sup>[43]</sup> The EUCRA highlights that society's level of preparedness for climate change risks is low, with policy implementation lagging substantially behind quickly increasing risk levels. In this context, there is a need for urgent action and for Ireland to learn from international best practice and to tackle emerging issues linked to adaptation.

The importance of cascading transboundary thinking is highlighted in the EUCRA as being needed to capture the full range of impacts across Europe and beyond, including in Ireland. Cascading and transboundary climate thinking emphasises that climate risks cross national borders, can flow through physical systems (such as river basins), can occur across trade links and can be realised through financial dependencies, as well as impacting people (through forced displacement, migration or tourism). It is important to note that these transboundary climate risks are distinct from, but help to inform, local adaptation actions.

Other important EU directives and regulations with implications for adaptation and resilience that have entered into force include:

- ▶ The European Corporate Sustainability Reporting Directive,<sup>[44]</sup> which entered into force on 5 January 2023. The directive modernises and strengthens the rules concerning the social and environmental information that companies must report. The new rules will ensure that investors and other stakeholders have access to the information they need to assess the impact of companies on people and the environment and for investors to assess the financial risks and opportunities arising from climate change and other sustainability issues.
- ▶ Regulation (EU) 2024/1991 on nature restoration,<sup>[45]</sup> which entered into force on 18 August 2024. This regulation aims to contribute to the long-term and sustained recovery of biodiverse

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**g** The Solidarity Fund is the main EU instrument for supporting recovery from natural disasters.



and resilient nature across the EU's land and sea areas through the restoration of degraded ecosystems, thereby achieving the EU's overarching objectives concerning climate mitigation and adaptation, achieving land degradation neutrality, enhancing food security and meeting the EU's international commitments. It will require Ireland to prepare a national nature restoration plan by 2026, with specific national targets and measures to enhance biodiversity within agricultural, forest, marine and urban ecosystems in the period up to 2050.

### 2.2.3. National

Ireland's policy framework for adaptation is currently at an important juncture. The second statutory NAF was published in June 2024, the 31 local authority climate action plans (LA CAPs) were published in February 2024 and the National Climate Change Risk Assessment (NCCRA) is currently under development, with a deadline for publication of Q1 2025. Planning is also under way for the second set of sectoral adaptation plans, which are to be submitted to the Government for approval by the end of September 2025. This represents a misalignment, and better sequencing of adaptation planning activities at local and national scales will be required in the next adaptation policy cycle.

The sectoral adaptation plans identified in the new NAF are aligned with the EU policy sectors for adaptation, although it remains a concern that there will still be no sectoral adaptation plan for business, industry and financial services. It will be important for the built environment and planning sectoral adaptation plan to be developed, as its absence is a significant current policy gap. There has also been little attention given to ensuring the resilience of Ireland's island environments and communities, which needs to be prioritised in adaptation planning and implementation. Cross-sectoral issues, such as management of the coastal zone and disaster risk reduction, require a more integrated and proactive approach and considerable investment.

Ireland's national policy framework is different from that of many other EU Member States, which typically have a more centralised approach. Ireland's use of a NAF with individual sectoral adaptation plans offers potential for more distinct ownership of adaptation plans and actions. However, formal monitoring and evaluation of the implementation of sectoral adaptation plans has been weak to date, and the allocation of human and financial resources for adaptation in most lead departments and agencies has been inadequate, highlighting the need for centralised accountability on implementation delivery.

Ireland's NCCRA is currently being developed by the EPA for delivery in Q1 2025. The NCCRA is taking a semi-quantitative iterative approach to supporting the identification, assessment and prioritisation of climate change risks. The methodology for the assessment was released as a working document in May 2024<sup>[46]</sup> to help support the development of the next iteration of sectoral adaptation plans.

## 2.3. Key themes of focus

### 2.3.1. Policy framing, capacity and coherency

There is a clear need to integrate adaptation planning within policymaking and decision-making in Ireland. There needs to be a shift towards longer-term proactive planning, accounting for the present and future impacts of climate change, rather than reactive responses to impacts as and after they occur. It is critical that the Government puts long-term plans and resourcing in place now to avoid reactive and possibly inadequate responses later.





To realise this longer-term planning approach, there is a need to build internal skills and capacity focused on adaptation within Government departments. This will take investment in personnel, training and effective collaboration. However, such investment will reap significant dividends in the longer term in the financial costs saved and the human and environmental impacts avoided because of increased resilience.

The NCCRA will potentially play an important role in moving towards a more proactive approach to adaptation. Its multistage risk assessment methodology should ultimately create a national climate damage risk register that will set out existing and planned adaptation priorities based on the urgency of decisions. Accordingly, the NCCRA should be aligned with the EUCRA for traceability. Issues of risk ownership and risk responsibility and the financial implications of this need to be considered in the NCCRA. This assessment should be seen as a living document, with successive versions reflecting the latest understanding.

The new NAF<sup>[47]</sup> provides an important foundation, creating the structure and ambition needed to realise a climate-resilient Ireland. Its key guiding principles are focused on adaptation governance, engagement and resourcing; improving the evidence base and capacity for adaptation; adaptation design and planning; and adaptation management and monitoring.

Realising a climate-resilient Ireland will necessitate increased coherency across a range of policy domains and scales. The forthcoming sectoral adaptation plans provide an opportunity to build this coherence. Renewed leadership and ambition will be essential to create the shift in thinking and in approach towards longer-term planning. Leadership in effectively implementing the new LA CAPs will also be vital. Moreover, it will be important that policy coherency is achieved, as much as possible, when implementing these plans. Connections between implementation actions at the local authority and sectoral levels must aim to be mutually supportive and strive to avoid any maladaptive outcomes.

When it comes to the implementation of adaptation actions it will be increasingly important to track action and implementation through monitoring and evaluation and the use of an agreed set of indicators. Moreover, in setting out adaptation actions, it is important to highlight the benefits of adaptation, and the principles of equity and just adaptation should be central. Adaptation, when done well, can increase wellbeing, community health, food security and community resilience.

The Council welcomes the new iteration of the NAF's inclusion of a just resilience principle.<sup>h</sup> However, for the effective implementation of the principle, appropriate guidance for decision-makers and the sharing of effective examples of just and fair adaptation measures are needed. This should be provided in the new guidelines for sectoral adaptation plans, including mainstreaming just resilience needs into the next iteration of the plans.

### 2.3.2. Economic impacts and costs

The Climate Change Advisory Council–Economic and Social Research Institute Research Fellowship concluded in May 2024.<sup>[48]</sup> The project focused on creating a better understanding of climate change impacts for Ireland from an economic perspective, as well as identifying adaptation options. The project focused on five climate change impacts: coastal flooding, heat effects on labour productivity, human health, agricultural productivity and river flooding. It looked at available data and was

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**h** Just resilience is defined in the NAF as how different groups are affected by climate change impacts, how the benefits and burdens of adaptation responses are distributed across different groups and how different groups experience fair and transparent processes with a fair distribution of political power and participation in policymaking.



necessarily therefore selective rather than comprehensive in cases such as agriculture, where critical input on ruminant agricultural impacts was not available.

When looking at initial impacts, the cost of coastal flooding (which does not account for the cost of erosion) without adaptation is projected to be approximately €2 billion annually by the year 2050 under a representative concentration pathway (RCP) 4.5 emissions scenario.<sup>[49]</sup> With no additional planned adaptation measures in place, coastal flooding has the largest modelled negative impacts on gross domestic product (GDP) in 2030, 2040 and 2050. Under the same scenario the total annual cost of damage from river flooding is estimated to be €60 million per annum by 2050. In addition, a 1°C increase in the outdoor wet-bulb globe temperature<sup>i</sup> (a combined measure of heat and humidity) will result in a 1.6% reduction in labour productivity and an increase in emergency hospital admissions of approximately 12%.

One of the main findings of the work is that policymakers must consider the secondary impacts of climate change when designing and implementing adaptation policies. Secondary impacts stem from initial impacts in one sector or on one production factor (e.g. labour or capital) that spill over into the rest of the economy. For river and coastal flooding (in both 2030 and 2040) the secondary impacts are larger than the initial impacts. Examples of secondary impacts include displacement of people from their homes because of flood impacts, or other associated impacts of flooding such as contamination of drinking water and resultant impacts on the population's health. The study shows that policy assessments need to include secondary impacts to ensure that adaptation policies are evaluated at their true economy-wide costs. It is also important to note that true economy-wide cost estimates can be improved further by expanding sectoral coverage and capturing cross-sectoral impacts.

Effective adaptation can significantly reduce the real GDP losses associated with a given level of climate change. For example, based on recent analysis carried out in 2024,<sup>[48]</sup> gross damages costing over 2.7% of GDP can be reduced to residual damages costing less than 1% of GDP at protection costs of 0.25% (of GDP) by applying adaptation policies. Adaptation policies identified in the study include a range of measures documented in the economic literature.<sup>[47]</sup>

### 2.3.3. Financing for adaptation

Financing for adaptation measures is required over the short, medium and longer terms. The National Planning Framework and National Development Plan are key instruments for ensuring that medium- to longer-term funding is available for adaptation measures. To date, financing of adaptation measures through the National Development Plan has largely been limited to flood relief schemes, and there is a need to prioritise the funding of other capital projects related to adaptation. Commercial semi-state bodies also have a critical role to play in mobilising funding for the resilience of infrastructure, and this should be mainstreamed into their capital budget frameworks and price review mechanisms accordingly. A lack of financial and human resources for adaptation continues to be a barrier affecting commercial semi-state bodies that needs to be addressed.<sup>[50]</sup>

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**i** There are four main scenarios for future climates based on different concentrations of greenhouse gas emissions.<sup>[49]</sup> These scenarios are known as RCPs and they are RCP2.6, RCP4.5, RCP6 and RCP8.5. The RCP4.5 scenario has a medium level of greenhouse gas emissions. The two extreme scenarios are RCP2.6, in which greenhouse gas emissions are significantly mitigated, and RCP8.5, in which greenhouse gas emissions are not mitigated. The global average temperature in 2100 is projected to have increased by 1.6°C in RCP2.6 and by 4.3°C in RCP8.5.

**j** The wet-bulb globe temperature is a measure of heat stress in direct sunlight that takes into account temperature, humidity, wind speed, sun angle and cloud cover (solar radiation).



The Department of Public Expenditure, NDP Delivery and Reform (DPENDR) has tracked and reported annually on climate-related expenditure in the Revised Estimates for Public Services since 2019.<sup>[51]</sup> For the 2024 iteration of the Revised Estimates, the assessment was revised to incorporate consideration of the probable environmental and climate impacts of expenditure allocations. The criteria considered are broadly based on those contained within the *EU Taxonomy for Sustainable Activities*.<sup>[52]</sup>

The 2024 Revised Estimates assessment identifies activities considered to be favourable to climate change adaptation efforts. These include adaptation actions that either substantially reduce the risk of the adverse impact of the current climate on the economic activity or substantially reduce that adverse impact in future. To avoid maladaptation,<sup>k[53]</sup> it is noted that these adaptation actions should not increase the risk of an adverse impact on people, nature or assets. In the 2024 Revised Estimates, a total of €2.64 billion of expenditure is assessed as favourable to climate change adaptation. This includes flood risk management, forecasting and prevention, retrofitting of infrastructure to withstand current and future climate impacts, and funding for Met Éireann and research programmes across several Government departments and State bodies. No expenditure unfavourable to adaptation was identified. DPENDR has noted the limited detail available on expenditure items reported and that the current methodology will need strengthening and improvement to provide a conclusive assessment of State activities in adaptation.

The Future Ireland Fund (FIF) and the Infrastructure, Climate and Nature Fund (ICNF) are two climate-related funds announced in Budget 2024. The FIF is described as supporting Government expenditure in strategic areas, including climate. There is no limit on the potential size of the fund. The forecast level of contributions to the FIF is approximately €6 billion per year (0.8% of GDP). Approximately €4.1 billion will also be transferred from the dissolution of the National Reserve Fund in 2024. It must be noted that this fund cannot be drawn down until 2030 at the earliest, and for this reason it does not address near-term adaptation finance needs. Moreover, adaptation funding needs are not explicitly recognised in either fund.

The ICNF will seek to deal with the procyclical nature of capital spending<sup>l</sup> by supporting capital expenditure and avoiding backlogs in capital projects due to a lack of spending during downturns. It is intended that €2 billion will be invested in this fund each year from 2024 to 2030, building a fund of up to €14 billion. That €14 billion figure equates to the average annual amount of capital expenditure under the National Development Plan over 2023–2028. It must be noted that details of the annual drawdown limits on both the amount and the purpose of this fund will be critical in assessing its potential impact. The lifespan of the funds is also a key consideration. The Government recognises the need for additional investment beyond these two funds to help support the transition to climate neutrality, as well as to address climate change impacts.<sup>[54]</sup> While the establishment of the FIF and ICNF are welcome, adaptation funding not specifically identified under the individual fund mandates needs to be recognised and included in the management and drawdown of these funds from 2026.

Climate resilience needs to be front and centre in the wider policy consideration and in the use of support from EU funding programmes, such as the Common Agricultural Policy, Cohesion Policy

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**k** Maladaptation is defined as actions that may lead to an increased risk of adverse climate-related outcomes, including via increased greenhouse gas emissions, increased or shifted vulnerability to climate change, more inequitable outcomes or diminished welfare, now or in the future. Most often, maladaptation is an unintended consequence.

**l** This concept relates to the Government's approach to spending and taxation. A 'procyclical fiscal policy' can be summarised as increasing Government spending and reducing taxes during an economic expansion, and reducing spending and increasing taxes during a recession.



funding and other relevant EU funds, as per a December 2023 European Commission recommendation to Ireland.<sup>[55]</sup> Moreover, EU funds should be spent in such a way that they increase climate resilience and do not increase vulnerabilities, i.e. result in maladaptation.

### 2.3.4. Status of flood preparedness

Flooding from rainfall, rivers and the sea continues to be a major hazard. The increasing intensity and magnitude of rainfall events, sea level rise and future urban expansion heighten the risk from flood events and the need to adapt. This prompted the Adaptation Committee of the Climate Change Advisory Council to hold a dedicated session on flood preparedness in March 2024 that involved the Office of Public Works, Met Éireann and the Office of the Planning Regulator.

Inappropriate zoning of land has resulted in the considerable exposure of people, properties and infrastructure, with a range of vulnerability levels, to flooding impacts. It was noted that this shortcoming is being addressed for future developments through improved scientific knowledge of flood risk and awareness and training of local authority officials and through better consideration of flood risk management in county development plans and local area plans. Legal provisions also now allow the Minister responsible for planning to issue directions to local authorities on county development plans and local area plans. However, difficulties in planning continue to arise where the scientific basis is not strong, such as on sea level rise, coastal erosion and surface water flooding. It was also noted that the planning system needs to be mindful of maladaptation caused by new developments upstream that may have negative impacts on locations further downstream. In addition, it is also important to be aware of the risks of the so-called safe development paradox.<sup>[56]</sup> This is where the installation of flood defence infrastructure incentivises increased development. This ultimately leads to higher losses in the event of an extreme flood event overtopping the flood defence infrastructure.

A more systematic approach is needed to understand the threat from surface water flooding and the implications of increased rainfall intensity and short-duration intense rainfall events and their impact on the drainage system. The maintenance of culverts and drains needs to be improved, and there is a need for strengthened collaboration between Uisce Éireann, local authorities, the Office of Public Works and the Department of Transport on these matters. Further engagement and cooperation is needed across multiple sectors to promote an integrated catchment management approach to flood risk management. The need for, and multiple benefits from, nature-based solutions is increasingly evident and should be promoted and integrated across the rural and urban parts of catchments to increase the capacity of the land to absorb rainfall and to reduce pollution.

### 2.3.5. Communities and coasts

In its 2023 Annual Review, the Council outlined the urgent need for a coastal management strategy. While a scoping report on the strategy was published in 2023,<sup>[57]</sup> the Department of Housing, Local Government and Heritage urgently needs to prioritise the immediate development and deployment of a national coastal management strategy. This strategy is essential to deliver actions to increase the resilience of Ireland's coasts and communities to climate change impacts, including sea level rise and increased coastal erosion.

As part of efforts to engage communities and articulate their needs on the issue of coastal resilience and to generate recommendations for the national coastal management strategy, the Council commissioned a study on coastal community recommendations for building climate resilience.<sup>[58]</sup> The results were generated from insights from an online survey of 28 coastal community groups in combination with a follow-up participatory workshop in Galway city in March 2024.



In the absence of a national coastal management strategy, it was found that coastal communities often find it challenging to implement local coastal management measures. The key recommendations were as follows:

- ▶ Empowering volunteer groups can lead to sustainable solutions to climate risks and threats to biodiversity. Support from local authorities, the National Parks and Wildlife Service (NPWS), local political representatives and scientists is viewed as a critical enabler for coastal groups.
- ▶ A network of coastal communities will increase the impact and visibility of volunteer-led climate adaptation and conservation actions. Such a network would provide a space for volunteer groups to share their experiences, learn 'best practices' and design solutions; identify gaps in planning, science and governance; and submit informed and coherent responses to public consultations on new climate and nature policies impacting coastal and marine sectors.
- ▶ Community-led nature-based solutions can help protect and conserve the coast. However, implementing these nature-based solutions is extremely challenging for community groups, as they have to manage permission, private land ownership, site maintenance, signage, access control, best practices, volunteers and monitoring. It is urgently requested that the NPWS, local authorities and other governance bodies join up and deliver a national strategy and implementation plan to support community-led efforts.

### 2.3.6. Local adaptation planning and action

Each of the 31 local authorities finalised its LA CAP during the period under review. Both adaptation and mitigation actions are included in the LA CAPs and were informed by climate risk assessments undertaken by each local authority. The actions in most of the LA CAPs are structured according to the following strategic themes:

- ▶ governance and leadership,
- ▶ built environment and transport,
- ▶ natural environment and green infrastructure,
- ▶ communities: resilience and transition,
- ▶ sustainability and resource management.

There is a lack of dedicated financial resources for adaptation activities in local authorities. Support from the Government is needed to ensure that local authorities can budget for, adequately resource and implement adaptation actions while tracking spending accordingly. Significant funding is required to tackle the increasing threat from coastal erosion, flood events and sea level rise, and to mitigate the current and future climate-related risks identified in the LA CAPs. Existing climate-related funds and schemes should also better integrate adaptation measures, as well as biodiversity and nature-based solutions, at the local authority level to support adaptation and build resilience. The local authority biodiversity action plans, which are to be finalised by 2026, should be closely aligned with the LA CAPs and promote synergies in the implementation and funding of these plans and also in areas such as skills development and awareness.

Detailed governance structures are in place at national, regional and local levels for the implementation of the LA CAPs. With the broader scope of the LA CAPs, avoiding duplication of resources, ensuring coordination and maximising efficiencies will be paramount for their effective implementation. A potential mechanism for ensuring cooperation could be the development of an adaptation working



group under the climate action team within each local authority, supported by the relevant climate action regional office (CARO). Furthermore, close collaboration between the biodiversity officers and community climate action officers will be necessary to ensure that communities are engaged and have access to funds for community-based projects that pursue multiple benefits for biodiversity, water quality and climate.

While initial support for human resources on climate action at the local authority level has been provided by DECC in the form of climate action coordinators, climate action officers and community climate officers, the inclusion of mitigation and adaptation actions within the LA CAPs has increased the responsibilities of local authorities for climate change and has also broadened the remit of support staff, such as those in CAROs, who were initially focused on adaptation. Moreover, the short-term nature of the contracts for these posts makes it difficult to attract and retain staff and is a major concern and risk to the successful implementation of the LA CAPs. In this context, there is a need for cross-departmental cooperation and pooling of resources within local authorities for climate action and for ensuring that climate-related posts within local authorities are made permanent.

A new training plan for local authorities is under development for 2024–2027, and this will be important to build capacity across departments within local authorities including staff members involved in biodiversity work, public participation networks and spatial planning. The outcomes and impacts from the training plan should also be monitored and evaluated accordingly.

Action LG/24/3 from the 2024 National Climate Action Plan requires DECC to develop a monitoring and reporting system for the LA CAPs. The LA CAPs, when combined, contain over 5,000 actions, and these should be streamlined and prioritised with more outcome-oriented key performance indicators. It will be important that the performance of each local authority is monitored and evaluated regularly through this standardised system and that challenges in implementation are speedily identified and addressed.

## 2.4. Adaptation Scorecard monitoring

### 2.4.1. Scorecard updates on 2023

The fourth edition of the Climate Change Adaptation Scorecard was undertaken in 2024. The scorecard is an instrument used by the Adaptation Committee, which is designed to help monitor and review local authorities' and Government departments' progress towards climate resilience. It is based on questionnaires that are sent to the nine lead departments for sectoral adaptation plans as well as local authorities and DECC as the lead department for the implementation of the NAF. The 2024 NAF also notes the role of the scorecard process in providing an important independent assessment of sectoral progress on adaptation.

Based on a workshop held by the Adaptation Committee in September 2023, some adjustments were made to streamline the questionnaire and the categories in 2024. An improved guidance document was also prepared to assist the relevant Government departments in structuring their answers and to better inform them of the assessment process. The assessment of the questionnaire responses is based on the degree to which progress is being made solely in the implementation of adaptation policy and increasing resilience under three categories during the period April 2023 to March 2024:

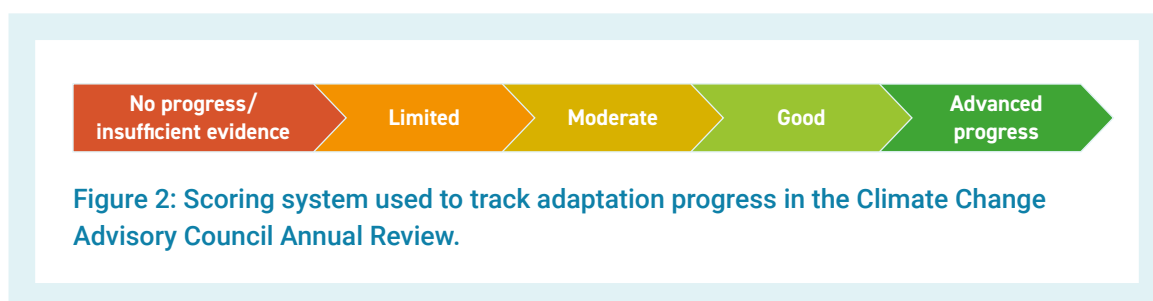
- ▶ **Governance and resourcing:** the extent to which systemic coordination of adaptation actions and planning is in place across sectors and scales, with relevant departments, agencies and local authorities putting in place the necessary human and financial resources for climate change adaptation.



- ▶ **Policy implementation and mainstreaming:** whether adaptation is being mainstreamed into policies, plans, strategies, programmes and frameworks and whether the implementation of sectoral adaptation plans and adaptation-related policies is having a meaningful impact on climate-resilient development.
- ▶ **Risk and adaptive management:** the extent to which efforts are being made to understand and address current and future climate risks and knowledge gaps and to proactively overcome barriers to adaptation.

### 2.4.2. Methods

The assessment of the questionnaires was undertaken by the Resilience Team of the Council Secretariat and a subset of members from the Adaptation Committee. Broader support and oversight was also provided by the Adaptation Committee. As far as possible, the assessment framework was consistent with the scoring system and approach taken in previous scorecards to allow for intercomparison (Figure 2).



The Council Secretariat and Adaptation Committee continues to refine the scorecard based on the inputs received from the lead departments and stakeholders involved, with focus on:

- ▶ developing an online method of administering the scorecard,
- ▶ harmonising the scorecard with other monitoring frameworks,
- ▶ monitoring progress at local government level on a regional CARO basis,
- ▶ using semi-structured interviews and engagements with lead departments,
- ▶ periodically exploring more long-term stocktaking of progress.

### 2.4.3. Results

This section presents an overview of the results of and analysis from the 2024 Adaptation Scorecard. Table 1 presents the overall results for the 11 sectors and their results across the three categories of assessment.

The results of the overall assessment are that four sectors demonstrated good overall progress, six showed moderate progress and one showed no progress and supplied insufficient evidence. This was a slight improvement compared with the scorecard results in 2023, with the same four sectors receiving an overall rating of good and three sectors moving from a previous rating of limited to moderate (Health, Communications Networks and Electricity and Gas Networks). The NAF, Water Quality and Water Services Infrastructure, and Agriculture, Forestry and Seafood were assessed as moderate. No sector received an overall rating of advanced progress.



**Table 1: Sector results across the three categories of assessment and overall.**

\*A revised submission was received from the Department of Housing, Local Government and Heritage (DHLGH) on 12 June based on the provisional feedback and the initial assessment that was issued. \*\*A late submission was received from the NPWS on 29 May. DAFM, Department of Agriculture, Food and the Marine; DoT, Department of Transport; OPW, Office of Public Works.

Rank	Sector	Governance and resourcing	Policy implementation and mainstreaming	Risk and adaptive management	Overall
1st	Transport (DoT)	Advanced progress	Good	Good	Good
2nd	Flood Risk Management (OPW)	Good	Good	Good	Good
2nd	Built and Archaeological Heritage (DHLGH)	Good	Good	Good	Good
2nd	Local Government	Good	Good	Good	Good
5th	Agriculture, Forestry and Seafood (DAFM)	Moderate	Good	Moderate	Moderate
6th	National Adaptation Framework (DECC)	Moderate	Moderate	Moderate	Moderate
6th	Communications Networks (DECC)	Moderate	Moderate	Moderate	Moderate
6th	Water Quality and Water Services Infrastructure (DHLGH)*	Moderate	Moderate	Moderate	Moderate
6th	Health (DoH)	Moderate	Moderate	Moderate	Moderate
10th	Electricity and Gas Networks (DECC)	Limited	Limited	Good	Moderate
11th	Biodiversity (DHLGH)**	No progress/insufficient evidence	Limited	No progress/insufficient evidence	No progress/insufficient evidence

Biodiversity (DHLGH) received an overall rating of no progress/insufficient evidence compared with a rating of limited in 2023. It was noted that there is a lack of governance structures, capacity and programmes in place for climate adaptation and for overseeing the implementation of actions outlined in the Biodiversity Climate Change Sectoral Adaptation Plan. There are also significant knowledge gaps in terms of understanding and assessing the vulnerabilities of and risks to Ireland's biodiversity





from climate change. This is of concern, given that Ireland is in a climate and biodiversity emergency and the key role of biodiversity in ensuring greater resilience to climate change and extreme climate events. In this context, the NPWS should ensure that adequate human and financial resources are dedicated to conservation and restoration initiatives that will enhance the resilience of habitats and species to climate change.

Please note that the analysis presented is abridged. A fuller version of the findings and observations for each sector can be found in a separate assessment report on the Climate Change Adaptation Scorecard, published concurrently with this adaptation review.

### 2.4.4. Key findings

The scorecard continues to be an important method for tracking progress in adaptation actions. This is particularly the case in the absence of a dedicated monitoring, evaluation, reporting and learning framework for climate change adaptation.

1. While different approaches to financing adaptation-related activities were observed, there is continued concern that the allocation of financial resources for adaptation in most Government departments, State agencies and local authorities is inadequate. There is a need to scale up financing across departments and to prioritise climate adaptation measures in relevant budget subheads, schemes and support mechanisms. Further work should also be undertaken to track adaptation financing, investment needs and the impact of adaptation-related expenditure on an annual basis. DPENDR and the Department of Finance have a key role to play in ensuring the adequate resourcing of the lead departments considered in this scorecard assessment.
2. An improvement is evident in the governance of climate change adaptation in several departments. Most lead departments and agencies are now playing an active role in coordinating adaptation activities through internal structures, dedicated multi-stakeholder committees and working groups. In some sectors, governance gaps were observed, particularly where human resources are limited, and commercial semi-state agencies and private sector stakeholders are the main entities responsible for implementation. Multi-stakeholder coordination structures should be further strengthened and used to oversee the inclusive development and effective implementation of the next sectoral adaptation plans.
3. The limited level of human resources for climate action at the local authority and CARO levels, the expanded remit of these staff to include the new LA CAPs and the short-term nature of the contracts for these posts are considered major concerns for and risks to the successful implementation of the LA CAPs that need to be addressed. The low level of human resources for climate change adaptation in some lead departments is also considered a risk to the effective implementation of the next round of sectoral adaptation plans.
4. Several lead departments have been active in terms of training staff members and the broader sectors on aspects of climate change adaptation. In the context of limited human resources and skills for climate change adaptation, the Government needs to clearly define and implement a programme for staffing and training of staff across Government departments and commercial semi-state bodies to build capacity for climate adaptation action across the system.
5. There has been an increasing focus on research and initiatives to improve knowledge of climate risk and vulnerability. However, only some sectors were able to demonstrate how the outputs from these initiatives are feeding into policy development and change. The integration of research findings into policy development relating to adaptation requires the continued attention of all lead departments.



6. While an improved understanding of the risks and impacts of climate change on critical infrastructure is evident, there is a need to move towards projects that implement adaptation solutions to improve the resilience of this infrastructure. Most sectors were not able to demonstrate the positive impacts of interventions on enhancing the resilience of infrastructure, systems and people to climate change. The next set of sectoral adaptation plans should target projects that deliver tangible outcomes to enhance resilience.
7. There has been continued progress in the development of policies and frameworks to enable adaptation measures and to mainstream adaptation into relevant policies, programmes and frameworks. This is evident in multiple sectors, and further analysis of the effectiveness and future impacts of this increased mainstreaming on enhancing resilience is required.
8. Although an enhanced enabling framework has been put in place for the implementation of nature-based solutions for the management of rainwater and run-off in urban areas, the uptake of these approaches is low. The implementation of nature-based solutions should be further prioritised across sectors in the next sectoral adaptation plans, as well as through the LA CAPs, including through appropriate funding streams, training, and monitoring and evaluation systems.
9. Disappointingly, most of the sectoral adaptation plans do not contain measurable targets, costed actions and associated key performance indicators. This continues to make it very difficult to objectively assess progress and monitor and review the implementation of these plans. Lead Government departments and State agencies for sectoral adaptation plans must ensure that the new plans, to be finalised by September 2025, contain ambitious targets, impactful, fully costed actions and measurable adaptation indicators.
10. Aspects of just resilience, avoiding maladaptation and interventions to improve human health and wellbeing are not being considered by most of the sectors in implementing the sectoral adaptation plans. These issues need to be better mainstreamed in the next sectoral adaptation plans.

## 2.5. Key overall gaps

### 2.5.1. Adaptation financing

Financing for adaptation measures is required over the short, medium and longer terms and needs to be mobilised from all sources. The FIF and the ICNF are welcome developments with potential for financing climate adaptation, but such use of these funds needs to be clearly designated. Clearer funding streams with details of distinct adaptation budgets across departments are also essential. Lead Government departments and State agencies for sectoral adaptation plans should budget annually for measures that enhance resilience to climate change. DPENDR should ensure that the necessary funding is identified and ringfenced on an annual basis and through the revised National Planning Framework and National Development Plan. Commercial semi-state agencies and regulators must prioritise projects to enhance the resilience of critical infrastructure in their budgeting frameworks.

### 2.5.2. Adaptation targets and indicators

The lack of a national set of adaptation indicators is a significant gap. It is promising to see the development of adaptation indicators in a pilot study by Transport Infrastructure Ireland supported by the EPA, and it is welcome to see reference to the value and necessity of indicators within the new



NAF, but the development and implementation of a national set of adaptation indicators is critical.<sup>[59]</sup> Tracking, monitoring and evaluating adaptation actions is an important step in building adaptive capacity across the system, and the use of adaptation targets and indicators would support this process. It will be especially important to develop such targets and indicators in the next iteration of the sectoral adaptation plans (due for completion in September 2025). Adaptation indicators will also be essential to objectively measure the progress in implementing the LA CAPs.

### 2.5.3. Systemic consideration of cross-cutting issues

A significant additional gap is the systemic consideration of cross-cutting, cross-sectoral adaptation issues. The 2024 NAF makes reference to a series of cross-cutting policy issues when listing the key sectors required to develop sectoral adaptation plans, including coastal management, built environment, urban environment, health impacts and disaster risk reduction. It is positive to see that these policy issues that do not fall under the remit of one designated Government department are identified and that accountability should be assigned. It is necessary for DECC to act immediately, through the National Adaptation Steering Committee, to facilitate inter-sectoral dialogue and to ensure that cross-sectoral issues are given systematic consideration in relation to adaptation action and integrated across policies and plans as appropriate.

### 2.5.4. National climate damage risk register

Ireland does not currently record the impacts of extreme weather events in a systematic or standardised way. Information on both economic losses and the spatial distribution of impacts from extreme weather events is currently collected on an ad hoc basis, and improved spatial analysis of climate hazards, losses and vulnerabilities is needed for effective, targeted policy interventions across sectors and for avoiding maladaptive actions.

The Central Statistics Office and Tailte Éireann, with support from the Office of Public Works and the Local Government Management Agency, should collaborate to ensure that a national climate damage risk register is established to monitor the financial and spatial impacts of extreme climate events in a uniform and standardised manner. The potential of the Weather Impact Register application, which was developed through the CAROs and piloted in several local authorities, should be further explored. Lessons can also be learnt from the European Risk Data Hub,<sup>[60]</sup> which is a repository for Europe-wide disaster risk data. This provides information on economic losses and includes information on the spatial distribution of impacts, which would be of potential use in the establishment of the national climate damage risk register.

### 2.5.5. Land use planning

Land use planning is often identified as a crucial tool to help identify and map climate mitigation measures in Ireland and is widely used in the agricultural sector.<sup>[61]</sup> However, land use planning is equally vital in relation to adaptation planning<sup>[62]</sup> and when examining adaptation actions. Examples across scales include flood management that examines urban and rural vulnerabilities across catchment scales, coastal management and coastal flood protection, and interventions in urban areas such as sustainable urban drainage and nature-based solutions to help reduce urban heating and increase comfort and wellbeing.



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