Strengthening Resilience to Climate Change

Recommendations for an effective EU adaptation policy framework

European Scientific Advisory Board on Climate Change

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About the European Scientific Advisory Board on Climate Change

The European Scientific Advisory Board on Climate Change (hereafter 'the Advisory Board') is an independent scientific advisory body that provides the EU with scientific knowledge, expertise and advice relating to climate change. The Advisory Board identifies actions and opportunities to achieve the EU's climate neutrality target by 2050. The Advisory Board was established by the European Climate Law of 2021, with a mandate to serve as a point of reference for the EU on scientific knowledge relating to climate change by virtue of its independence and scientific and technical expertise.

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Recommendations

Europe faces increasingly severe climate impacts, including rising loss of life, economic damages and ecosystem harm. While deep and sustained emission reductions – alongside the scaling-up of carbon removals – remain indispensable to limit future warming, adaptation must now be strengthened to prepare for unavoidable temperature increases and safeguard Europe's strategic priorities.

The European Scientific Advisory Board on Climate Change sets out five recommendations to move from fragmented and largely reactive adaptation efforts towards an effective, fair and transformational adaptation policy framework. These recommendations aim to inform the forthcoming European integrated framework for climate resilience and other ongoing EU initiatives.

Recommendation 1. Mandate and harmonise climate risk assessments
The EU should require climate risk assessments across relevant EU policies and decision-making. To support a more harmonised approach and strengthen adaptation planning across the EU, it should establish common climate scenarios – including a common reference – and methodological standards. Efforts to fully integrate climate risk assessment into corporate reporting, disclosure and financial supervision should be reinforced.

Recommendation 2. Adopt a common reference for adaptation planning
The EU should adopt a common reference for adaptation planning based on SSP2-4.5 to prepare for evolving physical climate risks arising from an emissions pathway to 2.8-3.3 °C of global warming by 2100 compared to the pre-industrial period. This would translate to higher levels of warming in Europe, which has historically warmed roughly twice as fast as the global average, and is currently experiencing about 1°C more warming regionally than the global average. More adverse pathways (e.g. SSP3-7.0) should be used for stress-testing to assess the robustness of policies, investments and adaptation options under higher-risk futures.

Recommendation 3. Set the vision for a climate resilient EU
The EU should set out a clear vision for a climate-resilient EU by 2050 and the longer-term, supported by sectoral strategies and cross-cutting adaptation targets. This vision should be grounded in science, EU commitments, and participation.

Recommendation 4. Embed fair and just climate resilience in all EU policies and measures
The EU should apply the climate-resilience-by-design principle across all its policies, programmes and investment decisions. It should develop and continuously update a monitoring, evaluation and learning system for adaptation. It should also establish a framework for fairness assessments to be applied to relevant EU policies and measures.

Recommendation 5. Mobilise public and private adaptation investment and establish a coherent approach to managing the costs of climate impacts
The EU should embed climate risk management into national economic governance and fiscal planning through its economic governance framework, and strengthen the contribution of the next EU multiannual financial framework to climate resilience. It should also strengthen efforts to mobilise and align private finance with climate resilience objectives. In addition, the EU should support efforts to address the growing climate insurance protection gap and strengthen the resilience of insurance systems to rising climate impacts and risks. Crisis response and recovery instruments should be strengthened to reflect more frequent and severe climate-related disasters.

Summary

Europe's escalating climate risks call for a stronger, more proactive and coherent approach to adaptation

Global temperatures are rising, with Europe experiencing significant and escalating costs from climate change impacts

Climate change is not a distant or abstract risk for Europe; it is imposing substantial human, economic and environmental costs that are rising rapidly. Global average temperatures have risen to around 1.4 °C above pre-industrial levels, and insufficient global progress on mitigation makes it increasingly likely that global warming will exceed the Paris Agreement's 1.5 °C temperature goal. Europe is warming faster than the global average, and the continent has experienced average annual temperatures over the past five years of around 2.4 °C above pre-industrial levels. Rising global temperatures have brought more frequent and severe climate hazards - such as heatwaves, droughts, wildfires, flooding, sea level rise and coastal erosion - and compounding impacts that are being felt across Europe.

Weather and climate-related extreme events have caused significant loss of life, serious harm to people's health, and impacts to ecosystems and economies. For instance, extreme heat has already caused tens of thousands of premature deaths across Europe, including an estimated 24,000 in the summer of 2025 alone, of which over two-thirds have been attributed to climate change. Heavy rainfall and flood events have killed hundreds, displaced communities, and caused severe damages to towns and infrastructure. These events are causing substantial economic damages and disruption. Estimated damages to infrastructure and physical assets reached an average of around EUR 45 billion per year over the 2020-2024 period, a five-fold increase compared to the 1980-1989 period.

Adaptation is necessary to protect the EU from rising climate risks and safeguard its ability to deliver on strategic priorities

Even under optimistic global mitigation pathways, scientific projections show that climate hazards will intensify over the decades to come. Without adequate adaptation, most climate risks in the EU are projected to reach critical levels by mid-century, bringing frequent, severe, persistent and far-reaching impacts. These will harm people's health and wellbeing, disrupt critical infrastructure and systems, weaken economic productivity and fiscal sustainability, and accelerate the loss of ecosystems and biodiversity. Taken together, with frequent and systemic impacts compounding one another, these risk eroding and destabilising the EU's economic and social foundations, compromising its ability to deliver on strategic priorities such as security, energy autonomy, economic competitiveness, social cohesion and democratic stability.

Societies must prepare for the impacts already being felt today, as well as those associated with future levels of warming. Adaptation plays an essential role in reducing the harm that climate hazards pose to people, places and systems. It has been shown to effectively reduce mortality during heatwaves, limit damages from floods, reduce losses in agriculture and forestry, and safeguard economies and ecosystem services. Adaptation strengthens climate resilience, that is the capacity to cope, recover and transform under a changing climate.

Yet current adaptation efforts in Europe remain insufficient and fragmented

Many climate risks continue to cause avoidable harm, indicating that existing adaptation efforts across the EU remain insufficient, largely incremental, often coming too late, and are not yet commensurate with the scale, pace and complexity of increasing climate risks. In some cases, poorly planned adaptation efforts have been maladaptive, increasing climate risks and potentially creating lock-ins that limit future options to adapt.

While adaptation measures are often initiated locally and most effective when tailored to specific places, local and national adaptation alone faces persistent barriers, such as in resources, capacities, coordination and long-term planning. Many climate risks affecting Europe are shared or transboundary in nature, such as risks to river basins and other ecosystems, energy and transport systems, supply chains and financial systems. Adaptation requires combined and coordinated efforts by actors across policy domains and at multiple levels of governance, including national and local, to put in place the enabling conditions for adaptation such as adequate policies, resources, and institutional capacities for coordinated systemic responses.

EU-level action is necessary to drive a more coherent and effective approach to the shared challenge of climate change

EU-level action on adaptation is required as climate impacts and risks undermine the effective delivery of EU policies including the functioning of the European single market, as well as the Union's ability to uphold its fundamental rights and meet its international obligations. Through coordinated EU-level intervention, climate risks can be assessed and addressed coherently and equitably across regions and populations, while benefiting from economies of scale in mobilising investment and providing climate data and services.

The EU has taken steps to integrate adaptation into EU policies and investment, but in a piecemeal way that lacks an overarching and coherent framework to guide action. The EU does not yet share a common understanding of what it should collectively prepare for, resulting in inconsistent climate risk assessments that often underestimate climate risks. EU adaptation planning and reporting remain limited, hampered by the absence of a clear long-term vision and measurable targets. This fragmented approach hampers adaptation efforts and will leave the EU inadequately prepared.

Ongoing EU policy processes provide a strategic opportunity to integrate climate resilience more systemically into EU policymaking and investment decisions

Several ongoing EU policy processes create an important window of opportunity to strengthen EU adaptation efforts. These include the development of a European integrated framework for climate resilience proposal (expected in the second half of 2026) and the negotiations on the next multiannual financial framework (MFF). This also includes legislative initiatives that precede these frameworks, such as the proposed European grids package, proposals on strengthening energy security, and the updates to the Governance Regulation.

Decisions taken in these processes will shape the EU's ability to anticipate, manage and reduce climate risks for decades to come. In this context, and as mandated by the European Climate Law, the European Scientific Advisory Board on Climate Change examined the conditions needed to enable effective adaptation in a complex, uncertain and rapidly changing climate, and how EU-level action can support anticipatory, coherent, fair and systemic adaptation across the Union.

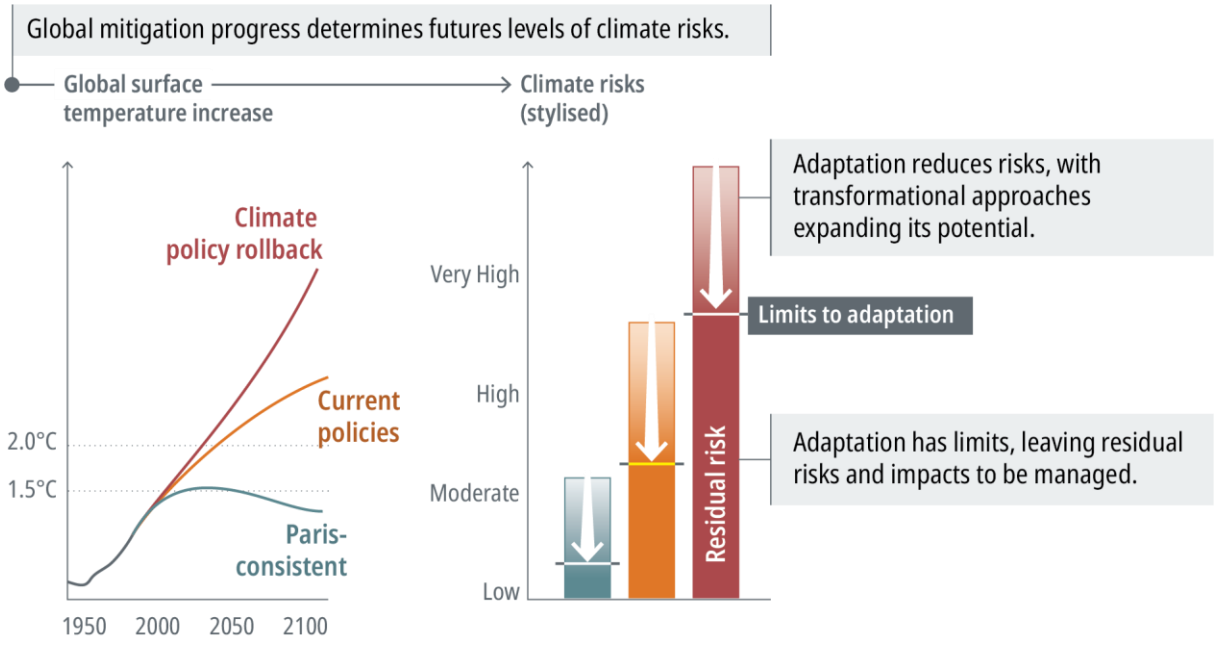
Building a framework for effective EU adaptation

Early and strategic adaptation, combined with rapid, sustained mitigation efforts are needed to reduce growing climate risks and manage residual impacts

Given the extent to which the climate has changed and will continue to change, the EU needs to be able to respond to current climate impacts, as well as to recognise and adjust to future climate risks and long-term trends. Rapid and sustained global mitigation efforts are necessary to stabilise, and eventually reduce, global temperature levels later in the century, and to limit the most severe climate risks, with every increment of warming increasing the frequency, magnitude and reach of climate hazards that drive climate risks. Without mitigation, climate risks will continue to escalate, becoming more difficult and more costly to manage.

At the same time, even under optimistic mitigation scenarios climate hazards will become more frequent, severe and unpredictable. Acting early and strategically to adapt to the warming climate is therefore necessary to avoid escalating damages and to deliver high societal returns, often with multiple co-benefits for health, ecosystems and economic development. Incremental adaptation (i.e. adjustments to current practices) can reduce near-term risks, while transformational adaptation – often involving large-scale, long-term and systemic changes – will be needed in many contexts, especially where incremental measures are no longer sufficient to manage rising risks, where limits to adaptation are being approached, or where deeply-rooted vulnerabilities constrain effective action (see Figure S.1).

Figure S.1 Managing climate risks requires rapid and sustained mitigation, ambitious adaptation and measures to manage residual risks



Notes: The figure illustrates, in a stylised manner, how different levels of global warming influence climate risk levels, and how mitigation and adaptation can reduce, but not eliminate, climate risks. The figure on the left presents projected levels of warming (relative to 1850-1900) across different combinations of emission pathways (which explores how society, demographics and economics might evolve) and representative concentration pathways (which imply different levels of mitigation). Associated climate risk levels and adaptation effects on the right are stylised. Note that soft and hard limits may vary depending on the warming pathways.

Source: Adapted from UNEP (2025a).

Core conditions that underpin effective adaptation across the EU

The Advisory Board focused its analysis on the conditions that underpin effective adaptation across the EU, rather than conducting a sector-by-sector review. The analysis concentrates on the planning, governance, and implementation conditions that allow societies to anticipate risks, manage uncertainty and adjust their responses over time.

The assessment draws on multiple sources of evidence, including: the latest climate science and wider scientific literature including warming projections; findings from the European Climate Risk Assessment (EUCRA); and government and research reports. It was conducted through the lens of the EU's principles and values, embedded in EU law and guiding policymaking in the context of societal choices and trade-offs.

The combined evidence was used to examine the strengths and weaknesses in the current EU policy framework and understand where adaptation efforts across the EU are lagging, which governance barriers persist and where EU-level action can provide direction, coherence, and scale while supporting solidarity, security and competitiveness.

A principle-based framework for effective adaptation

Given the diversity of climate risks, regional contexts and sectoral dynamics across the EU, effective adaptation cannot rely on a single set of measures. The Advisory Board therefore focused on identifying adaptation planning, implementation, and governance conditions that help actors reduce climate risks, manage uncertainty and adjust actions as knowledge and conditions evolve, across different contexts and sectors, and are grounded in scientific evidence and EU values and principles.

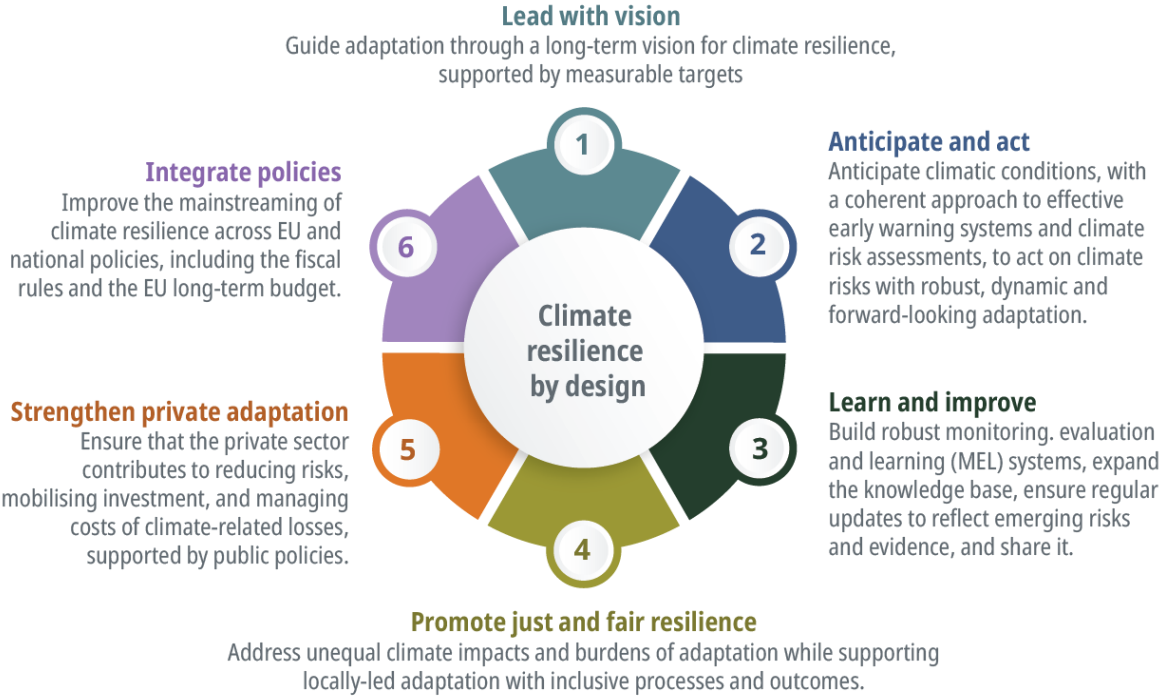
This assessment consistently pointed to conditions that underpin effective adaptation systems:

- long-term direction,
- anticipatory planning to proactively respond to current and future threats,
- iterative learning and adjusting,
- promotion of fairness and inclusion,
- mobilisation of both public and private resources, and
- coherence across governance levels and policy domains.

These aspects were synthesised into six guiding principles, presented in Figure S.2, which together define the foundation for an effective EU adaptation policy framework. The guiding principles form the analytical backbone of the report, structuring the assessment of the current EU adaptation policy framework and helping to identify where gaps persist. They also provide a practical reference for embedding climate resilience systematically into policy design and future decisions.

Notably, the guiding principles are consistent with the emerging EU principle of climate resilience by design, which seeks to embed adaptation considerations into policy and investment decisions from the outset, ensuring these decisions increase climate resilience and contribute to the EU's broader resilience and security.

Figure S.2 Guiding principles for an effective EU adaptation policy framework



On this basis, the Advisory Board identified a set of priority interventions that can translate these guiding principles into concrete EU-level action to strengthen climate resilience.

Global resilience strengthens European resilience

While this report focuses on strengthening domestic EU adaptation policy, supporting adaptation efforts beyond Europe remains essential. Climate risks outside of the EU can also affect the Union through supply chain disruptions, financial instability, migration pressures and geopolitical tensions. Strengthening global resilience therefore aligns with the EU's strategic interests, supports its international commitments and contributes to global stability.

Enhancing the EU's global role requires reinforcing partnerships with the most climate-vulnerable regions, supporting adaptation planning and risk governance, providing knowledge and capacity support, and investing in climate-resilient development pathways. The EU should ensure that its external actions – including engagement with global supply chains and the use of international carbon credits – support rather than undermine adaptation in partner countries. Participation in global adaptation initiatives and research alliances can also further international cooperation and knowledge exchange, benefiting both European and global climate resilience.

Key recommendations to strengthen Europe's climate resilience

Building on the six guiding principles and the assessment of EU policy gaps, the Advisory Board proposes a set of five recommendations to guide the development of an effective EU adaptation policy framework. Together, these recommendations translate the analytical findings of the report into a coherent set of priority EU-level interventions. Icons are provided alongside the key recommendation titles to outline under which guiding principles the supporting analysis can be found. Taken as a package, the recommendations are designed to reinforce each other and support effective, fair and transformational adaptation (hereinafter referred to as effective adaptation) across the EU.

Recommendation 1. The EU should mandate and harmonise climate risk assessments, using common climate scenarios and methodological standards to strengthen adaptation planning.

Rationale

Effective adaptation depends on understanding current and future climate risks and acting before these risks materialise. This requires comprehensive and forward-looking climate risk assessments, underpinned by climate scenarios that translate emission pathways into levels of warming and future climatic conditions.

Many climate risks affecting Europe are transboundary and systemic, with impacts in one country or sector cascading across borders, supply chains, ecosystems and financial systems. A consistent and coherent approach to climate risk assessment is therefore essential to support anticipatory action, ensure a level playing field where required, including for financial decision-making, and enable climate resilience by design across EU policies and decision-making.

At present, climate risks are often underestimated. Many policies and investments remain based on historical climate conditions or optimistic emissions pathways, leaving infrastructure, companies, ecosystems, and people inadequately prepared. While several EU policies and legislative instruments require climate risk assessments in different contexts, requirements vary widely in scope, methodology, time horizon and update cycles. This fragmentation undermines coherence, limits comparability and weakens EU-wide adaptation planning, such as required under the European Climate Law and Governance Regulation, leaving Member States vulnerable to compounding, cascading and transboundary risks.

Greater harmonisation can provide a robust and shared analytical foundation for adaptation, while still allowing flexibility for tailored approaches relevant for national and regional contexts. Common scenarios and methodological standards would facilitate and strengthen implementation, improve comparability, and support coordinated responses to shared risks. Such harmonisation allows for a joint approach, tools and data development, as well as a common market for risk assessment and adaptation services.

The Advisory Board therefore recommends the following:

1.1 **The EU should require climate risk assessments across relevant EU policies and decision-making.** These assessments should:
- be based on the common reference for adaptation planning, including more adverse scenarios for stress-testing;
- assess both physical hazards and socio-economic vulnerabilities (e.g. informed by shared socio-economic pathways);
- explicitly consider transboundary, compounding and cascading risks;
- be grounded in the latest scientific evidence, including through regular and mandated updates of EUCRA.

1.2 **The EU should establish a set of common climate scenarios**, including a common reference, to support a more harmonised approach to climate risk assessment and adaptation planning across the EU. These scenarios should:

- be based on and updated in line with the best available scientific evidence, including the Intergovernmental Panel on Climate Change's (IPCC) assessments and authoritative policy projections from the UN Environment Programme (UNEP).
- be co-developed by EU institutions and Member States (e.g. through cooperation between the Copernicus Climate Change Service and national climate scenario providers), balancing harmonisation with the need for tailored approaches;
- be guided by key design principles, including:
    i) assessing seasonal as well as annual changes;
    ii) considering changes in extremes as well as averages;
    iii) adequate spatial and temporal resolution for risk-informed decision-making;
    iv) showing how risks have already evolved to date and how they are projected to change in the future;

1.3 **The EU should establish methodological standards for climate risk assessments** where the common reference and climate scenarios can act as a reference to support a more harmonised approach across policies and governance levels. These standards should define common parameters, including:

- scenarios and time horizons;
- sectors and systems to be covered;
- minimum analytical requirements, differentiated by sectors and systems, and common definitions;
- frequency of updates and alignment of national assessment cycles.

The methodological standards should explicitly include the assessment of risks already being experienced today, to support the design of early warning systems and near-term risk management alongside long-term adaptation planning.

1.4 **The EU should enhance adaptation planning across sectors and governance levels**. In particular, it should:

- require Member States to define adaptation pathways based on harmonised climate risk assessments and translate them into policies and measures;
- ensure that both EU and national adaptation planning considers the relevant socio-economic vulnerabilities and prioritises the most climate vulnerable populations, regions and sectors;
- strengthen Member States reporting on adaptation plans and progress, including for transformational adaptation to support the most vulnerable, and take action where gaps are identified.

1.5 **The EU should reinforce efforts to fully integrate climate risk management into corporate reporting, disclosure and financial supervision.** This includes continuing to improve methodologies and practices for climate risk assessments, scenario analysis, stress testing and adaptation plans by the private sector, and promote consistency across EU legislation. The scope and implementation of the Corporate Sustainability Reporting Directive should reflect its role as a key source of information on climate risks across the EU economy. In future reviews, reporting requirements should be extended in a proportionate manner, informed by robust impact assessments and climate consistency checks. In particular, this should aim to ensure adequate geographic and sectoral coverage, and reflect both sectors' exposure to climate risks and economic significance.

Recommendation 2. The EU should adopt a common reference for adaptation planning to prepare for a pathway to 2.8-3.3°C of global warming by 2100 and use more adverse pathways for stress-testing.

Rationale

Pursuing mitigation targets and policies aligned with the Paris Agreement's global temperature goal remains the most effective way to limit the most severe climate risks and impacts. At the same time, adaptation planning must be informed by the range of climate futures, both in terms of long-term global warming levels and pathways, that cannot yet be ruled out given current emission trends and uncertainties around policy implementation (see Recommendation 1).

As part of the range of futures considered, a common reference for adaptation planning would help ensure a minimum level of climate resilience across the EU, while improving consistency in climate risk assessments and adaptation planning. The European Commission has proposed to use the expected physical climate risks arising from the IPCC's intermediate emissions pathway (SSP2-4.5) as the lowest acceptable baseline for adaptation in EU policies, and to use more adverse pathways when stress testing and comparing adaptation options.

SSP2-4.5 is broadly consistent with projections by UNEP based on currently implemented policies continuing. UNEP's projections imply global warming is likely (i.e. greater than 66% likelihood) to very likely (i.e. greater than 90% likelihood) not to exceed 2.8°C and 3.3°C by 2100 respectively, relative to pre-industrial levels. As Europe is warming about twice as fast as the global average, this would imply higher levels of warming in Europe. In line with the precautionary principle, planning at least for climate conditions in line with this emission pathway is prudent. Given remaining uncertainties and the risk of climate policy delay or reversal, adaptation planning must also systematically consider more adverse emissions pathways, such as SSP3-7.0. As mitigation efforts deliver results over time, the common reference could be periodically revised accordingly.

The Advisory Board therefore recommends that the following:

2.1 **The EU should adopt a common reference for adaptation planning based on SSP2-4.5**[1], to prepare for evolving physical climate risks arising from an emissions pathway to 2.8-3.3°C of global warming by 2100 compared to the pre-industrial period. This would translate to higher levels of warming in Europe, which has historically warmed roughly twice as fast as the global average, and is currently experiencing about 1°C more warming regionally than the global average.

2.2 **The EU should use more adverse emission pathways (e.g. SSP3-7.0) for stress-testing**, to assess robustness of policies, investments and adaptation options under higher-risk futures.

The common reference should be based on and reviewed periodically in line with the best available scientific evidence, including the IPCC assessments and authoritative policy projections from the UN Environment Programme.

[1] This recommendation refers to the emissions, concentration and climate outcomes associated with SSP2-4.5, not its underlying socioeconomics.

Recommendation 3. The EU should set out a vision for a climate-resilient EU by 2050 and the longer term, supported by sectoral strategies and adaptation targets.

Rationale

A clear, shared, long-term vision for a climate-resilient EU would strengthen policy coherence and provide strategic direction across EU and national adaptation efforts. Embedding such a vision in EU law, supported by sectoral strategies that reflect the vision and measurable adaptation targets, would guide policy planning, implementation and investment decisions over time.

The vision and targets, linked to the common reference for adaptation planning and harmonised climate risk assessments (see Recommendations 1 and 2), would enable the EU to manage climate risks in a way that reflects scientific evidence, EU values and principles, and societal choices – including the level of climate risk that people consider acceptable. Measurable targets are essential to drive implementation, enable progress tracking, and support timely course corrections as risks evolve and new knowledge emerges (see Recommendation 4).

The EU and its Member States have committed under the Paris Agreement to the global goal on adaptation, including the 11 cross-cutting and sectoral targets for 2030 and beyond adopted in 2023. While EU legislation reflects the overall global goal, it lacks concrete adaptation targets, in contrast to the EU's target-based climate mitigation framework. Existing EU adaptation and preparedness strategies articulate broad ambitions, but their visions remain too general and lack the legal force needed to drive action consistently across policy domains and governance levels.

A stronger vision-and-target framework would therefore help move EU adaptation from fragmented and short-sighted efforts towards a more strategic, anticipatory and accountable approach.

The Advisory Board therefore recommends the following:

3.1 **The EU should set out a clear vision for a climate-resilient EU by 2050 and the longer-term.** This vision should be supported by:

- sectoral strategies reflecting different risk profiles as well as adaptation challenges and opportunities;
- cross-cutting and sector-specific adaptation targets, for example for 2030 and 2040.

3.2 **The EU should ground this vision and targets in science, commitments, and participation.** The process for defining the vision for a climate resilient EU and EU adaptation targets should:

- build on the common reference for adaptation planning and harmonised climate risk assessments;
- align with EU values, principles and international commitments, including the global goal on adaptation;
- be participatory and inclusive, enabling meaningful engagement of relevant stakeholders;
- include periodic review to reflect evolving climate risks, new evidence and societal priorities.

Recommendation 4. The EU should embed fair and just climate resilience in all its policies and measures, underpinned by monitoring, evaluation and learning to support progress towards EU adaptation targets.

Rationale

Delivering effective adaptation requires that EU policies and investments are guided by the long-term vision for climate resilience and the associated sectoral strategies and adaptation targets (see Recommendation 3). At a national level, adaptation efforts must collectively contribute to achieving these shared objectives. Because climate risks are dynamic and uncertainty remains high, policies must remain effective as conditions change and new knowledge emerges.

This requires climate resilience to be systematically embedded into policy design and implementation, supported by monitoring, evaluation and learning (MEL) systems. MEL should integrate climate risk assessments (see Recommendation 1) with indicators linked to EU adaptation targets, enabling continuous feedback, learning and course correction. This process must pay explicit attention to fairness to ensure that adaptation efforts do not exacerbate inequalities or shift burdens onto already vulnerable groups, regions or future generations.

The current EU legislative and governance framework does not yet provide a sufficient basis to deliver these objectives. In particular, it lacks:

- a common approach to climate risk assessments, planning, monitoring and reporting of policies and progress towards EU adaptation targets;
- a clear definition of the adaptation needs best addressed at the EU level, including risk-management responsibilities across sectors and actors supported by adequate accountability mechanisms and dedicated resources to ensure implementation;
- governance arrangements that systematically engage all relevant sectors, administrative levels and private actors;
- consistent treatment of climate risks as a security concern;
- systematic assessments of the distributional impacts of adaptation, while the application of the 'do no significant harm' principle is too narrow to capture the multiple dimensions of fair and, just resilience.

The Advisory Board therefore recommends the following:

4.1 **The EU should apply the climate resilience by design principle across all EU policies, programmes, and**

4.2 **decisions.** This should:

- be aligned with the six guiding principles and the recommendations set out in this report;
- clarify EU-level responsibilities for climate risk management across policy domains;
- ensure progress towards EU adaptation targets through a mix of binding obligations, incentives and targeted capacity-building.

4.3 **The EU should develop and continuously update a MEL system for adaptation and support its use by policymakers at all levels.** The EU MEL system should include:

- data on evolving climate impacts and risks, ecosystem resilience, loss and damage, societal exposure and vulnerability;

- information enabling collective policy and progress monitoring based on a set of common indicators linked to EU adaptation targets;
- information on adaptation effectiveness, including the identification of avoided losses, cases of maladaptation, and distributional effects;
- links to early warning systems and decision-support tools for adaptation planning.

4.4 **The EU should establish a framework for fairness assessments and apply it to relevant EU policies and measures**. The framework should:

- define key concepts, including just resilience;
- provide a basis for identifying and addressing unequal distribution of benefits and burdens of adaptation across social groups, sectors, regions and generations;
- ensure meaningful participation of affected communities;
- be applied, as part of MEL, throughout the policy or project cycle to enable targeted action on structural vulnerabilities and to prevent regressive outcomes.

Recommendation 5. The EU should mobilise public and private adaptation investment, and establish a coherent approach to managing the costs of climate impacts, through the EU budget and economic governance framework.

Rationale

Climate impacts are placing growing pressures on the EU economy, financial system and public budgets, making early and sustained investment in adaptation crucial to strengthen climate resilience and limit future costs. However, adaptation finance remains insufficient, and both public and private finance are not yet adequately aligned with climate resilience objectives.

EU budgetary and economic governance frameworks play an important role in shaping adaptation investments. While the EU supports adaptation primarily through climate mainstreaming in the MFF, direct adaptation investments remain low, constrained by weak prioritisation of adaptation, inadequate tracking, and limited administrative capacity and technical expertise. Efforts to scale up private adaptation finance are still at an early stage. In parallel, EU economic governance influences national reforms and investments through the European semester and related instruments. While this framework has facilitated increased investments in security, climate risks remain treated as a separate issue rather than a core security concern.

Because adaptation cannot eliminate all climate risks, insurance, risk transfer and crisis response mechanisms are also critical to managing the residual costs of climate impacts. If well designed, these instruments can reduce fiscal shocks, incentivise risk reduction and support climate-resilient recovery after crises hit. However, the EU currently lacks a coherent approach to sharing and managing climate-related losses across private actors, national budgets and the EU level. There is a large and widening climate insurance protection gap, with only around one quarter of climate-related economic losses currently insured in the EU. Rising climate impacts and risks threaten insurance availability and affordability, increasing pressures on households, firms, and public finances at all levels. This also puts additional pressure on EU-level crisis response instruments, such as the EU Solidarity Fund and the Union Civil Protection Mechanism, which complement national efforts but are increasingly strained. Furthermore, these instruments do not sufficiently support and incentivise proactive risk reduction and building back better to adapt and transform in the long term.

The Advisory Board therefore recommends the following:

5.1 **The EU should use its economic governance framework to embed climate risk management in national economic and fiscal planning.** The European Semester, the Technical Support Instrument, the Stability and Growth Pact, and other economic governance tools should guide, support and enable national reforms and investments that embed climate risk management across security and other relevant policies and spending.

5.2 **The EU should strengthen the contribution of the next MFF to climate resilience** by:

- applying the climate resilience by design principle consistently across all programmes and spending categories, including when Member States design and implement national and regional partnership plans;
- improving expenditure tracking to identify which EU (co-)funded investments support or undermine climate objectives, including adaptation;
- providing targeted capacity-building and technical assistance to strengthen adaptation expertise and investment readiness among public authorities at all levels and private institutions;

- improving coordination between climate, regional development and social policies to address structural vulnerabilities and uneven climate impacts.

5.3 **The EU should strengthen efforts to mobilise and align private finance with climate resilience objectives**, including through the MFF and in cooperation with the European Investment Bank. This could include:
- creating and aligning financial and regulatory incentives across EU policies to support effective adaptation, while controlling for possible perverse incentives, such as in product standards, building codes, subsidy schemes or spatial planning;
- targeted use of public funding, including exploring opportunities for blended finance and innovative financing instruments, to enable and crowd in private adaptation investments.

5.4 **The EU should support efforts to address the climate insurance protection gap** and strengthen the resilience of insurance systems to rising climate impacts and risks, by supporting improved availability and affordability of insurance across Member States. This should include:
- considering EU-level reinsurance or public-private partnership mechanisms to enhance risk pooling and diversification, such as those in proposals by the European Central Bank and European Insurance and Occupational Pensions Authority;
- establishing consistent standards for embedding incentives for adaptation and risk reduction into insurance product design and underwriting practices, including through the implementation of the Solvency II and Insurance Distribution Directives.

5.5 **The EU should strengthen its crisis response and recovery instruments**, including the Solidarity Fund and the Union Civil Protection Mechanism, to ensure they are fit for more frequent and severe climate-related disasters. In addition, these instruments should:
- better incentivise proactive risk reduction and climate-resilient recovery, including building back better to adapt and transform after disasters;
- be closely coordinated with insurance systems to support long-term resilience and fiscal sustainability.

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1.1. Living with climate change

Europe is living with the impacts of climate change.

Climate hazards such as heatwaves, droughts and floods have become more frequent and severe across the continent, bringing significant and rising impacts to people, places, ecosystems and economies.

- **Record heatwaves, often compounded with droughts and wildfires, have become near-annual events over the past decade.** In 2025 alone, over 1 million hectares burned due to forest fires in the EU, around three times the 2006–2024 average (EFFIS, 2026), and western Europe experienced its hottest June on record (C3S and ECMWF, 2025). Rapid analysis using established peer-reviewed methodologies has estimated over 24,000 heat-related deaths across 854 European cities between June and August 2025, with 68 % attributed to temperatures being 3.6 °C higher than they would have been without climate change (Barnes et al., 2025). This follows an estimated 60,000–70,000 premature heat-related deaths across Europe in summer 2022, half of which were directly attributed to climate change (Beck et al., 2024).
- **Heavier rainfalls have driven severe floods in recent years**, with large-scale flood events causing hundreds of deaths, submerging towns, triggering landslides, displacing people and damaging infrastructure (EEA, 2024a). For example, catastrophic floods in the region of Valencia in October 2024 caused 223 deaths, displaced 15,000 people, and long-term economic, health and environmental effects (Martin-Moreno et al., 2025). Large-scale floods in July 2021 killed at least 222 people across Europe, including 134 in Germany's Ahr valley alone, also with extensive damage and disruption to towns and infrastructure (EEA, 2024a). Flooding has been compounded by more frequent periods of drought, such as in 2022 following a period of severe drought across Europe, when the impacts of heavy precipitation were intensified by increased runoff from hardened ground (Steensen et al., 2025).
- **More frequent and severe extreme weather events are causing rising economic losses.** Reported economic losses to physical assets and infrastructure alone increased from an annual average of EUR 8.5 billion per year in 1980–1989, to EUR 17.8 billion per year in 2010–2019, and EUR 44.5 billion per year for the 2020–2023 period, in 2023 prices (EEA, 2025b). Current climate-related agricultural losses have been estimated at an average of EUR 28 billion per year, and projected to increase to an average of EUR 40 billion by mid-century under current emission trends (Fi-Compass, 2025). Economic losses are often persistent, and can give rise to indirect effects and productivity losses that compound and intensify over time (Usman et al., 2025b). For instance, rapid analysis applied to the EU 2025 summer floods, droughts and heatwaves – which have been made increasingly frequent and severe by climate change – estimated direct economic losses of EUR 43 billion in 2025 alone, rising to EUR 129 billion by 2029 including indirect and compounding effects (Usman et al., 2025a).

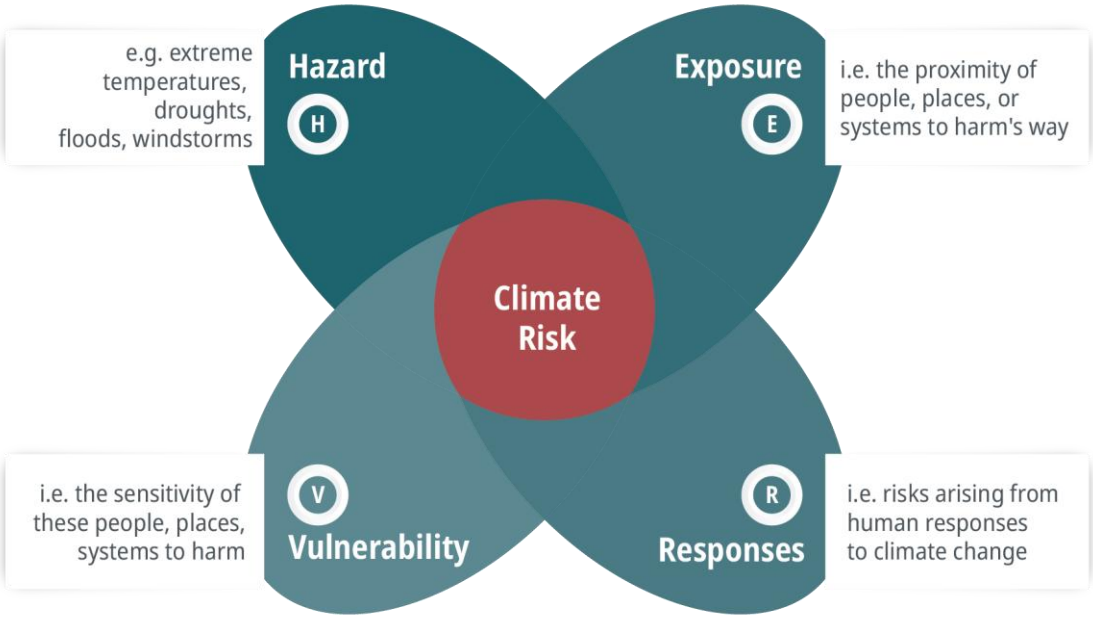
Europe is experiencing rapid and profound changes in climatic conditions, often at a pace that challenges long-standing ways of living, working, planning, building and managing crises. This reality requires urgent action to protect people, economies and ecosystems from rising climate risks and to strengthen the climate resilience of key systems that underpin Europe's security and prosperity. Adapting to climate change seeks to reduce the climate risks that threaten these systems, and to create the conditions that allow them to cope, reorganise and thrive under a rapidly changing climate.

Climate adaptation moderates harm and seizes opportunities from a changing climate.

Climate risks emerge when climate-related hazards (such as extreme temperatures or floods) interact with people, places or systems susceptible to harm and in harm's way (Simpson et al., 2021). Rapid, sustained climate mitigation remains the only way to stop global warming, and to prevent climate hazards from becoming more frequent, severe, complex and difficult to manage. However, as climate risks are present and rising, adaptation is essential.

While some ecosystems or human systems may be able to adjust spontaneously to hazards, adaptation most often requires an active process of climate risk management, by addressing the key drivers of climate risk: exposure, vulnerability and responses (see Figure 1), while also managing the losses and damages caused by climate impacts (IPCC, 2022a). In practice, risk is reduced by addressing one or more of these components of risk. For example, building coastal defences may reduce the exposure of nearby residents to coastal flooding, or providing targeted supports may reduce vulnerability of certain groups during heatwaves.

Figure 1 Climate risks stem from the interaction of climate hazards, exposure, vulnerability and responses



Source: Adapted from Simpson et al. (2021).

As a process of reducing climate risks, adaptation aims to strengthen climate resilience. Climate resilience is the broad ability of people or systems to withstand impacts; to respond or reorganise in ways that maintain their core functions or identities; while maintaining the capacity to learn and transform as climatic conditions change. As a policy goal, building resilience involves both strengthening their ability to cope with sudden, acute events, and also adjusting to long-term trends and slow-onset hazards that may require deeper, long-term transformation (IPCC, 2022a).

Climate resilience depends closely on adaptive capacity, which is the ability and willingness to adjust to potential damage, for instance by mobilising resources to respond to climate risks. Adaptive capacity is influenced by a broad and diverse range of enabling factors and barriers, such as economic resources, technology, information, skills, institutions and socio-cultural factors (Chapagain et al., 2025).

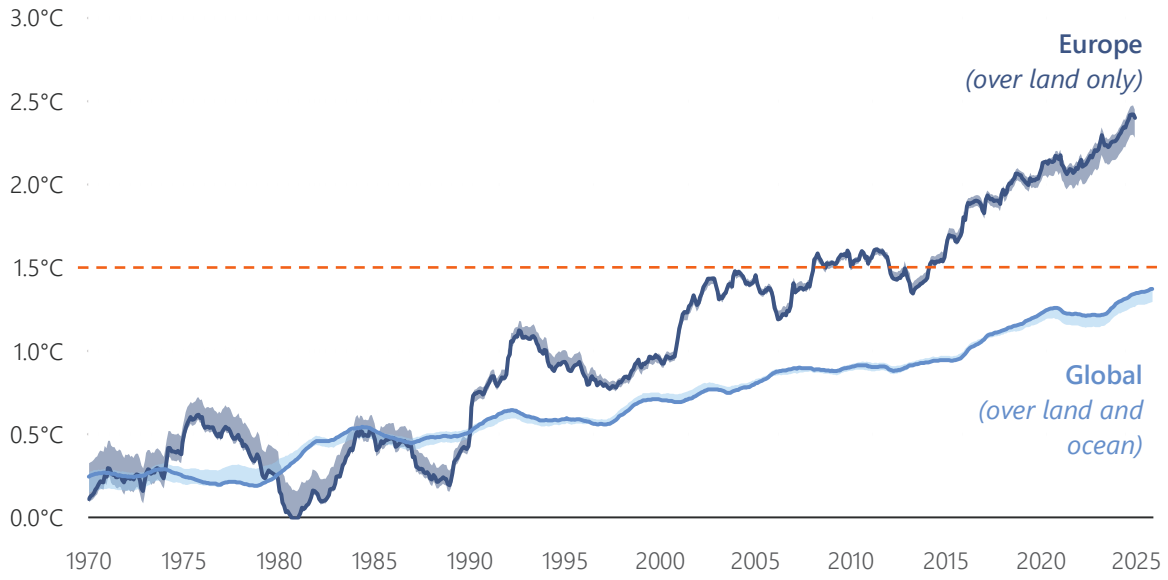
In tandem with reducing risk from concrete hazard events and trends, adaptation seeks to anticipate broader future trends so that the options used to adapt to risk not only avoid damages, but improve overall material conditions and wellbeing. As a process, adaptation can therefore help to create and seize opportunities in a way that ultimately makes societies more resilient, thus also contributing to delivering long-term security, prosperity and wellbeing.

1.2. Europe's rapidly changing climate

As average global warming has continued to rise, Europe is warming faster than the rest of the world and has been experiencing increasingly severe impacts of climate change in recent decades.

Since the Intergovernmental Panel on Climate Change's (IPCC) sixth assessment report in 2022, global temperature records have been repeatedly broken. The past 11 years, 2015-2025, are the 11 warmest on record (C3S, 2026a). In 2025, the global five-year average temperature reached around 1.4 °C above pre-industrial levels (C3S, 2026a). Europe is warming at around twice the rate of the global average, and in 2024, its five-year average temperature reached 2.4 °C above pre-industrial levels and the rate of warming is accelerating since 1980 (C3S and WMO, 2024; see Figure 2). As the climate warms, Europe has seen increasingly frequent and severe heatwaves, large-scale wildfires, devastating floods and shifting precipitation patterns (EEA, 2024a; C3S and WMO, 2025; Karinou et al., 2025). Cascading and compounding climate-induced hazards have resulted in accelerating coastal erosion, land degradation, desertification and the amplification of other environmental stressors (Gianoli et al., 2023; Van De Wal et al., 2024).

Figure 2 Average surface air temperature increase above pre-industrial levels



Notes: Anomalies in average surface air temperature (°C), shown as five-year averages (centred running 60-month periods) since 1970, relative to the average for the 1850–1900 designated pre-industrial reference period. The range from other sources is based on JRA-3Q (mean), GISTEMPv4 (mean), NOAAGlobalTempv6 (mean), Berkeley Earth (mean) and the HadCRUT5 (range). The European data up to 2024 is based on C3S's climate indicators published in April 2025, and the global data up to 2025 is based on the Global Climate Highlights 2025 report published in January 2026.

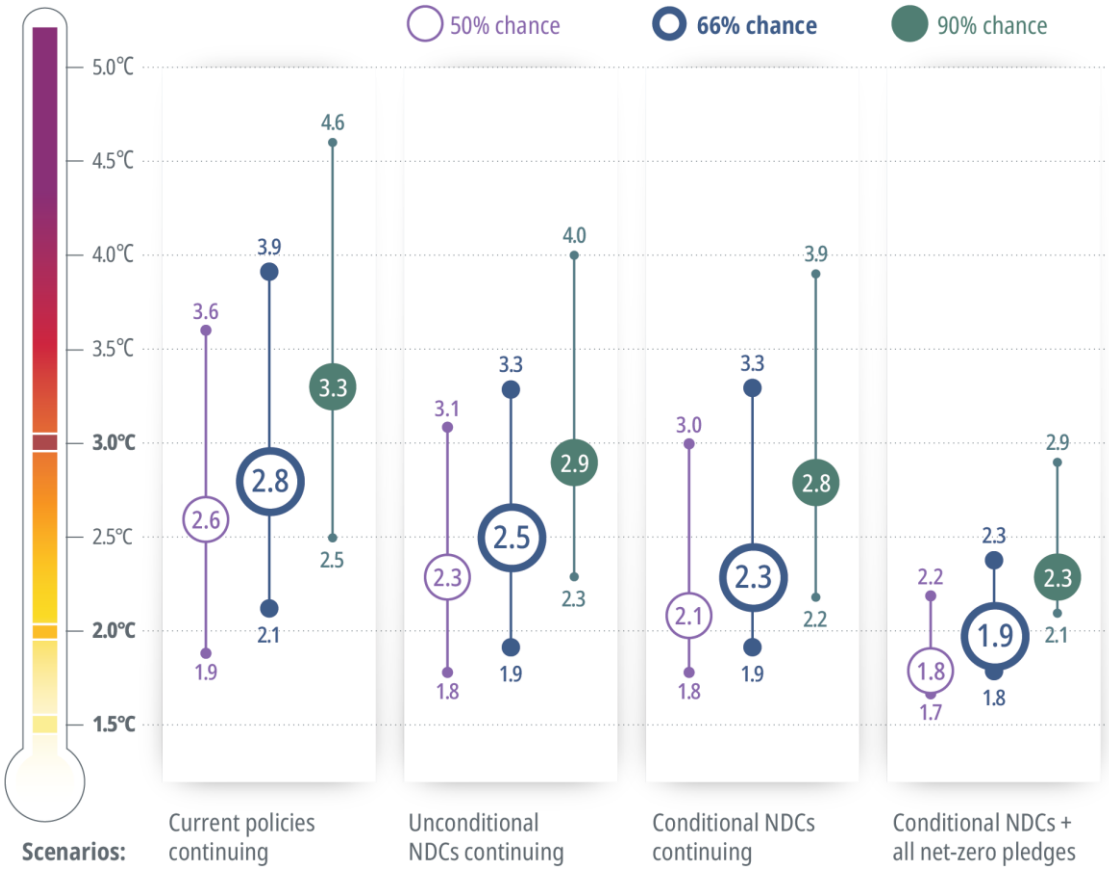
Source: Based on C3S/ECMWF (2026b, 2026a).

Given the current policy trajectory, global warming is very likely to exceed 1.5 °C before 2050 and has a one-in-three chance of surpassing 2 °C.

Since the IPCC's sixth assessment report, the UN Environmental Programme (UNEP) has released updated probabilistic global warming projections based on current policies and various assumptions about the implementation of countries' nationally determined contributions (NDCs) pledges (see Figure 3). Scenarios reflecting a continuation of current policies show more than 90 % chance of global warming exceeding 1.5 °C above pre-industrial levels by 2050, and one-in-three chance of surpassing 2 °C. By 2100, these scenarios imply a 50 %, 33 % and 10 % likelihood of warming exceeding 2.6 °C, 2.8 °C and 3.3 °C respectively. These projections, based on current policies, have largely fallen just under 3 °C thanks to global mitigation efforts and increasingly ambitious policies, whereas they were just under 4 °C at the time of the adoption of the Paris Agreement. However, higher levels of warming cannot be ruled out (UNEP, 2025d).

UNEP's most optimistic scenario, assuming full implementation of the most stringent pledges and of all countries' long-term strategies, still indicates a four-in-five chance of exceeding 1.5 °C, a one-in-three chance of exceeding 1.9 °C, a one-in-five chance of exceeding 2 °C and a one-in-twenty chance of exceeding 2.5 °C over the course of the 21st century (UNEP, 2025d).

Figure 3 Peak warming over the twenty-first century (°C) relative to pre-industrial levels and associated likelihoods and uncertainty around those estimates



Notes: The scenarios illustrate different global climate mitigation policy pathways: 'current policies' assumes only existing measures are continued; 'unconditional NDCs' includes all countries' current pledges; 'conditional NDCs' adds further actions dependent on international support; and 'conditional NDCs plus all net-zero pledges' assumes full implementation of all pledges and announced net-zero targets. 50%, 66% and 90% chance correspond to the likelihood of limiting global warming below the corresponding temperature limits.

Source: UNEP (2025d).

While mid-century warming will largely be determined by historical emissions, rapid emissions cuts are crucial to minimising further climate change.

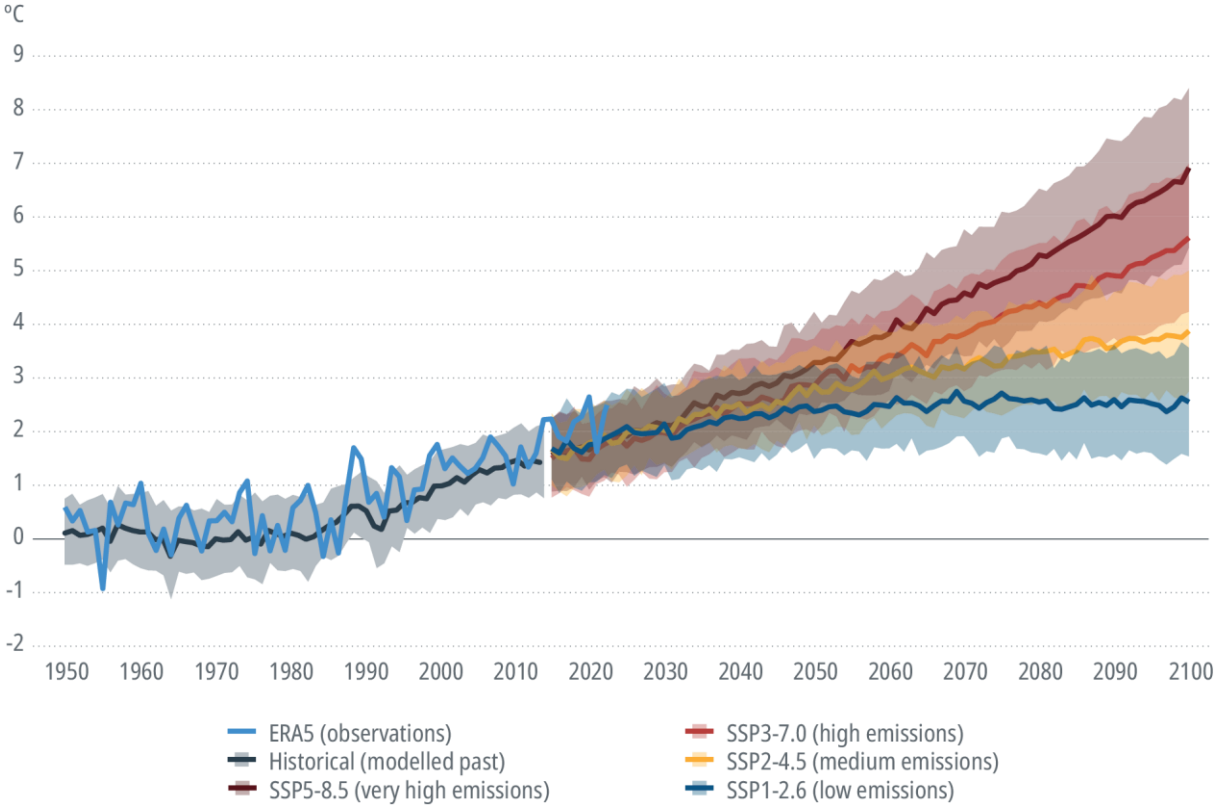
Human-induced warming has been increasing at an unprecedented rate, with 0.27 °C in the past decade alone. In 2024, it stood at 1.36 °C above pre-industrial levels (Forster et al., 2024). Unless global greenhouse gas emissions decline sharply, global warming is likely to reach 1.5 °C by the end of this decade (C3S, 2026a). The global average temperature in any given year is a combination of human-induced global warming and natural year-to-year variations, such as El Niño climate patterns in the Pacific Ocean and the North Atlantic oscillation. A recent study estimated that, of the 1.52 °C global annual average temperature increase observed in 2024, 1.36 °C can be attributed to human activities (Forster et al., 2024).

Irrespective of mitigation efforts, a certain level of additional warming up through the mid-century is inevitable as carbon dioxide emissions cannot be brought to zero instantaneously. Even if emissions were to stop immediately, a risk exists that global average temperatures rise further (IPCC, 2021; MacDougall et al., 2020; Palazzo Corner et al., 2023). Meanwhile, the scale of additional warming and the risk of crossing climate system tipping points in the second half of the century depend on the speed and depth of emissions reductions in the coming decades, with evidence indicating that some tipping points could already be exceeded, with 1 °C to 2 °C warming (Armstrong McKay et al., 2022; Bradley and Hewitt, 2024; IPCC, 2023a). This would only exacerbate the already heightened risk of catastrophic trends and events felt today. Recent research also suggests that seven of the nine planetary boundaries have been breached, including for climate change, biodiversity loss, land-system change and excessive nutrient pollution (PIK, 2025). Crossing tipping points will make adaptation much more challenging, due to the severe, globally irreversible climate impacts.

Europe is forecasted to continue warming faster than the global average, with scenarios suggesting reaching between 2 °C and 3 °C by 2050.

For Europe, the IPCC's sixth assessment emissions pathways display higher warming levels than the global level. In recent decades, Europe has been warming at a rate approximately twice the global average since the 1980s, and this faster rate of warming in Europe is expected to persist in the coming decades (EEA, 2024a; IPCC, 2022b). As shown in Figure 4, these translate to average estimates of European warming by 2050 at around 2.4 °C in low emissions pathways, 2.8-2.9 °C in medium to high emissions pathways and 3.3 °C in very high emissions pathways. By 2100, these average estimates for Europe correspond to around 2.5 °C in low emissions pathways, 3.9 °C in medium emissions pathways, 5.6 °C in high emissions pathways and 6.9 °C in very high emissions pathways.

Figure 4 Observed and projected increase of European land temperature compared to pre-industrial levels



Notes: Observed (ERA5) and projected near-surface temperature for different shared socioeconomic pathways (SSPs) across the 21st century relative to pre-industrial levels for the 38 EEA countries (i.e. 32 member countries of the European Environment Agency and six cooperating countries).

Source: EEA (2024a), based on data from the Copernicus Climate Change Service.

Global warming drives many climate hazards, both slow-onset and extreme hazards, increasing the frequency and severity of these events.

Warming causes a range of physical changes to the climate, such as altered wind and precipitation patterns, ocean warming and acidification, reduced ice cover, sea level rise and changes in water systems. These physical changes act as drivers for a variety of climate hazards, which include both slow-onset events (e.g. coastal erosion, desertification, vector-borne diseases, ecosystem shifts) and acute, extreme events (e.g. storms, floods, wildfires). As climatic risk drivers are on the rise in Europe (see Table 1), the frequency and intensity of climate hazards are projected to increase, as highlighted in the European Climate Risk Assessment (EUCRA) (EEA, 2024a).

Table 1 Key climatic risk drivers are on the rise in different European regions

Land regions	Northern Europe			Western Europe			Central-eastern Europe			Southern Europe		
	Past	Future		Past	Future		Past	Future		Past	Future	
		Low	High		Low	High		Low	High		Low	High
Mean temperature	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗
Heatwave days	□(*)	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗
Total precipitation	↗	↗	↗	↗	/	↘	↗	↗	/	↘	↘	↘
Heavy precipitation	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗
Drought	↗	↘	↘	↗	/	↗	↗	/	↗	↗	↗	↗

Notes: Underlying climate variables are heatwaves (days with maximum temperatures above 35 °C), heavy precipitation (maximum one-day precipitation) and drought (using a standardised precipitation evapotranspiration index over six months (SPEI-6, Hargreaves' method). Time periods and scenarios are past (1952–2021); future until the end of the century (2081–2100 relative to 1995–2014); low scenario (SSP1-2.6); and high scenario (SSP3-7.0). Greyed arrows indicate that there is limited agreement between models, datasets or indices. '/' indicates there is a low level of confidence in the direction of change. For past heatwave days in northern Europe, the square indicates there was no change, though it should be noted other indices show an increase.

Source: EEA (2024a), based on data from the Copernicus Climate Change Service.

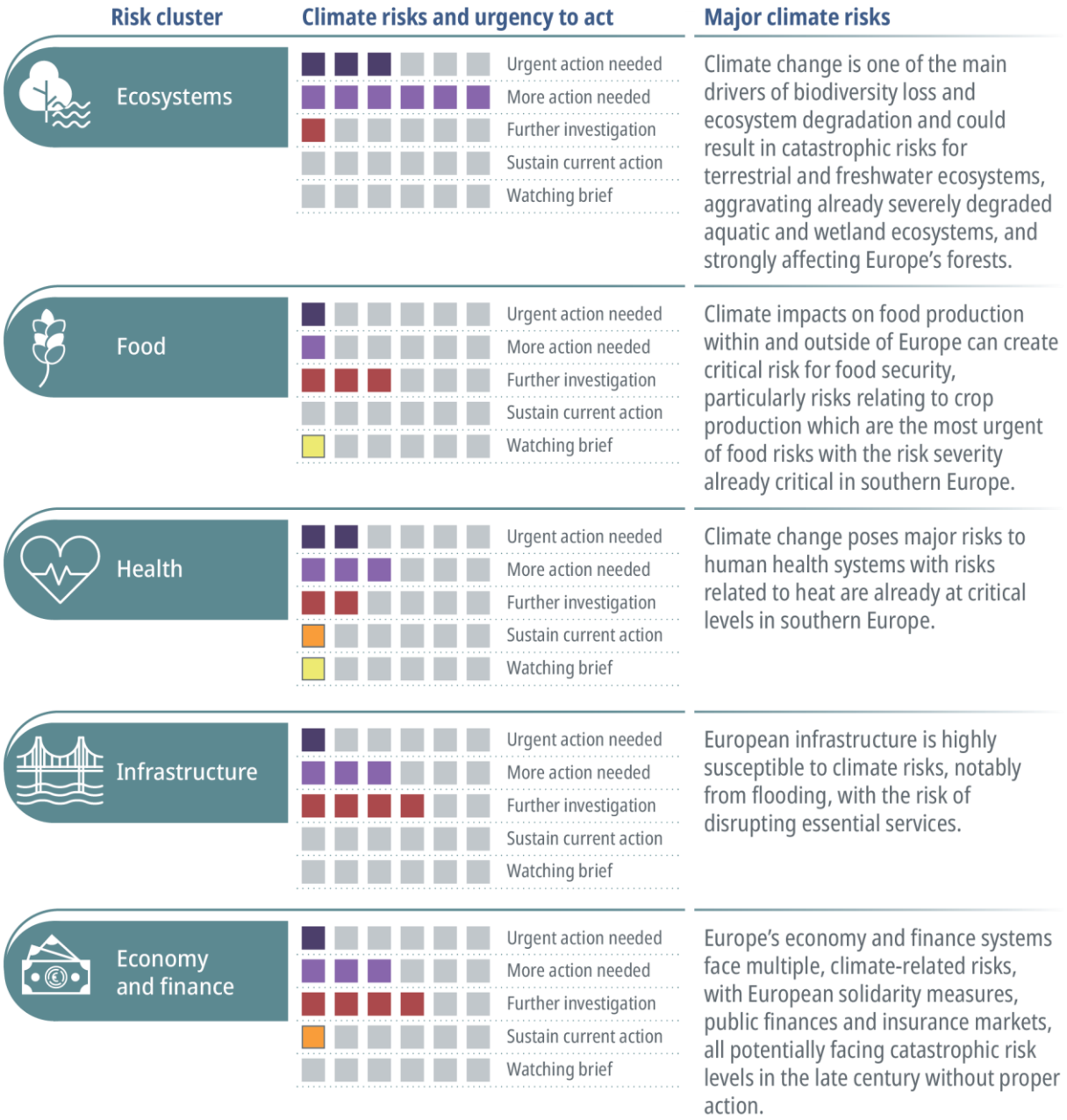
1.3. Impacts and risks to the functioning of the EU

Climate risks have will continue to escalate as global temperatures rise, affecting the health and well-being of Europeans, as well as Europe's economy, supply chains and ecosystems.

The increasing frequency and intensity of climate hazards are key drivers of climate risks. Climate risks are the potential adverse consequences that climate-related hazards can have for human and ecological systems, arising from dynamic interactions between these hazards, the exposure and vulnerability of affected systems, as well as human responses to climate change (IPCC, 2023b). These consequences affect health and well-being, livelihoods, infrastructure, services (including ecosystem services) and economic, social and cultural assets, along with ecosystems and species. The impact of climate hazards depends on factors such as land use, socioeconomic vulnerability, infrastructure and governance, which shape both the scale of impacts and the distribution of risks across Europe.

Adaptation in the EU remains incremental and fragmented, with adaptation measures falling behind escalating climate risks. EUCRA identifies 36 major climate risks across human and ecological systems that have severe consequences for Europe or require coordination at the EU level (see Figure 5). In assessing the urgency for action, based on the severity of the risk and the level of policy readiness, EUCRA finds that more than half of these risks require additional action, with eight requiring urgent attention. Even under optimistic mitigation scenarios compatible with the Paris Agreement, most climate risks in Europe are projected to increase further during the 21st century (EEA, 2024a).

Figure 5 Major climate risks for the EU and the urgency to act on them



Notes: Climate risks and the urgency to act outlines the 36 major climate risks for Europe, grouped into five risk clusters. Each square represents one climate risk, with the colour denoting the urgency to act. This includes an additional six risks for the hotspot region of southern Europe, where some climate risks are more severe that at the pan-European level.

Source: Adapted from EEA (2024a).

Climate change creates cascading and compounding risks that threaten the EU's resilience, as well as its economic, social and territorial cohesion and solidarity.

The threats and impacts of climate change are not confined to national or regional borders. Climate hazards, such as floods and wildfires, can directly affect areas spanning multiple countries, requiring cross-border coordination. They can also compound one another and interact with non-climatic pressures, amplifying impacts and triggering a sequence of secondary events across natural and human systems (Talebian et al., 2025; Steensen et al., 2025). For example, hardened soil caused by

drought increases runoff and thereby the impacts of heavy rainfall or repeated heatwaves without sufficient time to recover, exacerbating water scarcity. Climate hazards can also lead to impacts cascading across other systems or regions (see Figure 6). Energy, water or transport systems are, for instance, often highly interconnected systems where a failure at one point can be transmitted elsewhere, potentially affecting large parts of society and rippling across the wider economy and financial system (see example of the financial system in Box 1) (EEA, 2024a; IPCC, 2022b; Talebian et al., 2025).

Box 1 Transmission pathways for physical climate risk to public finances

Climate change affects economies and financial systems through interconnected channels that amplify impacts beyond direct physical losses. In addition to the direct damages to assets and capital stocks caused by more frequent and severe climate hazards, cascading, compounding and slower-onset changes can progressively weaken productivity, economic growth or exports – for example, through reduced labour productivity (Day et al., 2019), restricted credit supply (Nieto and Papathanassiou, 2025), or volatile input and business operating costs.

For governments, these real-economy impacts can reduce tax revenues, while simultaneously requiring higher public spending and incurring liabilities associated with crisis response and management. This contributes to deteriorating public finances, shrinking fiscal space, and worsening trade balances and debt sustainability (Barrage, 2025). For the financial system, these impacts and disruptions can also harm the ability of borrowers to repay loans, which combined with a broader decline in the macroeconomic environment, can heighten credit risks and risks to financial stability (Nieto and Papathanassiou, 2025; D'Orazio, 2025).

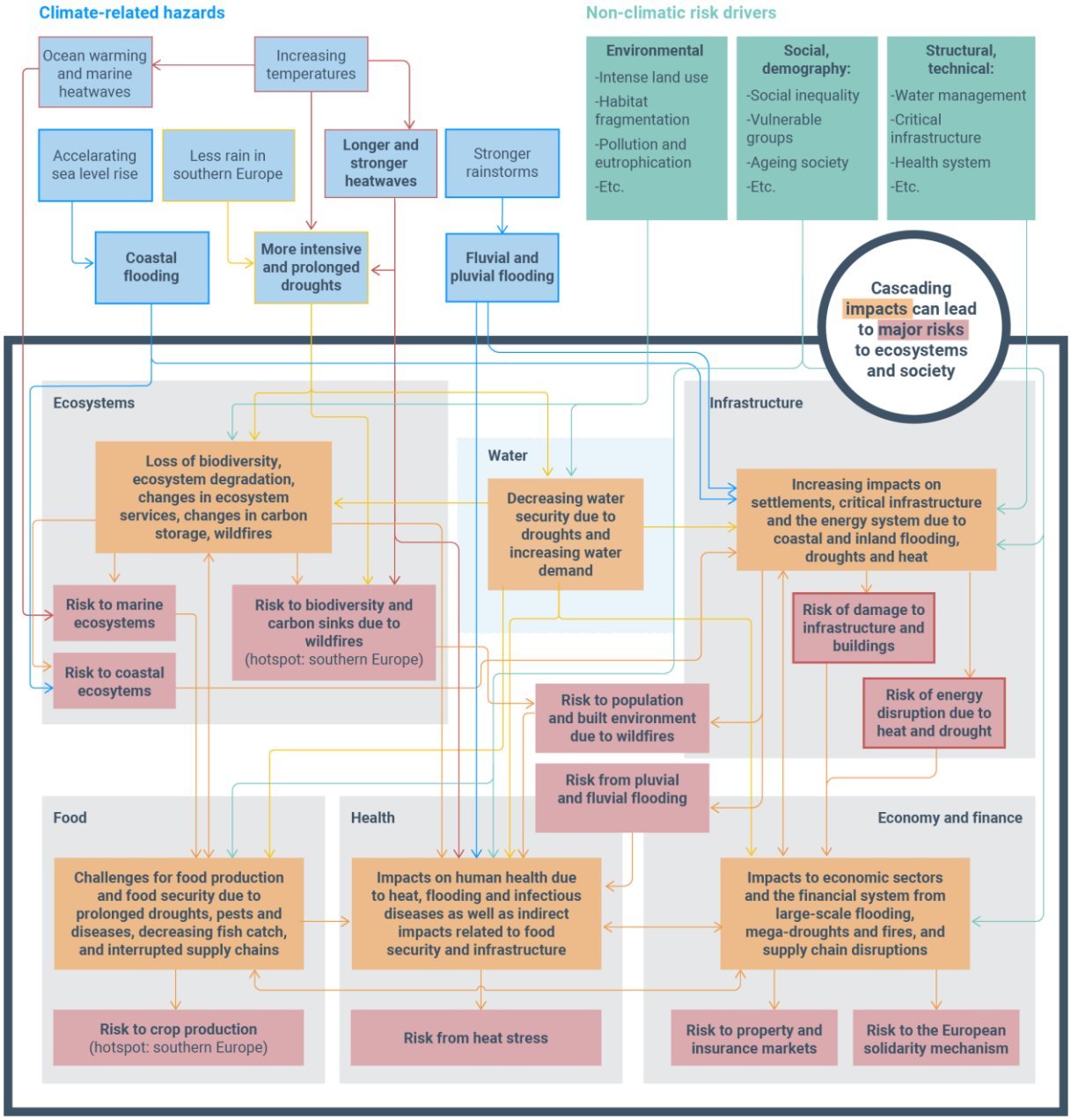
As markets and credit rating agencies reassess these conditions, both corporate and sovereign creditworthiness can decline, which increases bond yields and borrowing costs. Cascading effects (e.g. overlapping exposures, supply-chain disruptions and common hazard shocks) can spread losses across sectors and institutions, turning initial impacts into triggers for systemic stress. Feedback loops between the economy, fiscal capacity and financial markets can accelerate and amplify this process, eroding resilience and raising the risk of financial instability or a disorderly transition (ESRB and ECB, 2021; EEA, 2024a).

Cascading risks are particularly a challenge in the EU given the high levels of internal trade, infrastructure connectivity, and social and economic integration, along with the many natural systems (e.g. rivers, seas, mountains and forests) that are sensitive to climate change and that are shared (Benzie et al., 2019; Kivimaa et al., 2024; Schleypen et al., 2022). Member States rely heavily on waters that originate outside of their borders, as over 60 % of rivers in Europe are cross-border (Josefsson, 2025). Similarly, habitat and species connectivity is crucial to ecosystem health and resilience, which often requires coordination and management spanning across national borders (Hoek, 2022). This interdependence heightens the risk that cascading impacts in one place can inadvertently transfer or exacerbate climate risks faced elsewhere.

A fragmented approach to adaptation could undermine collective resilience, as insufficient measures in one country may trigger impacts and increased exposure in neighbouring areas (Advisory Board, 2025b; EC, 2024j). Finally, the EU and its Member States are also exposed and may contribute to climate risks outside the EU's borders, including through trade, food, development and security policies (Auer et al., 2025; Benzie et al., 2019). As climate change intensifies, these interconnected

systems increase both the likelihood and potential severity of transboundary impacts, making shared vulnerabilities a key feature of European climate risk.

Figure 6 Impact chain including cascading impacts and risks across five risk clusters



Notes: The diagram shows the links between key climate-related hazards, non-climatic risk drivers, direct impacts and the risk of these risk drivers according to five clusters and the cascading impacts and risks between the clusters. The diagram also includes a selection of the most urgent climate risks (red boxes).

Source: EEA (2024a).

Member States may face substantial economic losses and deteriorating debt dynamics, undermining their fiscal sustainability and ability to invest in mitigation and adaptation.

Climate change poses major and escalating risks across Europe, with mounting quantitative evidence highlighting substantial economic, social and fiscal impacts. These impacts manifest through multiple channels, for instance increased mortality during extreme heat events (Beck et al., 2024), reduced

labour productivity from heatwaves (WHO and WMO, 2025; Robinson et al., 2025; Allianz, 2025), damage to critical infrastructure (Forzieri et al., 2018) and agricultural losses from droughts (EEA, 2024a). Moreover, the economic impacts of such events would likely be persistent, with long-lasting consequences beyond the immediate shock (Usman et al., 2025b).

While subject to significant uncertainty, long-term economic projections in the literature consistently point to a high cost for inaction. Furthermore, recent studies generally report higher projected economic losses from climate change compared with earlier research (Bilal and Känzig, 2024, 2025; Neal et al., 2025; Tol, 2023). For example, flooding currently accounts for 57% of total losses from extreme weather events and, while figures vary year on year, caused EUR 31.1 billion across the EU in 2024 (EEA, 2025b). Studies project that, without adaptation, the annual costs of coastal and riverine flood damage respectively could reach the hundreds of billions and tens of billions of euros by the end of the century (Watkiss et al., 2018; JRC, 2020; Vousdoukas et al., 2020; Dottori et al., 2023).

More frequent and severe climate impacts strain public budgets by driving up response costs, depressing economic activity and tax revenues, and increasing liabilities for infrastructure damage, reconstruction, social protection and health services. This creates risks for the sustainability of sovereign debt in the near future and can result in worsening debt dynamics, which create a vicious circle where climate risks increase the cost of debt, while climate impacts reduce fiscal space to fund or raise debt for mitigation and adaptation to reduce those climate risks (Zenios, 2024, 2022; ECB, 2023).

As climate change will have uneven impacts across Member States and society, addressing these disparities will require attention to the EU solidarity principle as a mechanism for leaving no one behind.

Climate risks are unevenly distributed across Europe, with significant variation between and within Member States in their exposure and vulnerability to climate hazards. Southern Europe is particularly at risk from the increasing impact of heat and drought on fires, agriculture, outdoor work and tourism. Low-lying coastal regions are at risk of flooding, erosion and saltwater intrusion. European cities, regions dependent on tourism or vulnerable ecosystem services, and the EU's outermost regions[2] are also projected to become hotspots for multiple climate risks (EEA, 2024a; IPCC, 2022b). Heat-related stress and mortality are expected to be the highest and increase more rapidly in southern Europe (IPCC, 2022b; JRC, 2020). These differences in exposure to climate hazards could be made worse by uneven levels of adaptive capacity, with southern European Member States (in particular) already burdened with high debt-to-GDP ratios, which limits their fiscal space (EC, 2025p). Climate impacts will contribute to additional unplanned debt pressures (ECB, 2023), further constraining these Member States' ability to invest in adaptation. It also will test EU solidarity and risk deepening economic divergence, which could undermine the EU's internal cohesion (EEA, 2024a).

Climate change may exacerbate and widen inequalities and disparities across society as well. Groups such as the elderly, children, low-income households and outdoor workers (e.g. in farming and construction) are already affected more strongly than other groups by climate hazards, such as flooding, heat and drought. Often, those most exposed or vulnerable to climate risks have the lowest capacity to adapt (EEA, 2024a; IPCC, 2022b). This can lead to a vicious circle where climate impacts exacerbate existing inequalities, further increasing climate vulnerabilities. Populations that are highly

2 The EU has nine outermost regions: Guadeloupe, French Guiana, Martinique, Mayotte, Réunion and Saint Martin (France); the Canary Islands (Spain); and the Azores and Madeira (Portugal). They are distinguished by their remoteness from mainland Europe, insularity, small size (except French Guiana), difficult topography and climate, and economic dependence on a few products.

exposed and vulnerable may be increasingly displaced by climate hazards, resulting in migration as both an adaptation strategy and a survival necessity (IOM, 2025).

1.4. The need for adaptation

Adaptation protects people, places, ecosystems and economies from the rising risks and impacts of climate change.

With Europe experiencing significant climate risks and impacts, and risks expected to rise, the urgency of adapting and strengthening climate resilience is clear. By reducing vulnerability and exposure, and improving responses to climate change, adaptation has been shown to reduce risks to and impacts on people, places, ecosystems and economies.

For instance, adaptation has already played an important role in reducing mortality during heatwaves through measures that lower people's vulnerability to extreme temperatures, such as building and infrastructural changes, heat-health warning systems, or increasing urban green space (Urban et al., 2025; Wu et al., 2025; Gallo et al., 2024), which will become increasingly crucial as heatwaves become more frequent and intense in Europe (Masselot et al., 2025).

Adaptation can be effective in reducing the direct economic impacts of climate change, such as damage to property and assets from floods (Paprotny et al., 2025; Dottori et al., 2023; Vousdoukas et al., 2020; Poussin et al., 2015), or losses in agricultural (Hultgren et al., 2025), forestry (Verkerk et al., 2022) or labour productivity (Day et al., 2019) from extreme temperatures or weather events. Many of the benefits of adaptation are intangible, particularly where adaptation reduces irreversible losses and damages to ecosystems, cultural heritage or places (Tschakert et al., 2019).

Adaptation safeguards economic activity, and creates benefits and opportunities that often go beyond reducing direct climate-related losses.

The benefits of early and proactive adaptation often outweigh its costs (Brandon et al., 2025; Watkiss, 2022; World Bank, 2021), particularly when it generates indirect benefits or co-benefits that accrue even before a climate risk materialises. This is sometimes referred to as the 'triple dividend' of climate resilience, where in addition to (i) reducing direct economic losses from disasters, adaptation can generate (ii) induced economic and development benefits and (iii) additional social or environmental benefits (Brandon et al., 2025).

Strengthening resilience through climate adaptation helps to safeguard societal functions that underpin economic prosperity, security and well-being. For example, besides the direct losses businesses experience when extreme weather events occur, climate risks can harm economic growth through multiple channels, such as supply-chain and price volatility, reduced lending and credit growth or weakened investment and innovation (de Bandt et al., 2025; He et al., 2024). Strengthening businesses' resilience to climate risks gives them the security to develop and grow, and proactive climate risk management by businesses and financial institutions is often associated with improved profitability and financial performance (Doan et al., 2025; D'Orazio, 2025). By protecting broader economic activity, adaptation similarly preserves fiscal space for governments as climate risks intensify (Preinfalk et al., 2026).

Similarly, healthy and sustainably managed ecosystems provide vital functions and services to people and economies, for which adaptation is necessary to protect them. For example, removals provided by the EU's land use, land use change, and forestry (LULUCF) sector are expected to make a significant contribution to achieving the EU's climate mitigation targets, but the significant decline in the LULUCF

sink over the past decade highlights the need to strengthen resilience to climate impacts and extreme weather events (Advisory Board, 2025a; Migliavacca et al., 2025).

Well-designed adaptation measures can also generate additional co-benefits and synergies. For instance, in addition to safeguarding the vital functions that nature and ecosystems currently provide, nature-based approaches to adaptation (i.e. those that work with nature through protection, restoration and sustainable resource management) often provide new options for addressing adaptation needs while delivering wider economic, environmental or social benefits (Turner et al., 2022; Woroniecki et al., 2023). For example, well-planned urban greening measures can reduce exposure or vulnerability to climate hazards (e.g. providing shade and cooling, regulating water retention and flooding), with benefits for local biodiversity, air quality, health, recreation and well-being (Sharifi, 2021).

Similarly, measures that address wider vulnerabilities or improve material conditions affecting resilience to climate change, such as health or education, often contribute to broader sustainable development goals (and vice versa). Integrated and increasingly transformational approaches that address adaptation needs in tandem with disaster risk management, ecosystem- or nature-based approaches or sustainable development can act in mutually reinforcing ways to strengthen the climate resilience of people, economies and nature (IPCC, 2022a).

Adaptation is not limitless: mitigation is crucial to keeping global temperatures and climate risks at safer levels, while transformational approaches to adaptation are increasingly necessary to create new options to adapt.

Adaptation cannot fully eliminate climate risks, and measures to manage residual risks and impacts - those that remain *after* mitigation and adaptation efforts – also play a crucial role in protecting lives, health and assets. This includes crisis response mechanisms to respond quickly and effectively when extreme events occur, as well as insurance, risk transfer, or other financing mechanisms that support resilient recovery and rebuilding after these events (IPCC, 2022a).

In many cases, there are limits to the ability of people, nature and societies to adapt to climate change, and to prevent intolerable harms arising from climate risks and impacts (IPCC, 2022a; Berkhout and Dow, 2023; Thomas et al., 2021). These include:

- **Hard limits,** that generally reflect physical or biological conditions critical to the functioning of people, species or ecosystems. For example, increased heat and humidity may exceed the limits of human survivability in parts of the world (Romanello et al., 2024), while many ecosystems, plants, animals and places may be irreversibly threatened or lost due to climate change and impacts.
- **Soft limits,** that generally involve human systems, and mainly relate to the current limits in, for example, available resources, technologies, institutional capacity or socio-cultural factors.

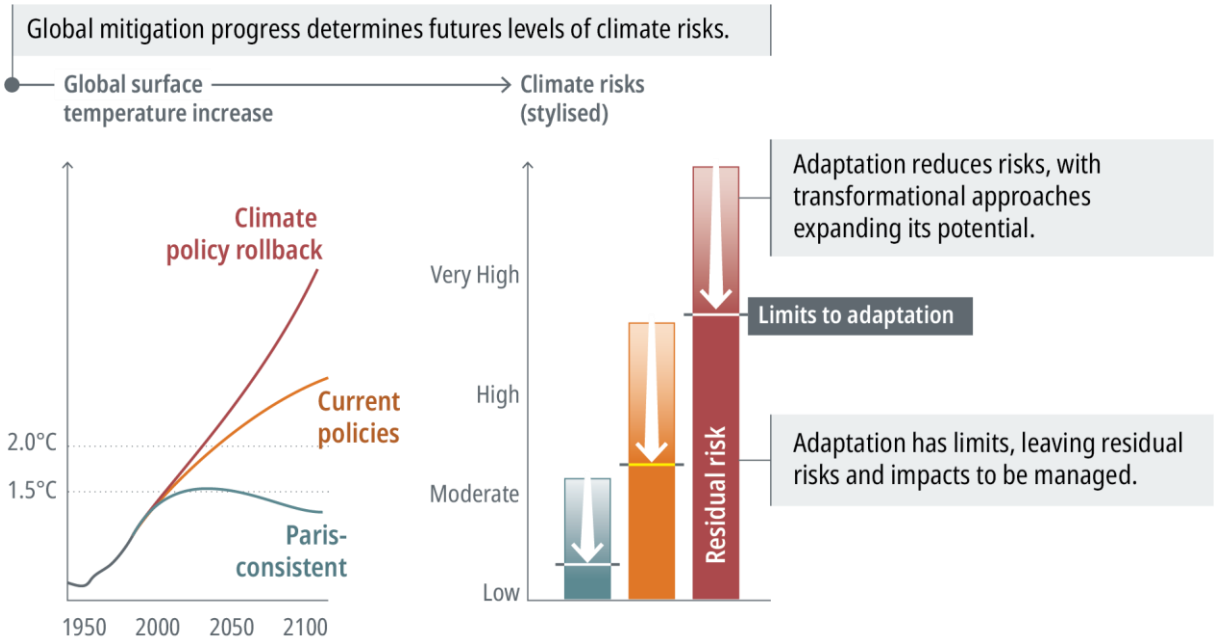
There is increasing evidence of hard and soft limits being reached with current adaptation practices in both natural and human systems (IPCC, 2022a). While soft limits can in principle be shifted and create more options to adapt (e.g. by enhancing adaptive capacity), they still often represent systemic obstacles or deeply rooted vulnerabilities that cannot be easily or quickly overcome. This reinforces the urgency of pursuing transformational approaches to adaptation that build adaptive capacity and address root causes of vulnerability, in order to overcome current limits to adaptation.

The nature of hard limits generally makes them immutable, and only reducing the rate and magnitude of warming can generally prevent these being reached and breached. The effectiveness of adaptation

is therefore closely linked to progress on climate mitigation; deep and sustained emission reductions and removals remain critical to prevent the most severe impacts of climate change. Every increment of warming increasing the frequency and magnitude of climate hazards making adaptation more challenging, more costly and less effective in moderating the impacts of climate change (Callahan, 2025; Midgley et al., 2023; Parsons et al., 2025a).

For these reasons, adaptation must be pursued within a broader framework for reducing and managing climate risks, with mitigation crucial to limit climate hazards and risks, adaptation to reduce the harms they pose, and mechanisms to prepare for and manage any residual risks that remain (see Figure 7).

Figure 7 Mitigation and adaptation play crucial roles in reducing and managing climate risks



Notes: The figure on the left presents projected levels of global warming (relative to 1850–1900) across different combinations of shared socioeconomic pathways (which explores how society, demographics and economics might evolve) and representative concentration pathways (which imply different levels of mitigation). Associated climate risk levels and adaptation effects on the right are stylised.

Source: Adapted from UNEP (2025a).

2. Delivering adaptation

2.1. Forms of adaptation

Climate adaptation takes many forms, through measures that reduce vulnerability and exposure, build adaptive capacity or improve responses to climate change.

Climate adaptation aims to reduce climate risks for people, places and systems and strengthen their resilience, that is, their capacity to cope with, respond to and transform under a changing climate. Adaptation can include physical, social, behavioural and institutional measures to reduce exposure (e.g. changing working times to reduce heat exposure) or vulnerability (e.g. diversifying livelihoods), improve responses (e.g. early warning systems) or build adaptive capacity (e.g. retraining workers to take advantage of opportunities in less climate-affected sectors) (see Figure 8).

Figure 8 Adaptation takes many forms, including physical, social and institutional measures

Notes: Categories are not mutually exclusive, and many actions may cut across several categories.

Source: Adapted from Biagini et al. (2014) and IPCC (2014).

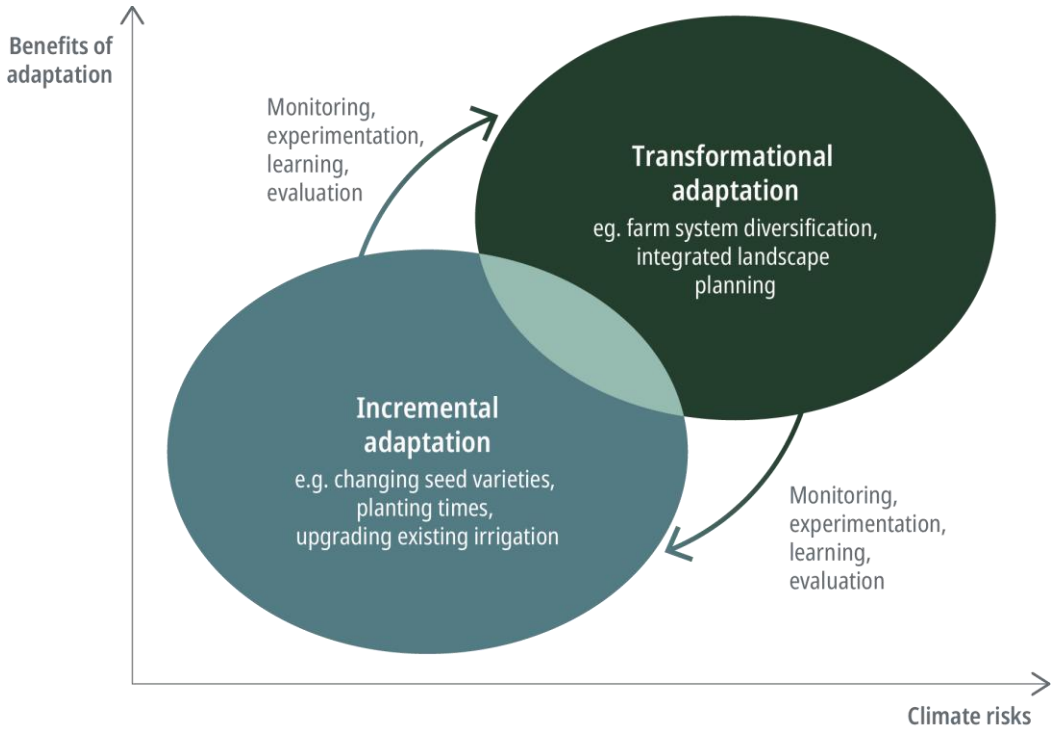
Adaptation includes both incremental and transformational approaches, where transformational adaptation involves more significant and systemic changes that often address root causes of vulnerabilities.

Adaptation measures are often described along a spectrum ranging from 'incremental' to 'transformational' adaptation. Incremental approaches to adaptation largely aim to adjust existing practices or systems, without changing their fundamental attributes. Transformational approaches to adaptation, on the other hand, involve changing the fundamental attributes of a system in order to safeguard its core functions in anticipation of climate change (IPCC, 2022a). Compared to incremental approaches, transformational adaptation broadly involves measures that (UNFCCC, 2024a):

- go beyond simple adjustments to existing practices and behaviours;
- happen on a large scale, transforming places or systems; or
- lead to deep and long-term societal changes that influence future sustainable development.

Many contrasting examples of incremental and transformational adaptation can be found in the literature. For example, in agriculture, adaptation to climate change can range from more incremental measures such as changing seed varieties or planting times or upgrading existing irrigation, to more transformational approaches such as changing farming systems or diversification into other activities (Gil-Clavel et al., 2025) (see Figure 9). Transformational adaptation is often characterised by novel or innovative approaches to addressing adaptation needs, not limited to technological innovations, but also extending to social or political innovation (Deubelli and Mechler, 2021). However, universal classifications are challenging, as the 'transformational' nature of an adaptation strategy depends on the existing baseline, context and actor (Biesbroek et al., 2026). What might be considered transformational in one location might be common practice in another, and incremental actions may also accrue to become transformational when done at a larger scale or intensity (Biesbroek et al., 2025b; Kates et al., 2012).

Figure 9 Incremental and transformational adaptation



Source: Adapted from Ferguson et al. (2022).

Transformational adaptation expands its potential, particularly when facing limits to adaptation, but often requires advance planning given long lead times or resource or governance requirements.

Incremental adaptation can play an important role in addressing immediate or short-term needs and supporting learning (Park et al., 2012; UNFCCC, 2024a). However, these approaches often address hazards in isolation, without considering system-level interactions, and fail to address the root causes of vulnerability and exposure. They can also fail to account for the fact that the costs of adaptation increase sharply and in a non-linear manner with climate change, meaning that incremental approaches alone can create lock-ins that make adaptation more challenging and costly in the long term (Midgley et al., 2023; Fedele et al., 2019). There is therefore growing recognition of limits to incremental adaptation, and that transformational, system-wide approaches are increasingly needed to avoid intolerable harm to people, societies and ecosystems (Council of the EU, 2025d; UNFCCC, 2024a; Kates et al., 2012).

Transformational adaptation provides long-term benefits and security, including reduced reliance on costly emergency responses as climate risks intensify. However, the long lead times and fundamental changes it necessitates mean that it should be planned for well in advance, to ensure it is by design, rather than by disaster (Cools et al., 2025). For instance, in coastal settlements that are highly vulnerable to future sea level rise, and where incremental options (e.g. raising coastal defences) are likely to be increasingly ineffective, long-term transformational strategies involving spatial planning or resettlement may be necessary to provide long-term security. In instances where climate impacts are pushing or have already pushed social and ecological systems to their limits, transformational adaptation can still enable people or ecosystems to shift to less vulnerable states or locations, allowing them to adapt in new ways and take advantage of new opportunities (Kuhl et al., 2021; Scolobig et al., 2023).

While transformational adaptation approaches offer long-term benefits and security, they also face larger barriers to planning and implementation, such as economic (e.g. lock-ins and high costs), social (e.g. public acceptance, value, norms), capacity (e.g. human and organisational capacities) and financial (e.g. availability of financial resources). Governance factors – such as existing laws and procedural requirements, a lack of risk ownership, or institutional silos – also affect the potential for transformational adaptation, in some cases also becoming barriers (UNFCCC, 2024a). Furthermore, transformational adaptation requires long-term efforts to sustain itself (Kates et al., 2012), alongside regular monitoring, learning and evaluation (Deubelli and Mechler, 2021).

Maladaptation occurs when adaptation efforts inadvertently increase risks or erode conditions for sustainable development, which requires a heightened focus on responses.

While adaptation aims to reduce risk, some poorly-planned or misconceived adaptation measures may ultimately increase risk, resulting in maladaptation (Higuera Roa et al., 2025). Maladaptation is usually an unintended consequence, which can include 'shifting' effects, where adaptation inadvertently creates or shifts risks to others (Juhola et al., 2016). For example, this is a common consideration in flood risk management, where measures in one location may shift flood risk along the catchment (Thaler et al., 2020). Maladaptation may also occur through 'rebounding' effects that increase risks for the actor carrying it out, usually by creating new sources of risk or by locking in pathways or dependencies that limit future possibilities to adapt (Juhola et al., 2016). For example, expanding irrigation systems to compensate for the effects of agricultural droughts may reduce groundwater availability in the long run, while incurring large investments that lock in water-intensive agricultural models (Bezner Kerr, 2023).

Maladaptation can also occur when adaptation measures erode wider conditions for sustainable development, for example, through increased greenhouse gas emissions, or by exacerbating environmental degradation, poverty or conflicts. As maladaptive outcomes materialise, this can trigger vicious circles that progressively expose the system to larger climate risks, pushing it closer to adaptation limits, while irreversibly weakening broader resilience (Higuera Roa et al., 2025; Juhola et al., 2016). For instance, adaptation measures that are especially resource or energy intensive, such as desalination (Barnett and O'Neill, 2010) or air conditioning (Byers et al., 2024), may reduce short-term vulnerability to climate risks, but risk entrenching higher emissions and contributing to further warming that increase long-term adaptation needs. Maladaptation is especially a concern when it transfers risk to specific groups or to those who are already vulnerable, making it even harder for them to adapt. The risk of maladaptation has led to heightened focus on responses as a dimension of climate risk, alongside the standard drivers of hazard, exposure and vulnerability (Simpson et al., 2021).

2.2. Governance of adaptation

Adaptation may emerge from private action and initiative, yet public intervention is crucial to overcome major barriers and to allow for transformational adaptation.

With people, households, property owners and businesses among the first to be directly exposed to climate risks, adaptation often emerges from private action, as actors invest or change their behaviour to protect their own health, income, property or livelihoods from climate risks. For example, farmers adjust their agricultural practices in response to climatic drivers, such as shifting planting times or choosing crops that are more resilient to drought. Households adopt measures to protect their homes and property from extreme weather, or purchase insurance to ensure that any damages are compensated. The literature documents numerous similar examples of adaptation that actors already undertake to reduce their exposure or vulnerability and response to impacts, such as behavioural changes, investment, consumption changes, insurance and migration (Maskell et al., 2025; Fankhauser, 2017).

Despite this, adaptation does not always occur when and where it is needed, and even when there are evident private benefits, public intervention is often necessary to overcome a range of barriers to adaptation (see Table 2). These include informational barriers, where private actors simply lack reliable and accessible information regarding adaptation; economic incentives and behavioural factors that affect their perceptions of the need and benefits of adaptation; and financial, capacity and institutional barriers or inequalities that contribute to slow and uneven adaptation progress (IPCC, 2014; Aakre et al., 2010; Fankhauser, 2017). Furthermore, many private adaptation measures may only be able to deliver incremental improvements, and without effective governance, this increases the likelihood that adaptation is fragmented and insufficient, and shifts risk onto those less able to adapt.

Table 2 Public intervention is needed to overcome barriers and create conditions for adaptation

Barriers and market failures	Illustrative examples of public intervention
Lack of reliable and actionable **information** on climate risks due to complexity and high transaction costs	• Invest in public monitoring, satellite and warning systems • Provide risk assessments, public tools and accessible platforms • Mandate data disclosure and sharing by private providers
Where adaptation involves **public goods** or **positive spillovers** that will not be provided by private action alone	• Provide adaptation public goods (e.g. infrastructure, information) and strengthen climate resilience of other public goods • Incentivise actions with positive spillovers (e.g. subsidies for innovation)
Negative externalities of individual adaptation actions that create or displace problems for others	• Subsidise, provide fiscal incentives or regulate private actions (e.g. building codes, land use planning) • Price externalities or resource use (e.g. water, carbon) • Coordinate management of cross-border or cross-sectoral risks
Adaptation requires **planning and coordination** over large spatial and/or time scales	• Integrate adaptation into legal and policy frameworks • Develop local, regional and national adaptation plans • Coordinate management of cross-border or cross-sectoral risks
Adaptation impeded by constrained or uneven **capacity or finance**, particularly among the more vulnerable	• Targeted support for low-income households and communities • Social and distributional policies to address root causes of inequalities and vulnerabilities
Low motivation to adapt due to low risk **awareness, perception** or other **behavioural** biases	• Develop risk tools and accessible platforms • Adapt training and communication strategies to account for behavioural factors
Moral hazards or **perverse incentives** that disincentivise adaptation	• Mandate assessment, disclosure and management of climate risk • Enact land use planning regulations to prevent construction in high-risk areas • Integrate adaptation incentives into public funding and insurance

Source: Adapted from examples of barriers and market failures from IPCC (2014).

Effective adaptation governance requires combined and coordinated efforts by public and private actors at multiple levels of governance.

Adaptation needs and options are often deeply rooted in the local context and knowledge, which means that many adaptation measures can be effectively developed and implemented at the local level (IPCC, 2022a). Local governance structures may sometimes be more agile and demonstrate better capacity for experimentation and learning than at higher levels, and in many places, have led the way with examples of effective adaptation and planning where national governments have lagged (Biesbroek and Lesnikowski, 2018).

While this has contributed to a perception that adaptation governance should solely or mostly be a local responsibility, on its own, local adaptation governance faces inherent limitations. Local governments are often amongst the weakest levels of government in terms of the division of powers and depend on governance arrangements established at higher (e.g. national or regional) levels. They often lack access to the same level of finance, resources, climate information or administrative capacity compared to higher governance levels, and as adaptive capacity is often linked to existing material conditions (e.g. size, prosperity, demographics), handing responsibility solely to local levels of governance may simply entrench and exacerbate existing vulnerabilities, rather than reduce them (Biesbroek and Lesnikowski, 2018; Nalau et al., 2015). Furthermore, as with private action, a patchwork of local adaptation interventions that lack an overarching governance framework increases the chance of shifting risks and of maladaptation and may limit adaptation to small-scale, incremental measures (Biesbroek and Lesnikowski, 2018). Transformational adaptation, in particular, requires planning, coordination and governance that often span a long time horizon or system scale, which may be beyond the capacity of individuals or local governance alone (Kuhl et al., 2021; Scheer et al., 2025; Deubelli and Mechler, 2021). Even strictly national-level governance of adaptation is often insufficient when dealing with large, transboundary risks that transcend systems and national borders, highlighting the importance of EU and international governance arrangements (Benzie et al., 2019).

Effective adaptation is therefore often described as involving 'multilevel' or 'polycentric' governance (Biesbroek and Lesnikowski, 2018; IPCC, 2022a), reflecting the fact that multiple stakeholders – public, private, community and individual – share responsibilities for adaptation across different sectors and scales. Multilevel governance emphasises formal (and mainly public) governance arrangements, with roles and responsibilities formally assigned across different levels of jurisdiction and decision-making, including global, regional, national and local, along with trans-regional and trans-national levels. Polycentric governance refers to both formal and informal arrangements, emphasising that adaptation involves public and private stakeholders interacting and sharing responsibility for adaptation at different levels (Biesbroek and Lesnikowski, 2018).

In polycentric models, adaptation may be both local, self-organising and the result of local initiative and experimentation (bottom-up); yet also be supported and enabled by overarching governance frameworks that provide guidance, set common rules and manage conflicts between different governance levels (top-down) (Biesbroek and Lesnikowski, 2018). While addressing adaptation at different governance levels can be mutually supportive, it also increases complexity, especially as adaptation needs can transcend the usual distribution of policy competences. Unclear understanding of roles, responsibilities and capacity can create gaps in ownership and accountability for adaptation and contribute to slow, fragmented and ineffective progress on adaptation (EEA, 2024a; Lenaerts et al., 2022; Biesbroek and Lesnikowski, 2018). In this multilevel and cross-sectoral governance landscape, the EU level has an emerging and distinctive role in addressing the need for adaptation in Europe, as discussed in the next chapter.

3. The EU's role in effective adaptation

3.1. EU roles and responsibilities

The EU acts where collective action is more effective than national efforts alone, guided by its founding treaties.

As discussed in Section 2.2, adaptation measures are often initiated locally and are most effective when tailored to specific places. However, local action alone faces limitations and barriers, such as constrained resources, uneven adaptive capacity and the risk of fragmented or incremental responses. Higher levels of governance, such as national and the EU, are essential to providing the enabling conditions for effective adaptation, including by supplying resources, policy frameworks and coordination to avoid maladaptation and address systemic risks. Initiatives at such higher levels can reinforce local action within a framework of overarching rules that articulate the broader goals to be achieved (IPCC, 2022e; Jordan et al., 2018).

This chapter focuses on the emerging EU-level roles and responsibilities in addressing the need for adaptation. It considers the boundaries for EU action laid down in its founding treaties, defining how powers are shared between the EU and its Member States, based on the legal principles guiding their exercise (art. 5 of the Treaty on the European Union, hereinafter TEU[3]). In areas where the EU does not hold exclusive competencies, the EU may only intervene if it is able to act more effectively than Member States at their respective national or local levels, in line with the subsidiarity principle.

Often shared and ambiguous risk ownership underscores the need to clarify the EU's adaptation roles and responsibilities.

While climate policy has generally been rooted in the EU competence in the matter of environmental policy, climate resilience cuts across many policy areas. These policies fall either under the EU's exclusive competences (e.g. conservation of marine life, competition rules), under shared competences with the Member States (e.g. environment, cohesion), or under areas where the EU provides support (e.g. industry, civil protection). Against this backdrop, and with the majority of climate risks co-owned by the EU and Member States, assigning roles and responsibilities to act on climate impacts and risks is a policy challenge (EEA, 2024a). Successive EU adaptation (EC, 2021c, 2013) and scientific literature (Biesbroek and Swart, 2019) confirm the ambiguity of risk ownership between the EU and Member States, while highlighting several climate resilience policy areas that require a stronger focus at the EU level. However, the current EU legal framework, including the European Climate Law (Regulation (EU) 2021/1119), does not clearly delineate the adaptation roles and responsibilities of the EU and Member States, resulting in weak accountability (Advisory Board, 2025b; Buser, 2022).

Without adequate adaptation, climate change will undermine the EU's ability to meet its aims and commitments.

To overcome the challenge of risk ownership and the resulting weak accountability, the EU's role in effective, fair and transformational adaptation policy can be analysed in the light of the existing EU legal framework. As elaborated below, the EU is bound to address climate risks. It is also well positioned to do so.

3 Consolidated version of the Treaty on European Union, OJ C 326, 26.10.2012, pp. 1–390.

The EU's adaptation roles and responsibilities derive from two main sources. First, from its internal legal and policy framework, including its competences and treaty-based objectives across multiple policy domains. Second, from its international commitments under multilateral environmental and human rights law. Together, these establish both the obligation and the capacity for the EU to act on climate risks.

EU internal policy commitments and positive spillovers

Environment and climate

EU policy must contribute to efforts to preserve, protect and improve the quality of the environment, along with protecting human health. In line with the precautionary principle (Article 191(1) Treaty on the Functioning of the European Union, hereinafter TFEU[4]), uncertainty about the damage to be suffered does not justify delaying action. Accordingly, the European Climate Law (Article 5) commits the EU to ensuring continuous progress on adaptation and reaching climate neutrality by 2050. The European Commission is responsible for monitoring and assessing collective progress on adaptation and for ensuring consistency and better integration of adaptation in all projects, programmes and policy areas. As such, the EU has an obligation to ensure that its own actions, policies and funding are climate resilient, while supporting adaptation and preventing maladaptation at other governance levels (Buser, 2022). This obligation is connected to the EU's mitigation and nature conservation commitments (see e.g. Nature Restoration Law, Regulation (EU) 2024/1991), as the progress towards the greenhouse gas emission reduction targets depends on the climate resilience of ecosystems and infrastructure within and outside of the EU (see Box 2).

Box 2 The role of climate adaptation in protecting EU carbon sinks crucial for climate mitigation

Climate change is one of the main drivers of biodiversity loss and ecosystem degradation in Europe, with even optimistic warming scenarios resulting in critical risks without adaptation (EEA, 2024a). As wildfires, droughts, windstorms and pests have reduced the ability of EU forests to act as carbon sinks, climate change has contributed to the rapid decline in the EU's land carbon sink, putting the EU's climate targets at risk (Advisory Board, 2025b; EEA, 2025c; Migliavacca et al., 2025). Implementing adaptation measures, such as the use of nature-based solutions, can improve the resilience of these ecosystems to protect and restore biodiversity, while also providing supporting climate mitigation through carbon storage and sequestration (EEA, 2024a).

Single market

The EU is tasked with ensuring the free movement of goods, services, labour and capital within the single market (Articles 4(2)(a), 26, 27, 114 and 115 TFEU), by adopting common rules and standards that ensure a level playing field in markets across Member States. The EU can also take measures to ensure that Member States coordinate their economic, social and employment policies at the EU level.

Climate impacts and risks affect the EU's single market: from trade, supply chains and trans-European networks, to debt sustainability and the broader financial system (EEA, 2024a). The EU single market is both a source of economic resilience and a channel for economic risk. Its high degree

4 Consolidated version of the Treaty on the Functioning of the European Union, OJ C 326, 26.10.2012, pp. 47–390.

of interconnectedness means that shocks can spread rapidly across Member States (Benzie et al., 2019). As exemplified by the financial contagion experienced during the late-2000s financial and subsequent sovereign debt crisis. This episode highlighted the vulnerability of integrated markets and underscored the need for coordinated responses. The collective action taken during that crisis illustrated the critical role of EU institutions in managing systemic risks originating in one or a few countries (ECB, 2012). In the crisis' aftermath, the EU significantly strengthened financial and prudential supervision at the supranational level (Quirici and Moro-Visconti, 2025). Today, large financial institutions are supervised by the European Central Bank (ECB) and the European System of Financial Supervision, ensuring consistent standards across the EU. These reforms addressed some of the weaknesses in the previous patchwork approach, which had contributed to inadequate management of systemic risks (ECB, 2025b). The EU single market's documented vulnerability and exposure to climate risks (EEA, 2026) underline that adequate climate risk management is essential for its functioning.

Human rights, democracy and the rule of law

The EU is committed to promoting and protecting human rights, democracy and the rule of law both within the EU and worldwide (Article 2 TEU; the Charter of the Fundamental Rights of the EU). The rule of law requires that all public powers act within the constraints set out by law, in accordance with the values of democracy and the respect for fundamental rights. Respect for the fundamental rights and democracy is inseparable from respect of the rule of law; none can exist without the others (Eckes, 2024; Waldron, 2010). The EU also has a legal duty to promote solidarity between generations (Article 3 TEU), and the Charter of Fundamental Rights of the EU specifies it is a forward-looking duty as exercising fundamental rights involves responsibilities towards future generations (see, e.g., EPRS, 2025). This is particularly relevant in the context of climate change, which threatens human livelihoods and survival in the most affected regions, carries urgent risks of irreversible harm and limited response options of future generations. Over the long term, it poses existential threats to humankind (ECHR, 2024). Climate adaptation is therefore a necessity for the protection of EU fundamental rights.

Transboundary risk management

The EU can act effectively in transboundary contexts. As explained in Section 1.3, climate change is a key and urgent transboundary challenge, where climate hazards can affect multiple countries and trigger impact chains, spillovers and feedback loops, amplifying risks such as inequality, disease outbreaks and geopolitical tensions (EEA, 2024a). These are key challenges for the EU given the high level of economic integration and shared socio-natural systems that are sensitive to climate change. Cooperation and coordination are necessary to ensure coherent adaptation efforts that address transboundary risks and ensure that the implementation of adaptation measures does not unwillingly transfer or exacerbate climate risks faced elsewhere.

Both EU's exclusive competences and EU's role in shared competences stem from the need for a coherent approach to managing transboundary challenges through common principles, rules, coordination and shared funding. A coherent approach has proven critical in shared crises, demonstrating the EU's capacity to act collectively when risks exceed national boundaries. For example, apart from the financial crisis mentioned earlier, the EU responded to the transboundary health and economic shocks caused by the COVID-19 pandemic and its fallouts by pooling resources and risks, such as through EU-issued common debt to fund Member State recovery.

Economies of scale and positive spillovers

The EU has a large potential to benefit from economies of scale and positive spillovers, including many important enablers for adaptation that national and local levels may lack on their own. Pooling national-level capacities, such as with shared stockpiles and equipment under the Union Civil Protection Mechanism, provides a cost-effective way to strengthen collective capacity. Another area with significant EU added value is knowledge diffusion, where there have been calls to create a "fifth freedom" in the single market centred on research, innovation, data, skills, knowledge and education to strengthen these aspects (Letta, 2024). EU-level innovation and research programmes such as Horizon Europe are important sources of scientific knowledge on climate change, that also maximise potential innovation spillovers resulting from diversity, collaboration and dissemination across national borders. In addition, social innovation, learning-by-doing, and sharing of experience which are essential to climate adaptation (Cundill and Harvey, 2019) are fostered through pan-European initiatives, including the EU Mission on Adaptation, the Covenant of Mayors, Interreg and Climate-Adapt platform. Knowledge and data harnessed through EU-level tools and guidance – such as monitoring mechanisms with early warning systems, advisory services and climate risk assessments – to strengthen evidence-based decision-making and coordinated responses across Member States (Lenaerts et al., 2022)

Stable policy direction and investment outlook

The EU is well-placed to provide an overarching policy frame and investment outlook. Policy certainty and a long-term outlook and direction are pivotal for investors and help avoid harmful lock-ins (Advisory Board, 2025b; Groen et al., 2023; Hilson, 2020). Strong coordination for disaster preparedness and adaptation can further improve this outlook as it reduces the risk of business disruption by protecting core societal functions and by smoothing recovery (EC and HR/VP, 2025b). The outlook and policy direction require the development of long-term thinking, visions and goals (see Chapter 4) and the institutionalisation of iterative procedures and guardrails for transformation pathways (Kern et al., 2023).

Economic, social and territorial cohesion

The EU cohesion policies redistribute resources towards regions through targeted funding, capacity building and technical assistance, with the aim of reducing economic disparities within the EU. These policies recognise the need for geographical implications in building resilience as part of a wider sustainability transition (Rodríguez-Pose and Bartalucci, 2024). They also embody the EU value of solidarity, which is also expressed in crisis response instruments such as the Union Civil Protection Mechanism and the EU Solidarity Fund that allow Member States to support one another when major disasters occur. However, climate change poses challenges to EU solidarity and cohesion: it risks creating or widening economic disparities and may stress the capacity of existing mechanisms to respond effectively (EEA, 2024a). Adaptation, particularly targeted towards vulnerable regions and Member States (see Chapter 6), can strengthen cohesion, solidarity and the EU's collective resilience to climate change (Biesbroek and Swart, 2019).

EU international commitments

In 2016, the EU signed and ratified the Paris Agreement, committing to the global goal on adaptation, pursuing efforts to limit global warming to 1.5 °C and aligning financial flows with these goals. As a party to the United Nations Framework Convention on Climate Change (UNFCCC) since 1992, the EU is bound by all relevant decisions of the Conferences of the Parties (COP) and has an obligation of conduct to implement its nationally determined contribution (ICJ, 2025). The resulting

obligation pertains to both cutting greenhouse gas emissions and adapting to climate impacts, within the UNFCCC's broader aim of preventing dangerous anthropogenic interference with the climate system. The success of mitigation efforts in this context depends on adaptation, including the protection of carbon sinks and adequate water supplies (Rayner, 2023). The EU is also committed to aligning finance flows with climate goals as set out in Article 2.1(c) of the Paris Agreement.

Failure to mitigate and adequately adapt to climate change may amount to internationally wrongful acts (ICJ, 2025). In its landmark advisory opinion of 23 July 2025, the 15 judges of the International Court of Justice (ICJ) unanimously concluded that the parties under the UNFCCC have an obligation to adopt measures in the fields of both mitigation and adaptation. Under the UNFCCC and the Paris Agreement, countries already have specific obligations to plan for and act on adaptation that must be complied with, not just acknowledged. Importantly, the court reiterated that the fulfilment of these obligations be assessed against the standard of due diligence (ICJ, 2025). This means that states, including the EU - a legal person and a party to the Paris Agreement and other relevant international agreements - are expected to use their best efforts in anticipating, planning and implementing adaptation measures, consistent with their capacities and the best available science. This involves taking proactive and effective steps to enhance EU adaptive capacity, reduce vulnerability and strengthen resilience to climate change. Accordingly, EU's failure to act on available evidence, within its capacities, would constitute a breach of its legal obligations under the UNFCCC and related frameworks, including the Kunming-Montreal Global Biodiversity Framework (CBD, 2022; see also Box 2).

EU can act as an implementation catalyst of international law at EU level. International agreements concluded by the EU are binding on its institutions and Member States, and the latter are thus obligated to adhere to their provisions (OPEU, 2020) often with EU support. For example, by translating international law obligations into EU directives or regulations, the EU anchors them in both the European and the national legal systems. In this way, the EU can act as an implementation catalyst for international law (Albrecht, 2024).

3.2. EU progress and the opportunity to step up

The EU needs a stronger adaptation policy framework to address climate impacts and risks and support progress toward climate neutrality by 2050.

As elaborated in Chapter 1, the EU faces systemic risks to critical infrastructure, supply chains and the single market, with cascading effects across borders. As highlighted in the same chapter, adaptation is cost-effective, with evidence showing that proactive measures significantly reduce damage and deliver high societal returns. While it cannot substitute for mitigation, adaptation efforts across the EU are key to staying on track towards climate neutrality by 2050, notably if they succeed in preserving and enhancing the carbon sink. To safeguard lives, economies and ecosystems, and to respect its international and domestic commitments, the EU must adapt and support adaptation at all other governance levels.

In 2025, the Advisory Board therefore recommended that the EU strengthen its adaptation policy framework, particularly by clarifying and strengthening its vision and objectives for climate resilience (see also Chapter 4), and support it with effective governance and a solid legal foundation (Advisory Board, 2025b).

The upcoming European integrated framework for climate resilience offers an important opportunity to strengthen the EU's adaptation policy framework.

Responding to these needs and to requests from the European Council (2024) and the European Parliament (2024), the European Commission is currently preparing the European integrated framework for climate resilience, expected by the end of 2026 (EC, 2025i). The initiative is rooted in the EU's wider strategic priorities inspired by the Niinistö report on security and preparedness (Niinistö, 2024) and embedded in the EU preparedness Union strategy (EC and HR/VP, 2025b) and the competitiveness compass (EC, 2025l). These documents identify EU adaptation policy as central to safeguarding the EU's security, prosperity, health and well-being, alongside strong mitigation policies. It is therefore encouraging that the upcoming framework is expected to include several legislative and non-legislative elements aimed at strengthening the governance and integration of adaptation into EU policies, notably:

- common definitions, objectives and goals for climate resilience;
- common climate reference scenarios for resilience decisions;
- provisions on climate risk assessments and planning;
- clarification of risk ownership;
- the horizontal principle of 'resilience by design' applicable to EU policy and funding decisions;
- a toolbox to support public and private actors in preparing for future climate realities.

The Advisory Board aims to contribute to this framework by identifying limitations and opportunities in the current EU approach to adaptation and providing recommendations to strengthen it to support the EU's climate resilience.

The Advisory Board has focused on identifying core, cross-cutting conditions that can guide EU policy framework from effective, fair and transformational adaptation.

The Advisory Board focused its analysis on the core conditions that underpin effective, fair, and transformational adaptation across the EU. The IPCC associates successful adaptation with 'reduction of climate risks and vulnerabilities (for humans and ecosystems) and an equitable balancing of synergies and trade-offs across diverse objectives, perspectives, expectations and values' within a specified timeframe. (IPCC, 2022e). It further qualifies successful adaptation as (i) inclusive of different socioeconomic groups, especially the most vulnerable, and (ii) based on flexible and integrative planning processes that take into account different climate scenarios.

However, assessment of adaptation effectiveness is not easy, as adaptation policies tend to lack the clear targets and metrics, such as those in climate mitigation policies. Additionally, effectiveness of adaptation depends on context and societal choices, such as what level of climate risk society is willing to live with, and needs to be measured on longer timespans given adaptation measures lead times, which introduces many confounding factors to its measurement (Singh et al., 2022; Puig et al., 2025; Dilling et al., 2019). Moreover, effective adaptation requires more than a single set of measures, given the diversity of climate risks, regional contexts and sectoral dynamics across the EU.

In this context, the Advisory Board focused on identifying the conditions for adaptation planning, implementation and governance that help actors manage climate impacts and risks, dealing with uncertainty and adjusting actions as knowledge and situation evolve. These conditions work across different contexts and sectors and are grounded in scientific evidence and normative principles (see Box 3).

Box 3 EU principles and values guiding this advice

The EU institutions are committed to evidence-based policy-making in line with the precautionary, polluter-pays and do-no-significant-harm principles and consistent with the European Climate Law (EC, 2023b). Additional guidance stems from principles promoting the efficient use of resources, international cooperation, solidarity among Member States and intergenerational fairness. These principles help align the EU climate and other policies with EU values, enshrined in Article 2 TEU.

When policy options entail distinct social, economic or environmental implications, and when dealing with uncertainty, decisions should be grounded in these EU principles and values and communicated transparently (Advisory Board, 2023). Notably, attitudes toward risk should be guided by the precautionary principle, which calls for anticipating, preventing or minimising potentially dangerous or irreversible harm, for example by stepping up mitigation and adaptation to prevent or minimise climate hazards, even when scientific evidence about the likelihood or magnitude of that damage is uncertain (IPCC, 2001).

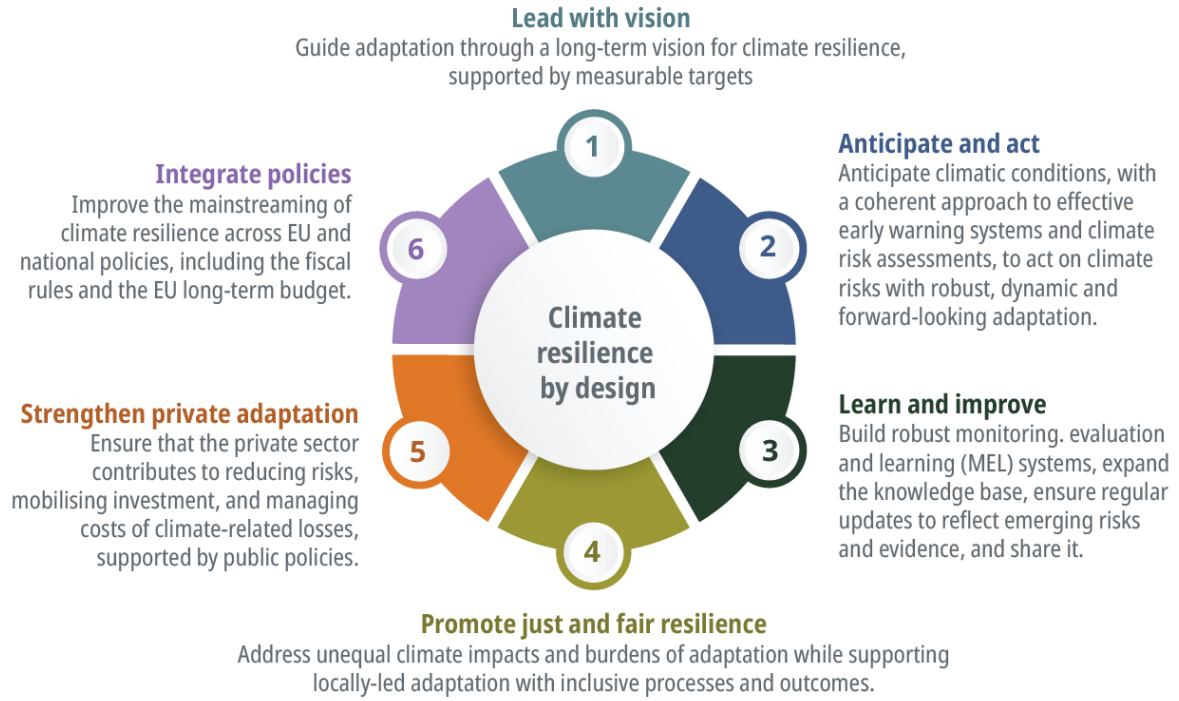
The Advisory Board structured its assessment and recommendations around six guiding principles for effective, fair and transformational adaptation.

This assessment points to conditions of adaptation planning, implementation and governance that underpin well-functioning adaptation systems: long-term direction, anticipatory decision-making based on future climate conditions, proactive and transformational adaptation, monitoring and evaluation to support learning and iterative policymaking, fairness and inclusion, the mobilisation of public and private actors, and integration across governance levels and policy domains. These conditions were divided into six guiding principles, presented in Figure 10, which together define the foundation of what the EU should aim to deliver.

These guiding principles form the analytical backbone of the report, on which the Advisory Board has structured its policy assessment. This assessment draws on multiple sources of evidence, including the latest climate science and warming projections, findings from EUCRA, the scientific literature and government and research reports. The combined evidence has been used to examine the strengths and weaknesses in the current EU policy framework and understand where adaptation efforts across the EU are lagging, what policy gaps persist and where EU-level action can provide direction, coherence and scale and support solidarity. Given the breadth of climate risks, this assessment is not exhaustive; it has focused on domestic (i.e. EU internal) adaptation efforts, and where sectoral gaps are highlighted, priority has been given to assessing policies addressing risks identified in EUCRA as requiring action (EEA, 2024a).

This approach ensures that the resulting recommendations are high-level yet actionable, offering guidance that is relevant across policy domains and governance levels and grounded in scientific evidence and EU law, in line with the Paris Agreement. The guiding principles and the Advisory Board's recommendations derived from them (see Summary as well as the assessment in the following chapters) are intended to guide an EU policy framework, that enables effective, fair and transformational adaptation (herein referred to as effective adaptation). In this context, an EU adaptation policy framework is considered effective insofar as it fulfils expectations and meets its defined objectives, including its capacity to enable effective adaptation outcomes.

Figure 10 Guiding principles for an effective EU adaptation policy framework



Lead with a vision

Guide adaptation through a long-term vision for climate resilience, supported by measurable targets.

4. Lead with a vision

Guide adaptation through a long-term vision for climate resilience, supported by measurable targets.

Embedding a collective long-term vision and adaptation targets in law provides policy stability and a common direction, helping to go beyond fragmented efforts towards the effective management of climate impacts and risks today, and wider transformation in the longer term. The vision and targets can help align EU action with science, EU values and principles, and international commitments. Tracking progress towards short- and medium-term targets supports policy planning and implementation.

The EU has committed to the global goal on adaptation, which is tied to limiting global warming by 2050 and supported by 11 targets with measurable indicators. However, current EU climate legislation neither establishes EU-wide adaptation targets nor sets out a long-term adaptation vision. EU adaptation and preparedness strategies set out visions and actions, but they are not enough on their own to ensure forward-looking action across policies and governance levels.

The forthcoming European integrated framework for climate resilience is an opportunity to strengthen the EU's legal framework by setting a common vision for 2050 and beyond, underpinning it with measurable targets (e.g., for 2030 and 2040). The vision and the targets can frame the EU's adaptation efforts effectively if they (i) rely on common definitions, values and principles; (ii) align with EU commitments under the Paris Agreement and other international agreements, including the Sendai Framework for Disaster Risk Reduction and 2030 Agenda for Sustainable Development; (iii) are proportionate to the scale of impacts and risks, across the EU; and (iv) are grounded in the latest science and socioeconomic developments.

4.1. Why this guiding principle?

An EU-level climate resilience vision embedded in a legal foundation can increase long-term policy stability.

The vulnerability of people and ecosystems to climate change is deeply rooted in the structures and practices of modern societies, affecting both current and future generations. Addressing these challenges therefore requires fundamental, system-level changes, which often take decades to plan and implement (Scheer et al., 2025; IPCC, 2022e). Such transformations, in turn, demand a long-term governance framework capable of ensuring coherent and sustained policymaking (Scheer et al., 2025).

A long-term EU-level vision of an adapted and resilient EU can provide direction to such a framework, going beyond short political cycles (Pot et al., 2023), and ensuring continuity even as governments and institutions change (Advisory Board, 2025b; Groen et al., 2023; Hilson, 2020). Such a common vision could be an outcome of a collective exercise that imagines desirable futures beyond present limitations, helping to inspire transformative thinking and inform the goals and objectives needed to move towards those futures (Friedrich and Hendriks, 2024; Pender, 2025).

Long-term in this context does not mean that the vision is about the distant future only; it can encompass a resilient society adapted to the climate it experiences now and in the decades to come. Within this context, the concept of transformation provides a useful lens for assessing both near- and long-term adaptation measures that can realistically support societal goals for climate resilience and

sustainable development (IPCC, 2022a). This includes improving resilience to current extremes and risks, not only preparing for distant climate scenarios. For example, by 2040, a vision could aim for zero casualties from weather extremes, as reflected in Canada's long-term goals (see Box 4).

Embedding the vision in the legal framework can support planning, for instance to help inform the choice of specific policies and investments that lead towards that vision and provide long-term policy certainty – one of the most important conditions for mobilising investment. It would also foster anticipatory governance: a proactive policymaking approach that seeks to anticipate disruptions, emerging risks and critical events (Giusti, 2025; OECD, 2025a). The EU's need for such an approach is elaborated further in Chapter 5.

Operational targets framing the planning and delivery of outcomes across sectors and cross-cutting dimensions mobilise policy development and implementation.

Driven by the long-term vision, the EU needs to foster adaptation outcomes and results (Buser, 2022; Keessen and Van Rijswick, 2012). Targets in public policy serve as explicit instruments for clarifying governmental priorities and expected outcomes within defined time frames (Begley et al., 2019; Boswell et al., 2015). They function as management and accountability tools, enabling those responsible for implementation to plan, allocate resources and monitor progress effectively (Institute for Government, 2021). By making objectives transparent, targets inform citizens and stakeholders about policy priorities, thereby strengthening public scrutiny and parliamentary oversight (Begley et al., 2019). Furthermore, targets help maintain attention on long-term strategic goals that might otherwise be neglected (Carey et al., 2020). When well designed, they shape policy formulation, guide delivery and provide measurable benchmarks for success, reinforcing both performance and democratic accountability (Boswell et al., 2015; Lester and Neuhoff, 2009).

Defined time horizons within the vision and the targets are necessary to deal with acute events and long-term changes and for guiding effective and transformational adaptation.

Policymakers have strategic leeway to postpone or bring forward adaptation planning and action when seeking to align with the pace of events to suit their purposes (Goetz and Meyer-Sahling, 2009; Pot et al., 2023). However, defined time horizons for both the vision and the targets can help ensure steady progress and adequate solutions that deal with both acute emergencies (e.g. wildfires) and slow-onset ones (e.g. desertification and loss of biodiversity). Likewise, having a substantiated and detailed end goal helps inform the choice of measures that have transformational potential, track adaptation progress, evaluate effectiveness of measures and catch maladaptation before it happens. As pointed out in Chapter 1, climate impacts and risks have changed, creating new risks to which our societies have not yet adapted. Moreover, even under optimistic mitigation pathways global temperatures will increase. The unavoidable continued increase in climate hazards for Europe are increasingly well identified. This highlights the need for adaptation to the changed climate of today and preparing for the future, including exceeding 1.5 °C global warming (see Chapter 1). According to Theokritoff et al. (2025), the overshoot of the 1.5 °C target needs to be factored into long-term plans and policies, for example for infrastructure-based measures and for irreversible impacts such as sea level rise.

The EU vision and targets can help to align action with science and commitments that include EU values and principles.

Defining the EU vision and objectives is a normative task falling onto policymakers (Hilson, 2020; Juhola and Kruse, 2015; Nalau et al., 2024). Countries have demonstrated different approaches to doing so, with a few examples of relevant policy choices at the national level provided in Box 4. By defining its vision and targets in law, the EU can translate scientific insights on effective adaptation into

policies, and their democratic legitimacy depends on ensuring they are aligned with EU values and principles (see also Box 3 in Chapter 3).

Box 4 Examples of adaptation visions and goals at the national level

The obligation to use climate risk assessments when updating adaptation goals with dedicated governance and time frames. The German Federal Climate Adaptation Act (2023) requires the government to present a precautionary climate adaptation strategy with measurable goals, measures and indicators per cluster of action, including clusters with cross-sectoral action areas, for example municipal climate adaptation planning. The strategy must build on the climate risk assessment and be updated every four years. The strategy adopted in 2024 includes 39 targets with dedicated federal measures and recommendations for state measures. Most of the targets are to be reached by 2030 (e.g., minimising of the direct and indirect impacts of climate change on biodiversity) some extend to 2050 (e.g., making building stock more resilient), and some are set to be reached as early as 2025/2026 (e.g. 'introducing federal monitoring of spatial development plans') (German Federal Ministry for the Environment, 2024).

An adaptation aim informed by the local warming trajectory. France's national adaptation plan (NAP) adopted in March 2025 sets out the aim to prepare the country for the consequences of global warming of 1.5 °C by 2030, 2 °C by 2050 and 3 °C by 2100, with higher respective warming implications for mainland France (2 °C by 2030, 2.7 °C by 2050 and 4 °C by 2100), reflective of Europe warming faster than the global average. France's climate risk assessment informing its NAP relies on the reference warming trajectory for adaptation, with the expected impacts grouped under several policy relevant indicators such as average summer temperature, intensity of extreme precipitation, and soil dryness indicator (UNECE, 2025). These are reflected in the plan's 52 measures, of which some have a European dimension, such as options for pooling extreme risks and joint research efforts (Government of France, 2025).

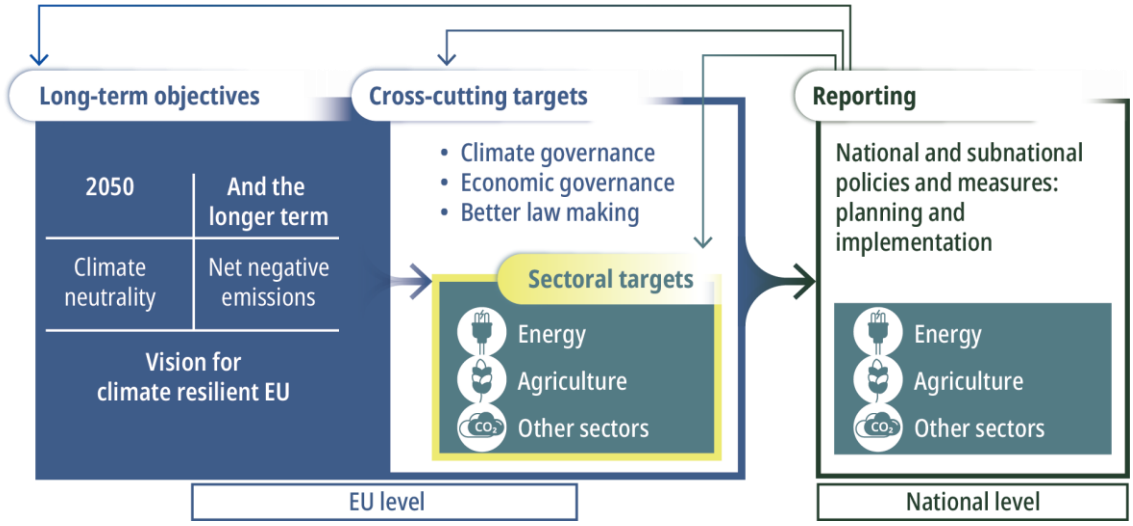
A value-led vision with long-, medium- and short-term goals that reflect national, regional and local priorities. Canada's NAP sets out the following vision: 'All of us living in Canada, our communities, and the natural environment are resilient in the face of a changing climate. Our collective adaptation actions enhance our well-being and safety, promote justice, equity, and reconciliation with Indigenous Peoples, and secure a thriving natural environment and economy for future generations' (Government of Canada, 2023). The plan's long-term goals, medium-term objectives (e.g. by 2040, 'deaths due to extreme heatwaves have been eliminated') and short-term targets outline national-level efforts and recognise regional and local priorities.

Targets based on a shared understanding of key terms and concepts and defined accountability can mobilise implementation and enable progress tracking.

A collective policy direction is not sufficient, especially if it is only vaguely defined or if there is no defined accountability (Higham et al., 2021). For example, evidence from municipal land use planning suggests that 'it is certainly not sufficient to establish general principles of law, which only require that the matter be considered' (Boehnke et al., 2023). To deliver on the vision and targets, it is important to clarify risk ownership and accountability (see Chapter 9) and set up robust monitoring, evaluation and learning (MEL), including progress tracking based on shared definitions of key terms and concepts (Kim and Shin, 2024) (see Chapter 6).

In this way, the long-term vision and targets can support policy integration. Their implementation can be carried out through mechanisms tailored to specific sectors (horizontal integration) and different levels of administration (vertical integration) see Figure 11 (Fankhauser et al., 2016, 2015). Such joined-up governance is a precondition for effective adaptation (Clar, 2019) (see also Chapters 2 and 8).

Figure 11 EU vision and targets guiding horizontal and vertical policy integration



Flexible, participatory and forward-looking planning, grounded in science, societal priorities and iterative learning, is essential for setting policy direction and avoiding maladaptation.

Climate risk assessments, scenario analyses and strategic foresight (Iden et al., 2017; Vervoort and Gupta, 2018) are valuable for informing the normative choices when defining a long-term adaptation vision and targets. Given the evolving understanding of risks and impacts, the high complexity and uncertainty inherent to climate adaptation policy (Clar, 2019) and shifting societal needs and preferences, it is important to allow flexibility and iterative updates of the vision and targets. Such a reflexive approach to adaptation (Taylor et al., 2025) helps prevent path dependencies and reduces the risk of maladaptation (see Chapter 6).

Long-term goal setting, therefore, can benefit from socio-politically contextualised visions that bring together experience, science-based projections and societal preferences (Amorim-Maia and Olazabal, 2025; López-Muñoz et al., 2025). Interim goal setting can then draw on adaptation pathways and reflexive learning (Werners et al., 2021), which help in the sequencing of decisions and measures in time to achieve the long-term objective.

By applying forward-looking flexible and adaptive planning based on iterative assessments (IPCC, 2022c), the EU can minimise adverse distributional effects while encouraging fundamental shifts as part of transformative adaptation. As pointed out by(2020, 2020), 'transformational adaptation requires the ability to envision various scenarios and … address the root causes of vulnerability in the long term.' The participatory nature of the goal-setting process, behind both the overarching vision and the targets, is therefore key (Vervoort and Gupta, 2018), as elaborated further in Chapter 7.
Building on the findings in Section 4.1, the following section analyses the EU's current approach to leading with a long-term vision supported by adaptation targets.

4.2. Anchoring EU adaptation policy in a vision and targets

The Paris Agreement sets out the global goal on adaptation, with an implicit vision of globally enhanced adaptive capacity, strengthened resilience and reduced vulnerability by 2050.

The EU is bound by international law, including the Paris Agreement (see also Chapter 3). The Paris Agreement (Articles 2 and 7, UNFCCC, 2015) commits its parties to applying due diligence in pursuing the global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view towards contributing to sustainable development and ensuring an adequate adaptation response in the context of the 1.5 °C temperature goal to be achieved by mid-century. The following vision can be thus derived from the pursuit of these active objectives reflecting the ambition to achieve enhanced adaptive capacity, strengthen resilience and reduce vulnerability at a global level by 2050. The stated aim of the Paris Agreement is to reinforce the global response to climate change in line with the sustainable development goals (SDGs) set out in the 2030 Agenda for Sustainable Development (UN, 2015b). The global goal on adaptation is translated into more granular (i.e. regional, national and local long-term) objectives through the national adaptation plans (NAPs) and national adaptation strategies (NASs) required under the UNFCCC Cancun Adaptation Framework, (2010).

The EU's commitment to the goals of the Paris Agreement is supported by the UN's Sendai Framework for Disaster Risk Reduction, alongside the 2030 Agenda for Sustainable Development.

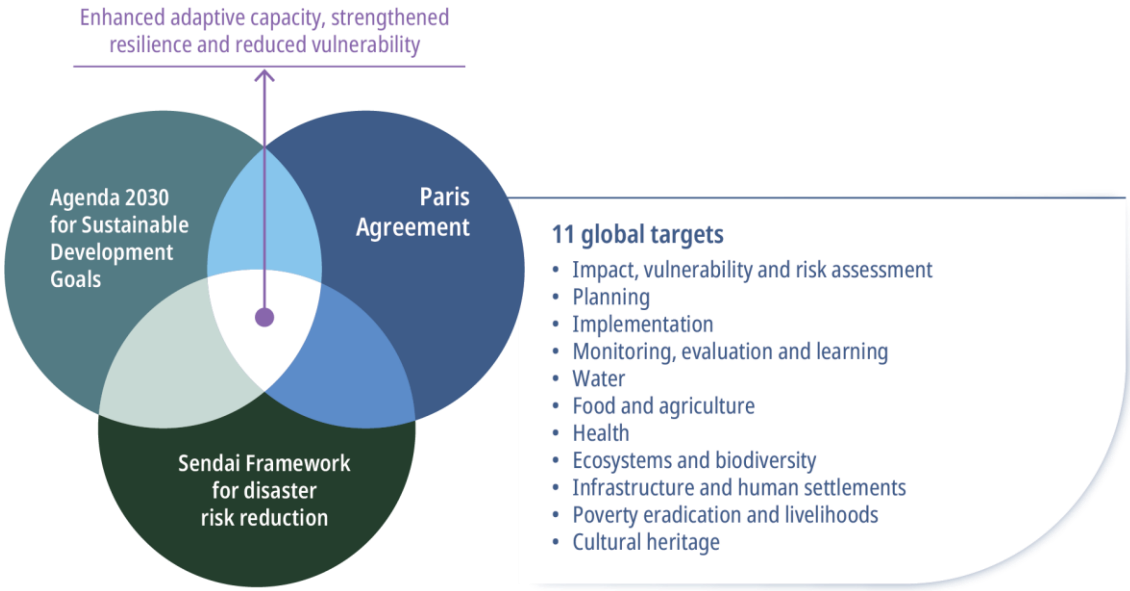
The EU's commitment to the Paris Agreement is supported by the UN 2030 Agenda and the Sendai Framework for Disaster Risk Reduction (UN, 2015a) among other documents. The Sendai Framework recognises that the state has a primary role in ensuring:

> 'the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries (UN, 2015a).'

The Sendai Framework sets four priorities for action within and across sectors and governance levels and identifies seven global targets to be achieved by 2030. These targets cover all types of disaster risks, including those from climate change. Through its first action plan to implement the Sendai Framework (EC, 2016), the EU began shifting from disaster management to disaster risk management across policies (EC, 2023e), which means more efforts going to preparation and anticipation. Driven by the Sendai Framework, the EU has set five disaster resilience goals underpinned by specific objectives set out in the Commission's recommendation of 2023 (EC, 2023e). Climate impacts are considered mostly implicitly, but Member States are explicitly required to address climate risks to deliver on goal 1 (improved risk assessment) and goal 3 (enhanced early warning).

The UN 2030 Agenda for Sustainable Development, with its 17 SDGs, supplements this shift with a blueprint for resilient societies. Its goal 13 is targeted to urgently addressing climate change and its impacts. Together with the Paris Agreement, the Sendai Framework and the 2030 Agenda are relevant for framing the EU's vision of a resilient society adapted to a changing climate (see Figure 12), calling for integrated approaches to adaptation, sustainable development and disaster risk reduction (UNCC Secretariat, 2017).

Figure 12 The UN 2030 Agenda, Sendai Framework for Disaster Risk Reduction and Paris Agreement create a framework for the EU's climate resilience vision and adaptation targets



Notes: Further details on the substance of the 11 targets adopted under the global goal on adaptation can be found in paragraphs 9 and 10, UNFCCC, 2023 and OECD, 2025.

Source: Adapted from UNCC Secretariat (2017) and Decision 2/CMA.5 (UNFCCC, 2023a).

Since 2023, the global goal on adaptation has been underpinned by 11 targets agreed under the UNFCCC. Their achievement can be supported by the guiding principles presented in this report.

In recent years, the parties to the Paris Agreement have been advancing on the ways to operationalise this goal under the Glasgow–Sharm el-Sheikh work programme. As a result, the United Arab Emirates Framework for Global Climate Resilience agreed in 2023 (Decision 2/CMA.5, UNFCCC, 2023) includes 11 targets, 7 of which are thematic and 4 of which align with the dimensions of the iterative adaptation cycle (see Figure 12).

The dimensional targets are organised around the adaptation policy cycle: (1) impact, vulnerability and risk assessment; (2) planning; (3) implementation; and (4) MEL. The guiding principles presented in this report support their achievement. For example, the target on MEL commits the parties to have established and operationalised a MEL system for adaptation, supported by adequate institutional capacity; this aligns with the guiding principle 'learn and improve' as detailed in Chapter 6. In turn, the target on impact, vulnerability and risk assessment requires parties have conducted up-to-date climate risk and vulnerability assessments and used the results to inform their adaptation plans, policies and planning processes, which is in line with the guiding principle 'anticipate and act' as further elaborated in Chapter 5. The second part of the target description, dedicated to early warning systems and climate information services (UNFCCC, 2023a), links to the guiding principle 'learn and improve' as presented in Chapter 6.

The remaining seven targets are thematic or sector-related: water, food and agriculture, health, ecosystems and biodiversity, infrastructure and human settlements, poverty eradication and livelihoods, and cultural heritage. All targets are to be achieved by 2030 and progressively beyond (UNFCCC, 2023a) and are underpinned by a set of indicators (see Section 6.3 and Figure 15).

The European Climate Law's adaptation provisions (unchanged since 2021) no longer reflect recent global advances, leaving the EU with an ambition level that falls below its commitments.

The European Climate Law translates the EU's Paris Agreement commitments into the domestic legal framework and supports the Member States in fulfilling their own Paris Agreement commitments, for example developing NAPS or NASs. The law provides a framework for achieving progress in pursuit of the global adaptation goal by requiring that the relevant EU institutions and the Member States 'ensure continuous progress in enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change' (Article 5). The European Climate Law provisions on adaptation have not changed since their adoption in 2021 and therefore do not reflect the advances in the operationalisation of the global goal on adaptation. Notably, the law does not reflect the 11 targets agreed under the UNFCCC (see Figure 12). The mere requirement to demonstrate continued progress in adapting to climate change sets a low level of ambition, resulting in adaptation efforts not keeping pace with intensifying climate impacts and escalating risks (Advisory Board, 2025b). Apart from the obligation of progress, the law mandates that the Commission develop and regularly update the EU climate adaptation strategy.

The EU's strategies outline broad resilience and climate-resilience visions but lack operational objectives, explicit links to core EU values and time horizons beyond 2050.

The EU climate adaptation strategy (EC, 2021c) sets out a vision for an adapted and resilient EU by 2050, and the preparedness Union strategy (EC and HR/VP, 2025b) broadens this vision beyond climate impacts, reflecting the integrated all-hazards approach to security, defence and other policies (see Box 5). Both strategies vest the EU with a rather broad vision and, while underpinned by institutional measures and embedding the disaster resilience goals mentioned earlier, they do not require progress towards measurable climate resilience targets. Neither strategy explicitly links its vision to shared EU values, aims or principles, such as those embedded in EU primary law (e.g. integrating environmental policies into all fields and policies of the EU as per Article 11 TFEU; the EU protecting the well-being of its peoples as per Article 2 TEU; or everyone's right to life as per Article 2 of the EU Charter of Fundamental Rights; see also Section 3.1) or go beyond 2050.

Box 5 Resilience and climate-resilience visions set out in EU strategic documents

EU Adaptation Strategy

'In 2050 the EU will be a climate-resilient society, fully adapted to the unavoidable impacts of climate change. This means that by 2050, when we aim to have reached climate neutrality, we will have reinforced adaptive capacity and minimised vulnerability to climate impacts, in line with the Paris Agreement.'

EU Preparedness Union Strategy

'… to create a secure and resilient EU with the capabilities required to anticipate and manage threats and hazards, independently of their nature or origin, to ensure that European citizens have adequate protection and preparedness, and to preserve the vital functions of the society in all circumstances.'

Sectoral visions emerging as part of EU strategic documents support the broader vision of climate resilience at the EU level, in addition to global targets.

In parallel with the horizontal climate and security visions, EU has developed visions for selected sectors. For example, the sectoral vision set out in the EU water resilience strategy makes references to intergenerational justice and broader fairness (see Chapter 4), including:

> 'a water resilient EU, providing water security for all. This entails the protection and restoration of aquatic ecosystems, and a fair balance between water supply and water demand responding to current needs, including the realization of the human right to safe drinking water and sanitation, without compromising the rights of future generations (EC, 2025o).'

The same applies to the sectoral vision set out in the EU vision for agriculture and food:

> 'the Union of 2040 must be a place where farming and food production thrive across our continent in all their diversity. A place where farming is attractive for future generations, and the agri-food sector is competitive, resilient, future-proof and fair (EC, 2025k).'

These visions provide a strong foundation for incorporating EU adaptation targets into sectoral legislation, especially since the two relevant thematic target areas are already defined under the global goal on adaptation (see Figure 12).

The visions share related concepts such as preparedness, resilience, adaptive capacity and vulnerability, but the lack of common definitions risks creating policy ambiguity.

The existing visions use similar terms and concepts, which would benefit from a shared and consistent understanding. For instance, EU policy documents could more clearly embed concepts such as 'enhanced adaptive capacity' and 'minimised vulnerability' within the broader context of preparedness and resilience.

Although the EU preparedness Union strategy (EC and HR/VP, 2025b) does not explicitly define 'preparedness', it offers enough guidance to frame it in the climate context as a state in which the necessary capacities, systems and resources are in place to anticipate, absorb and effectively respond to climate hazards. This includes both short-term shocks and long-term stresses and involves proactive planning, early warning systems, response capability and climate-resilience-building measures that reduce exposure and vulnerability while enabling timely, coordinated action.

This understanding suggests that preparedness for climate hazards is closely aligned, if not overlapping, with the concept of climate resilience. This distinction may have policy implications when considered in the context of the preparedness by design principle put forward by the Commission to guide the EU's next long-term budget and policy (see Chapter 9).

The need to develop a values-based vision of a resilient EU has been recently confirmed in EU strategic foresight.

In the 2025 EU strategic foresight report, the Commission points to the need to develop a vision of a resilient EU in 2040. The vision is to be grounded in the EU's goals and values and deliver on three key elements:

1. peace through European security;
2. the values of democracy, human dignity, freedom, equality, the rule of law and respect for human rights; and
3. people's well-being, which includes sustainable prosperity respecting planetary boundaries and a habitable planet with a climate-neutral and climate-resilient economy (EC, 2023a).

4. Although a 2040 horizon is not sufficiently long term considering EUCRA findings[5], the foresight call for a value-based vision is consistent with an integrated approach to security and climate risk management (see Chapter 8).

The forthcoming European integrated framework for climate resilience will provide a legal basis for the EU's adaptation vision and targets and offer an opportunity to link them to the latest science and risk assessments.

In March 2025, as part of the preparedness Union action plan (EC and HR/VP, 2025b), the Commission announced 63 actions to be implemented by the Commission and the Member States to achieve the vision of a resilient and secure EU. These actions consist of legislative and non-legislative measures to be implemented between 2025 and 2027 and include the European integrated framework for climate resilience. This is an opportunity for the EU to legally embed the collective vision and targets that are measurable in terms of outcomes and process and reflective of the latest scientific insights, the Paris Agreement and the EU's core values and principles. To ensure that the vision-setting process is participatory and informed by the latest science, including shared climate projections, the first EUCRA (EEA, 2024a) can provide valuable support for upcoming legislative and policy processes. However, because there is currently no legal basis for either conducting the assessment or applying its findings, no formal link exists between EUCRA, the European Climate Law and the planning and reporting obligations under the Governance Regulation (Regulation (EU) 2018/1999) – an issue further detailed in Chapters 2 and 5.

5 A long-term policy horizon going beyond 2050 is one of three policy horizons considered in EUCRA (short-term: up to 2040; medium-term: up to 2060; and long-term: beyond 2060), recognising that 'the policy horizon for any given climate risk is a central component of developing an effective adaptation policy' (EEA, 2024a).

Anticipate and act

Anticipate climatic conditions, with a coherent approach to effective early warning systems and climate risk assessments, to act on climate risks with robust, dynamic and forward-looking adaptation.

5. Anticipate and act

Anticipate climatic conditions, with a coherent approach to effective early warning systems and climate risk assessments, to act on climate risks with robust, dynamic and forward-looking adaptation.

EU policy needs to facilitate anticipating and acting on climate risks. Anticipating climate risks is essential to minimising harm, avoiding maladaptive lock-ins and ensuring long-term climate resilience. In line with the precautionary principle, anticipating climate risks needs to support proactive measures to prevent avoidable suffering and damage. This means ensuring that policy and investment decisions are made on the basis of comprehensive risk assessments; that long-term adaptation planning is robust from the outset to a range of possible futures; and that policymaking needs are based on adaptation planning and review cycles that allow for course correction as the understanding of risks and solutions evolves.

The current patchwork approach to risk assessments and climate scenarios could be strengthened and would benefit from greater standardisation. Forward-looking risk assessments are the foundation of anticipatory action. They enable policymakers to explore a range of plausible futures, assess risks and choose robust adaptation options. The EU has made progress on embedding risk assessment requirements in some EU legislation. However, this remains uneven, with diverse requirements across EU laws that often rely on middle-of-the-road or lower-end scenarios. This can result in an underestimation of climate risks and inconsistent approaches (e.g. in scenarios and methodologies) across the EU, in Member States and by the private sector. These gaps could be addressed through a common EU approach to risk assessments, including common scenarios and a minimum baseline scenario, which balances the need for standardisation with flexibility to tailor approaches to local specificities.

The EU has a policy cycle that could be strengthened to support robust and dynamic planning with embedded updates to adjust course. Adaptation planning is often based on identifying sequential actions to take in response to changes in the climate, which requires having mechanisms in place to allow for course correction. The European Climate Law and the Governance Regulation in theory provide a planning and reporting cycle. However, the current approach has proved insufficient, hampered by the absence of EU adaptation targets and the fragmentation of the planning and reporting landscape. EUCRA has helped identify adaptation priorities and inform EU planning but it is not subject to regular, legally anchored updates. The forthcoming integrated framework on climate resilience and the 2027 revision of the Governance Regulation are opportunities to ensure that integrated national policy planning and reporting enable robust, dynamic and forward-looking adaptation across the EU.

5.1. Why this guiding principle?

Anticipating and acting mean taking proactive steps to minimise impacts before they arise, in line with the precautionary principle, and seizing opportunities.

Adaptation requires timely decisions that anticipate risks across different time horizons, and proactively act on them to minimise harm, avoid lock-ins and seize opportunities for climate resilience (Simpson et al., 2025).

In the shorter term, this requires being able to respond effectively to the unprecedented extreme events and climate impacts already being experienced today, with near-term, low-regret measures that can immediately reduce these risks. Stress testing[6] existing crisis management systems and improving early warning capabilities is a priority. This can help ensure risk governance is fit for purpose, with warnings that trigger timely and coordinated responses before unprecedented risks materialise, rather than after disasters have occurred. For example, an analysis of the 2021 floods in Belgium, caused by unprecedented rainfall, showed that better preparedness could have strengthened risk governance (e.g. with clearer roles and responsibilities and robust early warning systems) to reduce the scale of human and economic losses (UNU CRIS, 2024).

Europe also faces evolving and escalating climate risks in the longer-term, with many potentially reaching catastrophic consequences levels over the coming century (see Chapter 1). Proactive adaptation needs to look ahead, because many decisions taken today have lifetimes spanning decades or even centuries. For example, coastal protection infrastructure typically requires a lead time of 30 years, while urban spatial planning takes decades to implement. Nature-based solutions, such as planting trees for slope stabilisation, also require time before benefits materialise (Anderson et al., 2021). Given these long lead times and the urgency to accelerate adaptation, decisions must account for both current and future climatic conditions, including multiple hazards and systemic risks. This includes planning for both incremental measures and transformational adaptation, which planners must anticipate and act on to ensure such changes happen by design rather than by disaster (Cools et al., 2025).

This principle reflects the precautionary principle embedded in EU law (see Chapter 3), which calls for preventive measures where risks of serious or irreversible harm exist, even under uncertainty. Adaptation must embrace this approach to prioritise early action and anticipate future needs, including where transformational adaptation is needed.

Delivering long-term climate resilience in the context of uncertainty requires robust and dynamic adaptation planning.

A key challenge for longer-term adaptation decisions is that these often face a context of deep uncertainty about the future warming and resulting climate conditions, vulnerability and exposure of human and environmental systems. When there is deep uncertainty and a likelihood of gaining more knowledge over time, it can be important to keep flexibility in decisions. While this can sometimes imply waiting for further information before taking a decision, delayed or insufficient adaptation in many instances can lead to irreversible and even catastrophic consequences. Critical infrastructure or spatial planning decisions, for example, create lock-ins for decades or even centuries, making it important that they are resilient from the outset to a wide range of possible climate futures. In such situations, acting proactively can be beneficial and provide more flexibility in the long run, even if the need for adaptation is uncertain. In contrast, delaying adaptation can make adaptation options less effective and more costly over time, while incurring economic losses and costly emergency responses (Adger et al., 2009; Hallegatte, 2009; Moure et al., 2023; James et al., 2019).

To accelerate adaptation efforts and ensure that decisions are both timely and resilient to future climate conditions, adaptation must be planned strategically, in a forward-looking way, and be built directly into policymaking (Füssel, 2007; IPCC, 2022e). Yet, traditional decision-making tools, such as

6 Stress testing is a structured exercise to test whether systems, infrastructure or plans can withstand or respond to low-probability but plausible climate scenarios or events (e.g. a 1-in-100-year flood event). For example, in the Netherlands, climate stress tests were introduced to inform and stimulate climate adaptation policy at the municipal level (de Klerk et al., 2021).

cost–benefit analysis, assume well-understood probabilities and single 'best' outcomes. While these can support some adaptation planning, they can be difficult to apply to many, especially long-term, adaptation decisions given the conditions of deep uncertainty and the fact that 'best' outcomes might not be the most robust options in multi-risk settings (Allison et al., 2024; Dittrich et al., 2016).

Instead, adaptation planning increasingly relies on decision-making under uncertainty frameworks, which prioritise actions that are effective across multiple plausible futures rather than predicting a single optimal solution (IPCC, 2022e). The literature identifies different characteristics in such frameworks to remain effective and responsive over time, even as risks evolve. For simplicity, this report uses the broad grouping set out in Herman et al. (2020), who distinguished between:

- **robust planning**, where the focus is on identifying options that perform well under a wide range of future conditions; and
- **dynamic planning**, which aims to identify adaptation policies that respond to new observations over time.

These two groups are not mutually exclusive. Robust adaptation planning can include dynamic planning, though the reverse is not always true.

Proactive adaptation requires embedding risk assessments, including climate scenarios, into policy cycles.

Climate risk assessments consider the severity of climate risks based on how climate hazards will interact with vulnerability and exposure, which guides the choice of adaptation options. Forward-looking climate risk assessments are typically underpinned by climate scenarios, which explore a range of plausible futures to navigate future uncertainty. Embedding climate risk assessments in the policy cycle can ensure that the latest scientific evidence supports policymakers in identifying solutions and trade-offs and prioritising robust adaptation planning. These are the essential building blocks of proactive and anticipatory action, enabling preparation for current and future climate risks, preventing harm before it occurs and guiding changes forced by climate change, including transformational ones, to seize opportunities and deliver the most beneficial outcomes.

This chapter focuses on the need for EU adaptation policy to anticipate risks through a coherent approach to climate scenarios, climate risk assessments and strengthened adaptation planning.

5.2. The role of climate scenarios in forward-looking risk assessments

Forward-looking climate risk assessments are underpinned by high-resolution climate scenarios to navigate uncertainty relative to future climate trends and risks.

Climate adaptation is typically forward looking, often requiring anticipation of future climate risks and their systemic impacts. Analysing trends in historical climate observations is critical to understanding the risks faced today, but alone is inadequate to plan for the decades ahead, underscoring the need for scenarios to guide forward-looking adaptation planning (Simpson et al., 2025). Climate scenarios help planners explore a range of plausible futures (e.g. different warming trajectories or abrupt changes in climate system behaviour such as tipping points or feedback-driven shifts) to assess climate risks and impacts and inform the selection and prioritisation of adaptation options.

While practices are still evolving, scenario analysis for climate risk assessments typically need to consider several factors (Grace et al., 2025), including but not limited to the following.

- **Type of scenario.** Scenarios could be based on greenhouse gas emissions pathways that represent specific narratives, and projections of their respective temperature outcomes. These outcomes could be probabilistic or deterministic, but in all cases mindful of accompanying uncertainties. Scenarios could also be based on key geophysical changes (e.g. circulation changes where flooding risks are significant).
- **Number of scenarios.** Scenarios are not predictions, and an appropriate range of scenarios should always be considered, although this can be resource intensive.
- **Hazards covered.** Scenario analysis should identify the chronic and acute physical climate hazards to be assessed, along with possible interactions between hazards.
- **Time frames.** Scenarios should cover time periods in which risks need to be assessed, recognising that risks have changed even today, but they should also be linked to long-term goals, planning horizons and time frames within which adaptation will take place. This should be informed by both aspirational goals (i.e. what is desired or to be avoided) and operational goals relating to the pathway that is taken to achieve that goals (NZCCC, 2010).
- **Geographical resolution.**[7] The detail with which scenarios can accurately capture local features and climate extremes is important for adaption planning. This often requires downscaling global climate projections (typically from around 100 km resolution) to finer scales (e.g. 10–50 km for regional models), although this is computationally more challenging (Chang et al., 2026; Schneider et al., 2023). Reanalyses of recent decades, especially in areas with good observations, can provide a good sense of how some hazards have already been changing, typically at much higher resolutions (e.g. 9 km for ERA5-LAND, and even higher for limited area reanalyses) and can be used alongside scenarios to assess relevant trends.

Despite their importance, scenario analysis is challenging to undertake, including due to limitations in resources, skills, data and uncertainty relating to timescales and quantifiability (Grace et al., 2025).

Beyond climate hazards, risk assessments need to be based on a robust analysis of vulnerability and exposure in a multi-hazard risk context.

Climate hazard information alone cannot fully characterise climate risk. Risk assessments are the most useful for adaptation planning when they combine climate projections with robust analyses of vulnerability and exposure in a multi-hazard context. This means considering who and what is exposed, how vulnerable they are, and how adaptation responses might alter impacts (IPCC, 2022d; Andrijevic et al., 2023; Moure et al., 2023).

To produce comprehensive risk information to guide forward-looking adaptation, assessments often rely on static indicators or linear extrapolation of socioeconomic data, even though exposure and vulnerability are likely to change significantly and in a non-linear manner over time (Garschagen et al., 2021; ETC CA, 2024b). Incorporating socioeconomic projections and policy choices can help identify where action is most needed, which responses are effective, and what measures are socially acceptable (Garschagen et al., 2021; IPCC, 2022e). Shared socioeconomic pathways (SSPs) can support this analysis by providing insights into societal factors shaping vulnerability and adaptive capacity (Andrijevic et al.,

7 Resolution refers to the size of the grid cells used in climate models to represent the Earth's surface. It determines the spatial detail of climate projections. The coarser resolution of global climate models average conditions over large areas, which can obscure local climate features and extremes.

2023; Kok et al., 2019). These pathways can be used as a basis for developing granular, forward-looking indicators of exposure and vulnerability (OECD, 2025c; ETC CA, 2024b).

Risk assessments are also more useful when going beyond the assessment of one hazard at a time to include multiple compounding hazards and cascading risks (Ward et al., 2022). Expanding assessments to consider interlinkages between adaptation and nature in particular is needed, given the EU's dependence on ecosystems for food security, economic stability and carbon sequestration (Lazurko et al., 2025). Scenario-informed planning can help navigate uncertainty by integrating climate hazards, exposure and vulnerability, aligning adaptation efforts with broader resilience and sustainability goals. Where adaptation faces a context of deep uncertainty, it is important that scenarios, which illustrate possible paths, are continuously revisited and inform dynamic planning that can adjust over time as knowledge and climate risks evolve.

Through climate-proofing requirements and guidance, the EU has made progress in integrating climate scenarios into planning and decision-making.

The EU has sought to progressively mainstream climate adaptation by requiring some planning and decisions to be informed by forward-looking climate risk assessments (see Chapter 9). Climate risk assessments – and in some cases, climate scenarios – are explicitly or implicitly required in various pieces of EU legislation and guidance (see Table 3), covering a broad range of sectors and actors. The 2021 EU adaptation strategy (EC, 2021c) also explicitly commits to integrating resilience across sectors and levels of governance and to using better data and tools for decisions.

This now operates most visibly through climate-proofing requirements for EU-funded infrastructure for the 2021–2027 period, which guide promoters to screen large infrastructure projects for climate vulnerability and, where relevant, conduct detailed climate risk assessments using scenario-based projections over assets' lifetimes. As elaborated in Chapter 9, the effectiveness of the climate proofing of infrastructure in the current multiannual financial framework (MFF) is not yet known, and the Commission plans to update this as part of the upcoming integrated framework for climate resilience.

Table 3 Examples of applicable requirements and guidance for climate risk assessments and scenarios across EU legislation

Legislation or Guidance	Requirements for climate risk	Requirements for scenarios
Climate-proofing guidance for large infrastructure *(where required by EU legislation, e.g. InvestEU, CEF, ERDF, CF, JTF, TEN-T)*	Project promoters for large EU-funded infrastructure projects (where required by EU legislation) to carry out climate vulnerability and risk assessment, based on EU technical guidance on climate-proofing infrastructure.	Promoters to assess climate risks for the lifetime of the project. Choice and number of scenarios at discretion of project promoter, with recommendation to be based on the emissions pathways RCP4.5 for projections up to around 2060, while RCP6.0 or RCP8.5 are recommended for longer life projects and early-screening.
TEN-E regulation Regulation (EU) 2022/869	Projects of common interest to provide climate adaptation documentation (environmental reports covering climate risks) during permit process.	Not explicitly stated.
Floods Directive 2007/60/EC	Member States to assess long-term developments, in particular climate change, on the occurrence of floods when preparing and updating preliminary flood risk assessments.	Not explicitly stated for climate scenarios. Flood hazard maps must cover low, medium (and, where appropriate, high) probability scenarios, but Member States apply a range of methods in assessing climate hazards.

Legislation or Guidance	Requirements for climate risk	Requirements for scenarios
Nature Restoration Law Regulation (EU) 2024/1991	Member States to prepare national restoration plans, setting out restoration measures needed to achieve 2030, 2040 and 2050 targets. These must also consider effects of climate change and synergies with mitigation and adaptation.	Not explicitly prescribed, but plans required to explain the relevance of climate change scenarios for the planning of the type and location of restoration measures.
Critical Entities Resilience Directive (EU) 2022/2557	Designated critical entities to carry out risk assessments at least every four years, covering 'all relevant natural and man-made risks which could lead to an incident'. Entities further required to take prevention measures, including 'disaster risk reduction and climate adaptation measures'.	Not explicitly stated.
European sustainability reporting standards (Commission Delegated Regulation (EU) 2023/2772, *where required by CSRD)*	Companies within scope to identify and assess material climate risks to their businesses, over time spans linked to assets' expected lifetimes or planning horizons in the short, medium and long term.	Risk assessment informed by at least one high emissions pathway for the assessment of physical risks, with examples referring to SSP5-8.5 and various Network for Greening the Financial System scenarios.
EU taxonomy for sustainable activities (Commission Delegated Regulation (EU) 2021/2139)	Technical screening criteria for determining the 'substantial contribution' or 'significant harm' of investments to the climate adaptation objective.	Activities with expected lifespan of less than 10 years required to use climate projections 'at the smallest appropriate scale'. All others required to assess physical risks 'across the existing range of future scenarios' consistent with the expected lifetime of the activity, covering at least 10-30 years. Examples refer to RCP2.6, RCP4.5, RCP6.0 and RCP8.5.
Guidelines on environmental scenario analysis *(where required by amended CRD and CRR)*	Financial institutions to integrate environmental risks, including climate, into regular risk management and stress-testing frameworks. Climate risks considered for (short-term) stress testing and (long-term) climate resilience analysis.	Choice and number of scenarios at the discretion of institutions, but required at least to define a baseline scenario and a set of adverse scenarios reflecting severe (i.e. tail risk) but plausible (i.e. reasonably probable) risks.
Solvency II Directive (amended) Directive (EU) 2025/2	Insurers to consider and identify material exposure to climate risk as part of own risk and solvency assessment.	'At least two long-term' scenarios shall be specified (where material exposure exists) to assess the impact of identified risks, including one where the global temperature increase remains below 2℃, and one 'significantly higher' than 2℃. Not required for small and non-complex undertakings).

Notes: The acronyms mentioned in this table include CEF (Connecting Europe Facility), ERDF (European Regional Development Fund), CF (Cohesion Fund), JTF (Just Transition Fund), TEN-T (Trans-European Transport Network), RCP (Representative Concentration Pathway), TEN-E (Trans-European Networks for Energy), CSRD (Corporate Sustainability Reporting Directive (EU) 2022/2464), CRR (Capital Requirements Regulation (EU) 2024/1623), and CRD (Capital Requirements Directive (EU) 2024/1619).

While progress has been made, the consideration of future climate risks across EU instruments and sectors remains uneven, with gaps to be addressed.

Climate risk assessments generally follow heterogenous methodologies and scopes (Arribas et al., 2022; Tehler et al., 2024; ETC CA, 2025; EC, 2023d) and often lack transparency about the remaining uncertainties (EC, 2024i). This can also be seen in Table 3, which summarises current risk assessment and scenario requirements across key EU instruments and highlights the diversity of requirements. Requirements on the use of climate scenarios are often implicit (e.g. as part of a required risk assessment) or vague, giving examples of potential approaches. While it is important to allow the approach to be tailored to local contexts, this can contribute to an underestimation of climate risks and an incoherent approach across the EU.

Current practices in Europe largely focus on middle-of-the-road climate scenarios – neglecting low-probability and high impact scenarios – potentially resulting in insufficient adaptation or maladaptation (EEA, 2024a). For example, current scenarios used by financial institutions have been shown to be closer to the lower end of the plausible range of future risk (Baer et al., 2023). Similarly, the Advisory Board's (2024a) assessment of the Trans-European Energy Networks draft scenarios also found that these were built on outdated climate information and did not reflect the climate projections expected with high levels of confidence (Advisory Board, 2024a), while others have similarly found that current scenarios do not consider the impact of future extreme weather events on energy security of supply (CERRE, 2025). In the Commission's 6th report on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC), it noted that only five Member States explicitly state that they have used modelling studies to assess the impact of climate change on flood risk (EC, 2021b).

The lack of standardisation across EU legislation contributes to inconsistent approaches used for climate scenarios in risk assessments across sectors and companies. National and sectoral risk assessments apply differing methods, time horizons and assumptions about extremes, undermining comparability and aggregation across Member States, funds and sectors, which hampers EU-wide adaptation planning (ETC CA, 2023; EC, 2026a). EU financial legislation and supervision also increasingly requires that businesses and financial institutions carry out climate risk assessments or stress tests informed by climate scenarios (Agostini and Galasso, 2025). However as shown also in Table 3, these requirements differ in terms of the number of scenarios, sources, levels of warming and time horizons against which climate risks should be considered, with significant discretion to choose and develop their own scenarios. While flexibility in risk management approaches is important for financial institutions to tailor analysis to their own needs, a lack of harmonisation can undermine the consistency and comparability of results, particularly for ensuring a level playing field in financial supervision (Basel Committee, 2024; Agostini and Galasso, 2025).

There is an opportunity to establish common EU climate scenarios and a baseline level of warming to drive greater consistency, coherence and ambition in adaptation policy.

The Commission has proposed using the physical climate risks arising from the IPCC's intermediate emissions pathway (SSP2-4.5) as the lowest acceptable baseline for adaptation planning for EU policies, and to use more adverse emission pathways when stress testing and comparing adaptation options. Member States will also be advised to follow this approach, and private stakeholders expected to do likewise, with the aim of a coherent and prudent approach to managing climate risks and adaptation planning across the EU (EC, 2024e). The Commission also aims to provide common climate scenarios to support policymakers, businesses and citizens (EC and HR/VP, 2025b). In the context of climate adaptation – which requires anticipating the range of plausible climate risks, as well as multi-level and cross-sectoral governance – this offers a promising step forward.

Based on currently adopted and implemented policies continuing, median estimates show global warming is projected to reach 2.6ºC in 2100 above pre-industrial levels (UNEP, 2025d). The emissions pathway SSP2-4.5 is broadly consistent with this, with median global warming reaching an average of 2.7ºC over the period 2081-2100 above pre-industrial levels (IPCC, 2021). Adopting a common reference for adaptation efforts, based on the emissions pathway SSP2-4.5, would help ensure a coherent approach and common level of climate resilience, notably for transboundary risks within the EU.

However, within the same emissions pathway, there is still a range of likelihoods for future levels of warming. For example, under the IPCC's SSP2-4.5 emissions pathway, average global warming over the period 2081-2100 is very likely (i.e. 90% interval) to be in the range of 2.1-3.5ºC, relative to pre-industrial levels (IPCC, 2021). According to more recent projections based on current policies continuing, by UNEP, warming above 3.3 °C is still possible, with a 10% likelihood, and would come with larger climate and societal impacts, making it a high-risk outcome (UNEP, 2025d) (see Box 6). Determining a common reference requires not only identifying an appropriate emissions pathway but also agreeing on a threshold for the level of risk to prepare for and residual risk to accept across the EU, balancing adaptation investment needs against the residual risk of climate impacts society is willing to accept.

Box 6 IPCC's sixth assessment scenarios and probability levels

Projected global greenhouse gas emissions result in a range of possible warming outcomes along with associated likelihoods, supporting effective risk management that considers the most likely outcomes and low-probability, high-severity risks.

The emissions scenarios[8] in the IPCC's sixth assessment report (IPCC AR6) range from very low to very high emissions futures. The temperature estimates for these scenarios are probabilistic, meaning they account for uncertainty by using probability distributions for key variables, generating a range of possible warming outcomes and associated likelihoods. For example, central global warming estimates for the IPCC's lowest-emissions scenario exceed 1.5 °C, peaking no higher than 1.6 °C, before returning below 1.5 °C by 2100, referred to as an overshoot and achieved through net-negative emissions. Simultaneously, there is also a 10% chance of 2 °C of warming being exceeded under the scenarios of this most ambitious category (IPCC, 2023c). More recent UNEP scenarios based on current policies imply a 50%, 33% and 10% likelihood of global warming exceeding 2.6 °C, 2.8 °C and 3.3 °C respectively by 2100 (UNEP, 2025; see also Section 1.2).

While there are no universally agreed thresholds for what constitutes a 'high' probability in international risk assessment frameworks, some sectors provide useful benchmarks. In the health sector, an event with a 10% probability can be considered 'very common' (EC, 2009). In the defence sector, a 10% probability can be considered 'frequent', and, when combined with high severity, can be treated as 'high risk' (USA DoD, 2023). Effective risk management requires not only addressing risks corresponding to central and average estimates, but also preparing for low-probability, high-severity risks (IPCC, 2020). Higher levels of warming are associated with lower levels of probability but also with larger magnitudes of climate impacts and societal implications; therefore, they should be considered high risk (IPCC, 2022d).

8 Throughout this report, future evolutions of emissions are referred to as 'emissions pathways' while future evolutions of climatic and other conditions are referred to as 'climate scenarios'. In this box, however, the term 'emissions scenario' is kept because of its direct use in reports of the IPCC and UNEP.

Prudent risk management would require preparing for warming above the median estimate given the high severity of risks.

A precautionary approach would be to prepare for global warming evolutions that, based on current policies continuing, would be likely (i.e. greater than 66% likelihood) to very likely (i.e. greater than 90% likelihood) not exceeded over the course of this century. This would correspond to preparing for physical climate risks arising from a pathway to 2.8-3.3°C of global warming by 2100 (UNEP, 2025d).

Regarding warming in Europe, UNEP scenarios do not include regional estimates. However, historically Europe has warmed roughly twice as fast as the global average and is currently experiencing about 1 °C more warming regionally than the global average (see Section 1.2). Moreover, Copernicus has provided estimates of European warming based on IPCC medium-emissions scenario (SSP2-4.5) showing Europe mean warming reaching 3.9 °C by 2100, compared to 2.7 °C globally (see Section 1.2).

Forward-looking adaptation planning must be informed by a range of climate futures and therefore the choice of more adverse emissions pathways, to consider the robustness of adaptation options against and stress-test policies, is also key. SSP2-4.5 reflects an intermediate emissions pathway that may result in policies and measures being inadequate, particularly given remaining uncertainties and the risk of climate policy delay or reversal. Given remaining uncertainties and the risk of climate policy delay or reversal, a precautionary risk management approach also calls for the systematic consideration of more adverse emissions pathways, such as SSP3-7.0, particularly where decisions and policies are taken in the context of high climate risks, limited flexibility and long-time horizons.

The harmonisation of risk assessments including common climate scenarios would strengthen EU-wide adaptation planning, but the benefits must be balanced with the need to tailor them to local specificities.

Developing common climate scenarios and a common reference would help address the current gaps and ensure EU laws and policies are based on comparable assumptions. These common scenarios can provide a shared reference point for adaptation planning and monitoring, highlighting the risks driven by climate change now and in the future. This could also support other users (e.g. finance, private, subnational) where there is a need to streamline processes and ensure comparability, consistency and a level playing field, such as in financial supervision (Clapp and Sillmann, 2019; Hoehn et al., 2025; O'Neill et al., 2020; see also Section 8.2). Supporting the use of common climate scenarios and approaches across levels of government will be important given capacity barriers (see Chapter 9), including through support for downscaling the scenarios, capacity building, sufficient data granularity and local relevance.

However, prescribing a single European scenario would risk losing valuable national expertise and context-specific insights. Many countries have developed tailored approaches, using different methods for downscaling, uncertainty treatment and the integration of hazard and socioeconomic information. For example, the Netherlands uses IPCC AR6 data combined with high-resolution regional modelling to capture uncertainties along two axes: (i) global warming, based on IPCC emissions pathways (SSP1-2.6 to SSP5-8.5), and (ii) a wet–dry axis reflecting regional hydrological uncertainties (van Dorland et al., 2024). This approach is critical for Dutch geography and water management, and it informs 'delta scenarios' that combine climate projections with socioeconomic and spatial planning strategies.

Harmonisation must balance the benefits of standardisation with the need for meaningful differences where justified. A co-development approach bringing together European services such as Copernicus and national authorities could help achieve this balance, agreeing on common principles (e.g. a common minimum baseline; attention to seasonal changes, not just annual averages; explicit

treatment of extremes alongside mean changes; continuity between observed changes to date and projected future risks) and providing common scenarios to support countries that need it. These common scenarios can act as a basis for a more harmonised approach to climate risk assessments, based on common parameters such as time horizons, frequency of updates, sectors considered and minimum analytical requirements (e.g. consideration of physical hazards and socioeconomic vulnerabilities, along with transboundary, compounding and cascading risks). Such an approach would ensure EU and national adaptation planning is underpinned by a coherent approach to climate risk assessments while retaining the necessary flexibility required for local specificities.

5.3. Robust and dynamic decision-making for adaptation planning

Adaptation policy planning should be robust from the outset with opportunities to adjust course embedded in the policy cycle.

Adaptation plans need to be embedded within the institutional architecture that will implement them, including legal frameworks, budgets and governance arrangements. To ensure urgent action is not delayed by rigid or ill-prepared institutions, adaptation policymaking itself needs to be designed to be robust and dynamic (Capano and Woo, 2017).

A collective vision and targets guide adaptation planning to support both incremental and transformational progress across different policy horizons (see Chapter 4). Climate risk assessments are a crucial first step (as discussed in Section 5.2), after which decision-makers can identify feasible options and strategies to adapt, when they would have to be implemented by, and at what point they start to become ineffective and require alternative or transformational adaptation (Muccione et al., 2024). This allows for sequencing actions that can be implemented progressively, in response to how the future unfolds, and based on the development of knowledge and stakeholder preferences (Werners et al., 2021, p. 273).

Such an approach is only effective if there are mechanisms in place to allow for course correction (Hallegatte, 2009; Allison et al., 2024; Haasnoot et al., 2013). Policymaking therefore also needs to be adjustable, that is, to have the processes and capacity to change course over time in response to new information from different sources. Adaptation planning crucially depends on the availability and regular update of climate risk information and climate risk assessments to account for contextual changes and to inform policymaking (see Chapter 6).

The EU has established a planning and reporting cycle with embedded updates that in theory can support the dynamic approach needed for adaptation.

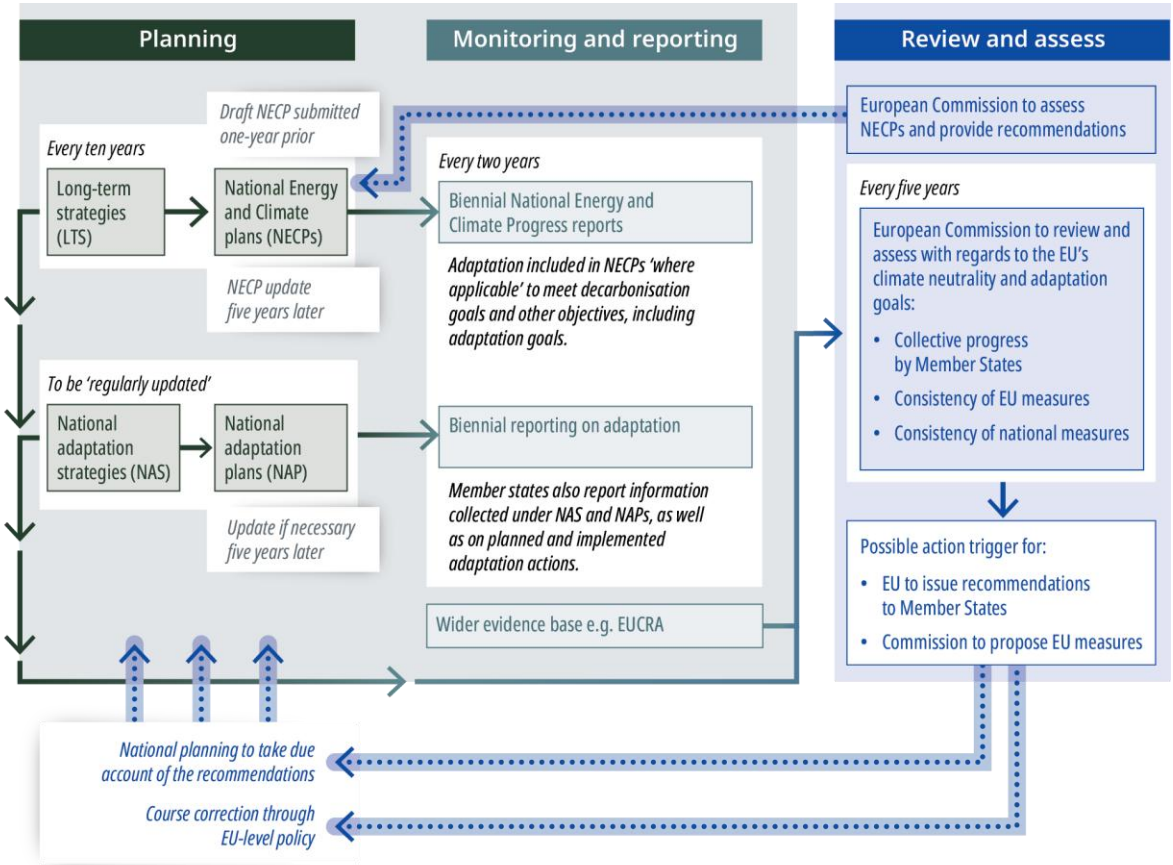
The EU has created a climate policy cycle under the Governance Regulation and the European Climate Law (Article 6.1(b)). This structured cycle enables the Commission to support adaptation planning, review progress to ensure consistency with EU climate goals and, where necessary, issue recommendations or take corrective measures. This cycle also provides the reporting and monitoring framework for assessing progress and compiling the EU nationally determined contribution under the UNFCCC.

Under the European Climate Law, and in line with Article 4 of the Paris Agreement, the EU set a long-term goal of continuous progress (see Chapter 4) and a requirement to adopt a strategy on climate change adaptation. Member States are required to adopt and implement NASs and NAPs, taking into consideration the EU strategy on adaptation, based on robust climate change and vulnerability analyses, progress assessments and indicators. Every five years, starting in 2023, the Commission is to

assess the collective progress made by all Member States on the adaptation and the consistency of EU measures with ensuring progress on adaptation (Article 5(4)).

The Governance Regulation supports this process through an integrated framework for planning, reporting and monitoring progress towards the EU's climate and energy objectives. It supports strategic climate planning by requiring Member States to prepare national energy and climate plans (NECPs), focused on achieving 2030 targets, and long-term strategies, and 2050 objectives. This is complemented by biennial progress reports to monitor progress every two years since 2021, in which Member States submit information on their NASs and NAPs, including objectives, implemented and planned measures, climate risk and vulnerability assessments, monitoring and evaluation systems and the use of climate services (Article 19).

Figure 13 The EU climate policy cycle established under the Governance Regulation and the European Climate Law



Notes: The figure provides a simplified overview of key steps in the climate policy cycle to show how Member States plan and report on adaptation, which is reviewed and assessed by the European Commission. For instance, annual reporting and the European Commission's technical review of implementation based on this is not shown.

In practice, the current approach has proved insufficient, hampered by the absence of EU adaptation targets and the fragmentation of the planning and reporting landscape.

This structured cycle of planning and reporting does not yet sufficiently support dynamic, robust and forward-looking adaptation. Unlike mitigation, adaptation reporting requirements under the Governance Regulation are inadequate, with the information submitted by the Member States remaining limited, largely descriptive and lacking quantitative data (ECA, 2024; EC, 2024k; EEA, 2025d). These challenges are reflected in the recent evaluation of the regulation, which highlights the need for

greater attention to adaptation in NECPs, as well as stronger governance of climate risks across sectors (EC, 2024m, 2024l).

This gap may be partly attributed to the lack of a harmonised approach to climate risk assessments (see also Section 5.2) as well as the lack of measurable adaptation targets with associated indicators (see Chapters 4 and 6) to guide climate adaptation planning and the assessment of progress. Studies also point to an increasingly complex governance landscape. For example, social and just transition aspects of adaptation may be addressed in Social Climate Plans and Just Transition Plans, while information relevant for funding is channelled through Recovery and Resilience Plans. In parallel, sector-specific information is submitted to the EU through separate instruments, such as the Common Agricultural Policy (CAP) Strategic Plans or Building Renovation Plans. A similar fragmentation has been observed on the reporting side (Ecologic, 2023).

The EU Climate Risk Assessment has helped identify adaptation priorities and inform EU planning but it is not subject to regular, legally anchored updates.

The call for stronger governance of climate risks across sectors highlighted in the evaluation of the Governance Regulation reflects EUCRA findings on the severity and urgency of climate risks, as well as the extent to which policies are in place to address them, helping to identify adaptation priorities for the EU (EEA, 2024a). In response to this, the Commission published a Communication setting out policy steps (EC, 2024e).

Regularly updating climate risk assessments at EU level, as part of a wider evidence base, would strengthen EU-wide planning and progress assessment, and ensure policies remain responsive to evolving risks. However, there is currently no obligation to update it. Anchoring a regular update of EUCRA in legislation, for instance aligned with the European Climate Law's five-year review, could further strengthen the existing policy cycle to enable course adjustments in EU policy. This would be in line with national efforts, as an increasing number of countries are embedding periodic updates of climate risk assessments into legislation, often linking them to revision cycles for national adaptation strategies, plans, and sectoral or regional frameworks (EEA, 2025d).

The upcoming legislative initiatives are an opportunity to ensure that integrated national policy planning and reporting enables robust and dynamic adaptation across the EU.

The upcoming European Integrated framework for climate resilience and the 2027 revision of the Governance Regulation offer an opportunity to set a clearer vision with operational targets and strengthen the adaptation component of NECPs. Combined with regular updates of EUCRA, this would strengthen the EU adaptation governance framework by including EU adaptation targets and a structured process to update climate knowledge and risk assessments to review progress and adjust course.

Learn and improve

Build a robust monitoring, evaluation and learning system, expand the knowledge base, ensure regular updates to reflect emerging risks and evidence and share it.

6. Learn and improve

Build a robust monitoring, evaluation and learning system, expand the knowledge base, ensure regular updates to reflect emerging risks and evidence and share it.

Adaptation requires strong MEL systems to cope with uncertainty, guide proactive decisions, track progress and adjust actions. A robust knowledge base integrates climate, environmental and socioeconomic information, including data about losses and damages, ecosystem resilience and sectoral impacts. In addition, adaptation monitoring and evaluation track processes and outcomes in implementation of the adaptation measures, identify successes and failures, and capture signs of maladaptation. With adequate indicators, the EU could measure progress in strengthening climate resilience and align progress with its targets. Accessible platforms are then needed to connect local, national and EU stakeholders and enable them to share lessons, learn from each other and ensure adaptation policies remain evidence-based, fair and adjusted to evolving risks and contexts.

While data collection and modelling efforts have progressed at the EU level, information relevant for making adaptation decisions remains fragmented and incomplete. Knowledge gaps persist in some sectors such as ecosystem resilience and the quantification of adaptation costs and benefits, including losses and damages. The monitoring and evaluation of adaptation focus more on processes than outcomes and impacts. No standardised EU indicators exist, and national reporting is heterogeneous in quantity, quality and timing, and sometimes disconnected from policy development. Platforms for sharing knowledge are not always updated, are underused locally and sometimes lack user-friendly data and products.

The EU should strengthen its adaptation knowledge base and better share it to ensure evidence-based climate action across all levels of governance. The EU needs to expand its knowledge base by continuously collecting climate, ecosystem and socioeconomic data, while better quantifying adaptation costs and benefits. There is an opportunity to strengthen monitoring of climate impacts to be used as an input to evaluate successes and failures; and to establish indicators to track progress at the national and EU levels together with sectoral dashboards linked to the EU adaptation targets. National reporting should be harmonised to ensure consistent tracking of efforts across the EU. Platforms such as Climate-ADAPT need to be regularly updated, streamlined and tailored to user needs, with greater awareness and accessibility for local stakeholders.

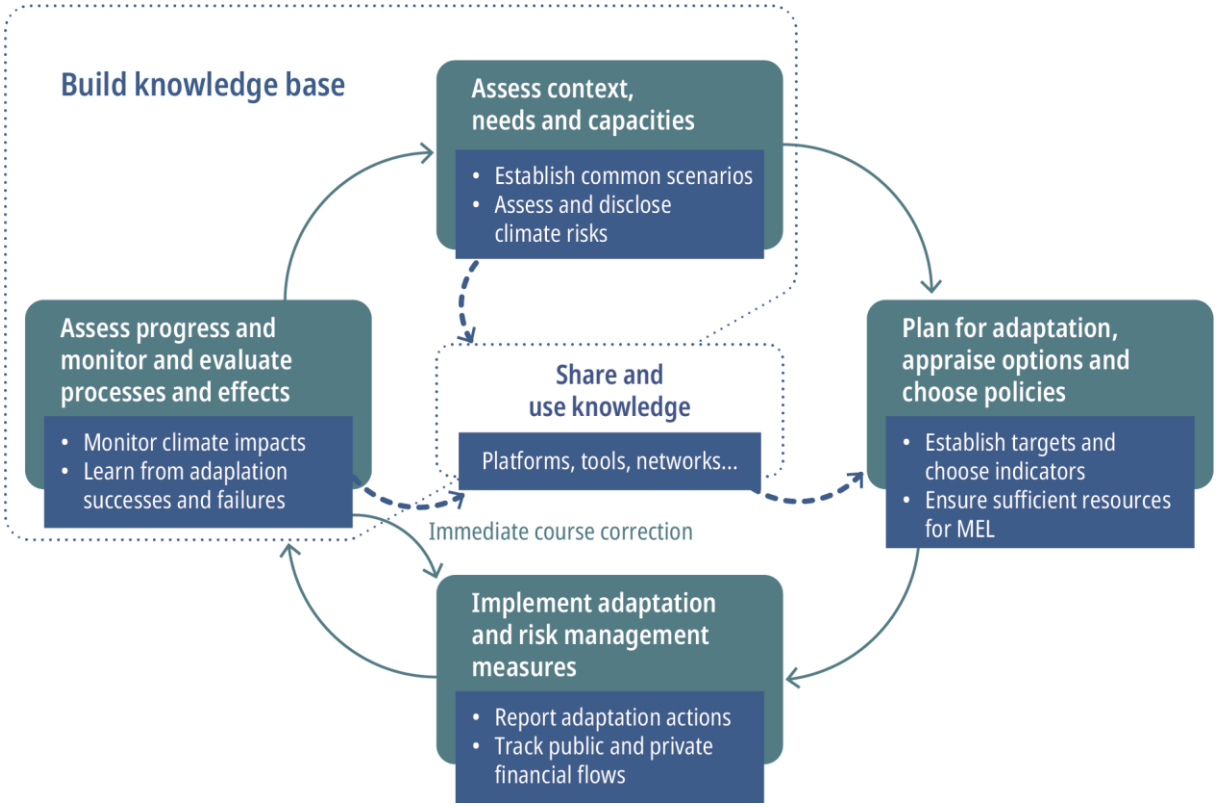
6.1. Why this guiding principle?

Efficient MEL systems are fundamental in deciding how to adapt and adjust policies to changing contexts and up-to-date evidence.

Monitoring, evaluation and learning is a fundamental step in the adaptation policy process for learning, accountability, policy progress and measure effectiveness across multiple levels (EEA, 2020). As adaptation needs to take place proactively and in spite of uncertainties (see Chapter 5), learning over time through a meaningful system that can track progress, identify challenges and feed into revisions of adaptation policies is essential to supporting an iterative process of policy improvement (ETC CA, 2024a; IPCC, 2022a). To be effective, such a learning system is fed by a solid knowledge base about current and future contexts built prior to making decisions, as well as by monitoring and evaluating adaptation policies during and after their implementation. In addition, this information needs to reach policymakers. Actions are therefore required in all the phases of the adaptation cycle to

support the MEL system (see Figure 14). In this context, establishing targets not only helps create a vision (see Chapter 4), but also enables checking if progress is on track while monitoring adaptation policies.

Figure 14 Learning system for iterative climate adaptation policies



Notes: In the green boxes, the adaptation cycle. In the blue boxes are examples of MEL actions that support MEL systems.

Source: Authors, adapted from (IPCC, 2022e, p. 2549; UNFCCC, 2023b, p. 5).

MEL systems exist and are necessary at different governance levels, including at the EU level.

A meaningful MEL system at the EU level helps to:

- create economies of scale by supporting international scientific cooperation and researching global and European trends and contexts that are relevant for all levels of governance;
- aggregate national and subnational information about hotspots for hazards, vulnerability and exposure;
- reduce territorial inequalities in the face of climate change by providing harmonised data and products to local stakeholders who do not have the capacity to collect and analyse data (see Chapter 7); and
- track overall adaptation progress in Europe, especially with regard to adapting to cascading, compounding and transboundary risks, to ensure the EU is becoming more climate resilient and reaching its adaptation targets (see Chapter 4).

6.2. Build the knowledge base for making adequate adaptation decisions based on current and future contexts

Providing contextual information before decisions are made enables policymakers to understand the present and get more information about potential, probable and possible futures.

Making adequate adaptation choices requires different types of evidence and knowledge, including about hazards, vulnerabilities, exposure, opportunities and societal preferences. Such a knowledge base feeds *ex ante* evaluations, notably impact assessments and climate consistency checks (as required under the better regulation guidelines), and stress testing, and it is needed to implement proactive measures and transformational adaptation (see Chapters 5 and 9). Information about the future also helps set and adjust vision, adaptation pathways and targets according to future needs (see Chapter 4).

Climate risk assessments must be carried out regularly across different spatial scales, for various sectors and levels of warming, and for both near-term and long-term time horizons (see Chapter 5 for detailed discussions on the status of and gaps in climate risk assessments within the EU). Those assessments require methodologically sound models, indicators and high-quality data (OECD, 2025c; NGFS, 2025), including data about biogeophysical trends (i.e. biological, geological and physical forces, such as weather and climate, and how these interact and influence one another) and about societal development (e.g. demographics, the economy, critical infrastructures and adaptive capacities) (UNEP, 2025a). Building this knowledge base therefore requires research in climatic, earth and ecological systems, with regard to both the monitoring of conditions and forward-looking modelling, which can give information about plausible futures and provide early signals of temperature exceedance or the crossing of tipping points. It also requires investigating socioeconomic trends that shape vulnerability and exposure. Monitoring vulnerability and exposure enables the identification of hotspots and priorities for action (see Chapter 7).

Analysing the costs and benefits of adaptation also supports the appraising of policy options.

Information about the expected costs of adaptation, or of not adapting, provides economic evidence supporting proactive actions and option appraisal. Various methods have been used to quantify investment needs that are more or less restrictive in terms of scope, such as cost–benefit analysis, multicriteria analysis, life-cycle cost analysis and total economic value analysis (Allison et al., 2024; Felicioni et al., 2025; Loomis et al., 2000), although some of these traditional approaches pose shortcomings in capturing the uncertainties and temporal scales of adaptation where the costs are immediate and easier to account but the benefits are not (Dittrich et al., 2016). Other decision-making approaches focus on prioritising robust options (see Chapter 5). For example, portfolio analysis is based on the principle of diversifying to spread risk; real option analysis formalises adjustments over time in response to new information. Choosing appropriate methodologies for estimating the potential costs and benefits of adaptation at the EU level is critical for adaptation planning (Chapter 5), which relies on having up-to-date and accurate input data. To be able to make fair decisions (see Chapter 7), not only is an overview at the EU level needed, but so is information on how the costs and benefits are shared among different places and stakeholders.

Despite efforts in data collection and modelling, gaps remain in the European knowledge base.

The EU has made significant progress in developing its monitoring and modelling capabilities of climate and earth trends. It supports research initiatives that bring input to decision-makers through,

for instance, the Horizon Europe research funding programme (Rayner, 2023). The European Earth observation programme, Copernicus, provides detailed data on the planet and environment and a yearly report on the European state of the climate, which is published jointly with the World Meteorological Organization (C3S and WMO, 2025). Earth observations through satellite-derived indicators provide input supporting the entire adaptation process, such as information on hazards, vulnerability and exposure for impacts and risk assessments, the identification of places for planning responses, the monitoring of implementation and the impacts of adaptation action (Connors et al., 2025). Destination Earth is another EU-level initiative that develops a highly accurate digital model of the Earth to model, monitor and even simulate hazards and activities. Other types of EU studies are also relevant for the knowledge base, such as the Eurobarometer, which provides information on the general expectations and preferences of EU citizens.

However, knowledge gaps persist in key areas, such as the following.

- Some **sector-specific data are lacking**. For example, major data gaps in the LULUCF sector were one of the drivers of the EU's recent Soil Monitoring Law (Directive (EU) 2025/2360), as well as the proposed Forest Monitoring Law. These aim to provide the EU with comparable national data on soil and forest dynamics, which would enable both mitigation (e.g., improved management of soil and forest sinks) and adaptation (e.g., prevention and early action forest resilience). While the Soil Monitoring Law entered into force at the end of 2025, the Forest Monitoring Law proposal was rejected in the legislative process in autumn 2025 (EC, 2025w).
- **Robust information about the expected costs and benefits of adaptation is limited and generally not sufficiently quantified** (EEA, 2026, 2025d; EC, 2026a), while other methodologies for selecting robust options are not regularly used. A recent European Commission study provided one of the most comprehensive estimates of required adaptation investments in the EU to date, based on a bottom-up analysis of adaptation needs and costs from the literature and from assessments published by Member States. However, this also highlighted significant uncertainties in estimates, and persistent challenges in the availability and reliability of adaptation cost data due to gaps and inconsistencies in how costs are estimated and reported between Member States (EC, 2026a).

6.3. Learn from the successes and failures of ongoing and past adaptation and monitor progress to improve policies over time

Adaptation monitoring and evaluation investigating both processes and effects (outcomes and impacts) enable learning from experience that can support effective measures and fair adaptation.

Both the Paris Agreement and the Sendai Framework highlight the need for an institutionalised and efficient MEL system for adaptation, and the EU adaptation strategy calls for its establishment (EC, 2021c). The better regulation guidelines and toolbox have structured the monitoring and evaluation of EU policies to inform policymakers about their effectiveness, efficiency and whether they continue to be fit for purpose (EC, 2023b). In particular, *ex post* policy evaluation mostly takes place at the end of the policy cycle to inform the next policies based on experience. Both monitoring and *ex post* policy evaluation are normative exercises involving a value judgment (Lemire et al., 2020); therefore, those who are involved in the process and those for whom it is being carried out have consequences on the findings (Biesbroek et al., 2025a; EEA, 2020). For example, extending the evaluation of the impacts beyond outcomes on targeted beneficiaries to identify signs of maladaptation is essential to supporting fair adaptation (Moure et al., 2026; Owen, 2021; UNFCCC, 2023; see Chapter 7).

Some challenges to adaptation monitoring and evaluation exist because of the complexity of adaptation, yet simple investigations can provide initial learnings.

Adaptation monitoring and evaluation globally and in Europe have so far focused on processes and outputs rather than on measuring outcomes and impacts, although both types of measurements are needed to assess the effectiveness of implemented measures (Berrang-Ford et al., 2021; EEA, 2025d; UNEP, 2025a). This situation reflects the conceptual, methodological, political and empirical challenges that arise when assessing adaptation (Biesbroek et al., 2025a; Moure et al., 2026; UNFCCC, 2023b), given the complex settings in terms of scale and scope that extend across sectoral boundaries, levels of intervention and time frames (Bours et al., 2015). It is notably complicated to attribute overall resilience to a specific policy (Dinshaw, 2014) and to capture impacts that take time to appear or are not linear (De Goër De Herve, 2024; EEA, 2020).

Yet, toolkits are being established to help evaluate adaptation, such as the one developed for the Adaptation Fund (Adaptation Fund, 2025). In addition, some aspects of adaptation monitoring and evaluation can be investigated in spite of this complexity. For instance, disasters provide a window of opportunity for conducting rapid investigations to understand why such an event was not anticipated and proactively prepared for, and how to prevent it from happening again (see the monitoring of climate impacts below). The development of concrete, measurable indicators following the adoption of timebound, legal targets (see Chapter 4) is also expected to facilitate monitoring and evaluation of adaptation efforts not only for wider progress tracking purposes, but also to assess the effectiveness of the implemented measures in ways that reduce project burden and make results comparable across Europe, even if context-tailoring is still advised.

Evaluating the effects of adaptation requires capturing a broad range of benefits.

In addition to the direct reduction of risk, several broader aspects need to be captured to give a broad picture of the effects of adaptation. Notably, adaptation brings co-benefits to the environmental and social objectives of sustainable development (Reckien et al., 2023; see Chapter 4) and contributes to economic competitiveness via investment and productivity (Brandon et al., 2025). Adaptation is also essential for the success of net greenhouse gas emission reduction, not least because of the effects of climate hazards on land carbon sinks and energy systems, which can severely undermine the EU's progress towards its mitigation goals; therefore, any avoided greenhouse gas emissions are also an indication of benefits of adaptation (EEA, 2023; UNFCCC, 2019). Moreover, identifying the missed opportunities, for instance using the window of opportunity after a disaster (see Section 7.3), and monitoring data on losses and damages provide relevant information concerning the limits to current adaptation policies and are ways to identify adaptation failures that need to be addressed in the iterative process.

Monitoring climate impacts identifies adaptation failures and helps set priorities for improvement, yet data on losses and damages are fragmented in the EU.

The impacts of climate change over time provide information regarding the successes and weaknesses of current adaptation policies and measures, as well as providing insights on the cost of inaction in areas lacking clear policy coverage. This is particularly the case with losses and damages data that group together several economic and non-economic aspects (UNFCCC, 2024b). Information about past and current losses and damages linked to climate change gives an indication of adaptation and insurance needs and identifies sectors and areas that lack effective adaptation and mitigation policies (Mechler et al., 2019). The French High Council on Climate, for instance, suggests monitoring climate change impacts in key sectors (health, food and agriculture, infrastructure and settlements, water, and ecosystem and biodiversity (HCC, 2025). Tracking losses and damages in a comprehensive and

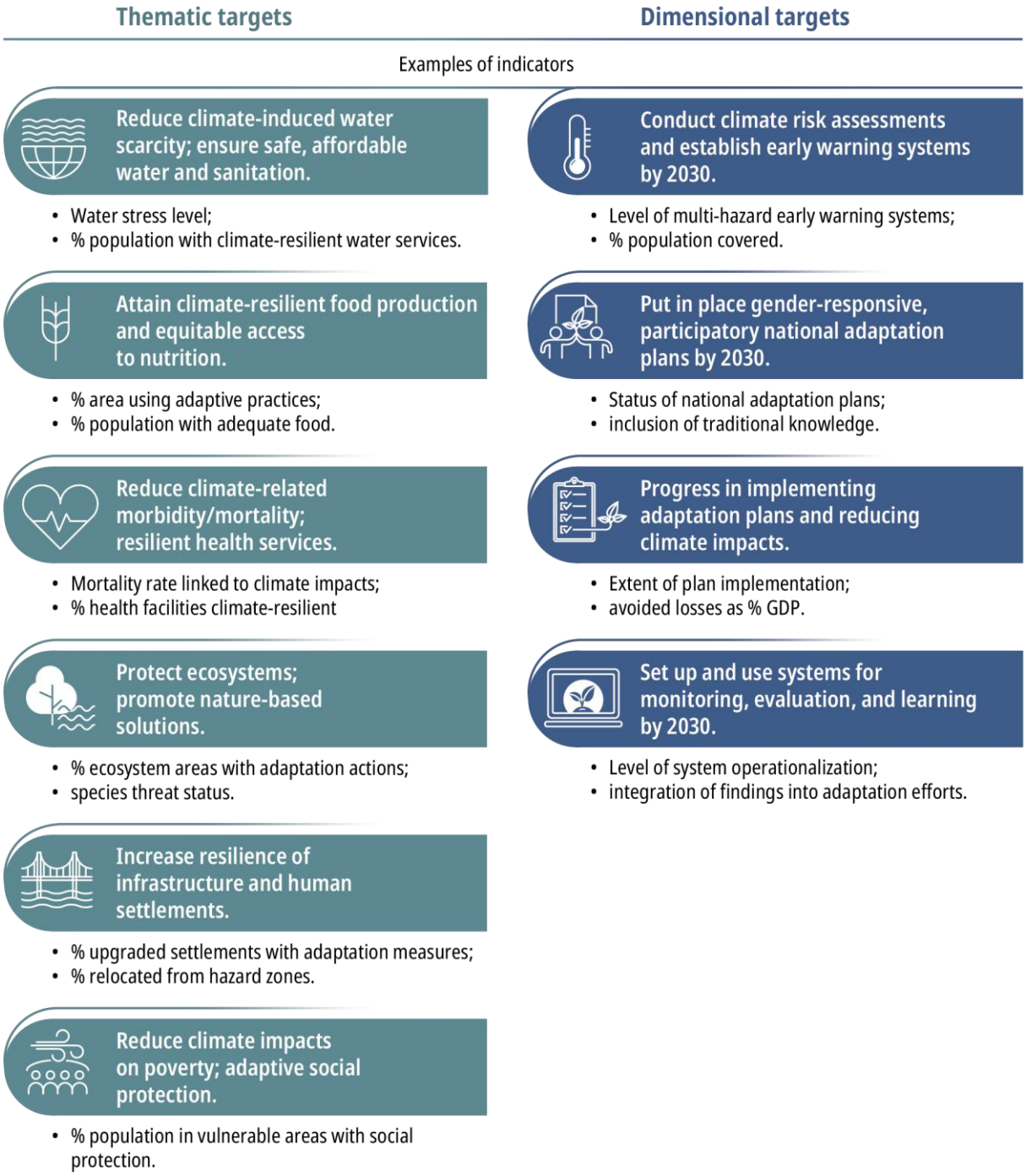
harmonised way, with input from both the private and public sectors (EC, 2021c), enables the exploration of trends, which in turn helps investigate drivers of change and provides the basis for discussions about risk ownership (James et al., 2019; see Section 8.3). Losses and damages data also support the retrospective attribution of an extreme event and its impacts on climate change. This is a first step towards investigating how much adaptation efforts have influenced that amount. Some monitoring of climate-related losses and damages has started to take place in the EU (see, for example, EEA, 2025a); yet, currently, such data are limited and fragmented (EC, 2024i).

Monitoring and evaluating adaptation can enable tracking progress towards climate resilience; however, there are currently no harmonised relevant indicators at the EU level.

The monitoring and evaluation of adaptation are also necessary for assessing progress. In particular, monitoring takes place during the implementation of policies contributing to adaptation, to keep track of progress and be able to adjust course in a timely manner. Such an endeavour requires good knowledge of the needs (see Section 6.2) and indicators associated with the adaptation targets (Arnott et al., 2016); see Section 4.2. It is challenging to develop adaptation indicators because they need to capture contextual specificities, are influenced by values, and need to balance ambition with feasibility in operationalisation (Bours et al., 2015; OECD and IEA, 2025; Williams et al., 2024). In contrast to mitigation, there is no universal metric for adaptation (IPCC, 2022e). Yet, indicators selected carefully enable connections between different levels of governance and various sectors (EEA, 2020).

In spite of the need, there is currently no harmonised list or dashboard of indicators specifically for tracking adaptation progress in the EU (EC, 2024k; EEA, 2025d; ETC CA, 2024a). Global sets of indicators help with a selection of indicators for the EU. For instance, 59 indicators were selected during the 2025 UN Climate Change Conference (COP30) underpinning the 11 targets of the global goal on adaptation (UNFCCC, 2025a; see Chapter 4 and examples in Figure 15). Yet, many others can inform progress as the expert-informed proposal shows (UNFCCC, 2025b), and flexibility for the parties to further disaggregate the indicators to match their specific contexts and needs is key (for instance, food and agriculture target indicators to be disaggregated by crops, livestock, fisheries and agroforestry). To support further efforts on indicators, the IPCC is updating its technical guidelines for assessing climate change impacts and adaptation, including indicators, metrics and methodologies, which is expected to be published as part of the seventh assessment report in 2027.

Figure 15 Targets and examples of indicators agreed under the global goal on adaptation



Source: Based on Decision 2/CMA.7 of the UNFCCC (2025).

Without EU-tailored adaptation indicators, European progress towards climate resilience is currently indirectly informed by investigations related to social policies under the European semester and the Social Scoreboard, the implementation of the SDGs and the assessment of vulnerability. However, the current datasets focus more on adaptation needs and capacities than on adaptation progress, outcomes and policy impacts (Biesbroek et al., 2025a; EEA, 2020). In addition, there are considerable gaps in relevant datasets, notably in terms of the diversity of themes covered, and in terms of the reliability and validity of the data (Dupuits et al., 2024; OECD and IEA, 2025).

Even if disconnected from each other, several information sources contribute to the monitoring and evaluation of adaptation policies at the EU level.

Academic research and assessments conducted by EU institutions such as the Court of Auditors and the Commission provide information on the progress and outcomes of adaptation policies and practices at the EU level (ECA, 2024; EC, 2025h). The progress of the EU towards a more resilient society is to some extent monitored through general assessments and assessments of the implementation of specific EU policies (e.g. European civil protection operations and EU climate policies), and through evaluations of EU policy instruments for adaptation (e.g. the Solidarity Fund; adaptation instruments for EU coastal areas). In addition, scientific studies on the effectiveness of some sectoral policies and measures are conducted (e.g. nature-based solutions for water management in Europe; wildfire risk management in the EU; drought risk management within the EU), and relevant activities funded by the EU are monitored (e.g. projects implemented under the mission on adaptation; weADAPT platform) (Bilgram et al., 2025; Rodríguez-Rojo et al., 2025; Santos, 2025).

The national reporting on adaptation is inconsistent in terms of quantity, quality and timing, rendering an EU-level overview of Member States' efforts challenging.

Tracking the progress of adaptation requires gathering information from multiple scales and combining it (Leiter, 2015; OECD and IEA, 2025), so national reporting is essential for learning at the European level and to review adaptation planning (see Chapter 5.3). The European Environment Agency provides periodic European-wide assessments of national-level progress on adaptation (Biesbroek and Swart, 2019); however, the input from the national reporting is heterogenous, notably because national MEL systems for adaptation are still being developed and operationalised and no Member States have so far set clear and measurable targets for adaptation in their national climate laws (EEA, 2025d). Yet, some countries assess their adaptation efforts through their NAPs or NASs (such as Germany, see Box 7), and that work provides a basis that can be used for national reporting purposes.

It is difficult for the EU to find the balance between requiring details and lightening administrative burdens (EEA, 2020), and Member States are currently required to report progress through two main avenues, one related to the NECPs and one related to the NASs and NAPs (see Section 5.3). However, the adaptation-relevant information under the NECPs presents gaps and inconsistencies in scope and quality (EC, 2024k). Input on the effectiveness of adaptation measures and long-term impacts is notably lacking, with reported information usually focusing on climate risks, impacts and adaptation priorities (Advisory Board, 2025b; UNEP, 2025a). The reporting process under the NASs and NAPs also suffers from challenges due to inconsistent subnational input (ETC CA, 2024a) and the misalignment of revision cycles. Not all countries have established a legal mandate for the periodic revision of NASs and NAPs, and even when such mandates exist, they vary from one Member State to the other, with an average of five years (ETC CA, 2024a). Therefore, the learning timelines are not consistent between countries, making it more complicated to assess progress at the EU level. Furthermore, there is significant variability in Member States' reporting of adaptation needs and costs in their NAPs, with a lack of consistency challenging efforts to assess investment needs at the EU level (EC, 2026a). Overall, this means that national reporting efforts are insufficient and currently add little value in terms of supporting future EU policy decisions (ECA, 2024).

Box 7 Adaptation progress tracking in Germany

Several instruments enable the assessment of the German national adaptation strategy, including the following.

- The 2024 **national adaptation strategy** sets 33 targets and 45 sub-targets, with most of them to be met in 2030 and some in 2050, grouped into seven clusters: infrastructure; land and land use; human health and care provision; urban development, spatial planning and civil protection; water; businesses; and cross-cluster issues (BMUKN, 2024; see also Chapter 4).
- **Progress reports** support the regular update of the strategy that takes place every four years (German Federal Ministry for the Environment, 2020). This update is required by the Federal Climate Adaptation Act.
- **Monitoring reports** are published regularly. The latter one is based on more than 100 indicators tracking both the effects of climate change (impacts) and adaptations actions (responses) across various sectors such as health, water, land, infrastructure and economy.
- A report published in 2025 (German Environment Agency, 2025a) also investigates **how to improve the national climate adaptation strategy**. Its key recommendations are to improve stakeholder involvement and participation, and to enhance the use of an integrative policy design approach across policy levels.

6.4. Provide access to knowledge and the opportunities to share it

Making the contextual knowledge base and lessons learned from monitoring and evaluation accessible to stakeholders is essential to ensuring learnings are integrated into the policy cycle.

Knowledge management practices have to align with user needs (Bharwani et al., 2025) to ensure learnings inform the establishment and adjustment of adaptation policies over time. Access to and use of knowledge are facilitated by platforms displaying data, lessons learned and guidelines, tools that aid decision-making based on evidence, and networks enabling the sharing of experience. At the same time, those platforms, tools and networks support economies of scale in knowledge production by avoiding unnecessary duplications and increasing knowledge diversity, which accelerates the implementation of adaptation (André et al., 2017; Witinok-Huber et al., 2025). Accessibility to knowledge is dependent on open and free environments, the format of the information and the possibility to combine different data and sources (Bruno Soares and Buontempo, 2019). To that end, the standardisation of climate services improves access, the understanding of relevant information, and collaboration (Doblas-Reyes et al., 2024). The European Climate Law also encourages the establishment of institutions connecting science and policy, such as climate advisory bodies. In addition, the granularity of data should fit the needs of policymakers.

The EU offers valuable platforms and networks for sharing knowledge, but more visibility for uptake and active upkeep are needed to ensure decision-makers actually use them.

The EU supports knowledge sharing through several platforms and tools such as the Copernicus Climate Change Service, the Risk Data Hub, Climate-ADAPT, the vulnerability sourcebook, the European Climate Data Explorer and the Adaptation Dashboard (MIP4Adapt, 2023). The rise of AI and digitalisation provides opportunities to develop additional tools, such as Destination Earth (DestinE). In

addition to platforms for accessing knowledge, Member States exchange experience and lessons learned by collaborating on thematic working groups and networks such as the EU Civil Protection Knowledge Network, which supports knowledge sharing and training in prevention, preparedness and response to disasters. Several networks also enable others to share knowledge beyond Member States, including stakeholder networks, research institutes and partnerships (Biesbroek and Swart, 2019) such as the Covenant of Mayors for Climate and Energy and the network Urbact, which facilitates the sharing of knowledge and good practices among cities and other levels of government and integrates the thematic of green cities in its 2021–2029 work programme.

In general, EU platforms for sharing knowledge are transparent and aid in the communication of complex information and in education (Curley et al., 2025). However, consolidation of the multiple platforms and further coordination between them could facilitate access to and uptake of knowledge by decision-makers. So far municipalities demonstrate limited awareness about the EU adaptation strategy and underutilise EU platforms, such as Climate-ADAPT and Copernicus, and networks such as the EU Covenant of Mayors (ECA, 2024). In addition, it is unclear how EU platforms contribute to local and national planning. Another limitation is that EU platforms are underperforming in terms of active maintenance, security and accessibility (Curley et al., 2025). National policymakers also report difficulties in interpreting available data and in the limited practice-oriented and user-friendly tools to help them make decisions (EEA, 2025d).

Promote just and fair resilience

Address unequal climate impacts and burdens of adaptation while supporting locally-led adaptation with inclusive processes.

7. Promote just and fair resilience

Address unequal climate impacts and burdens of adaptation while supporting locally-led adaptation with inclusive processes.

A fair approach to climate adaptation ensures that uneven vulnerabilities are addressed through targeted support, solidarity, cross-border coordination and inclusive decision-making. Enhancing fairness in adaptation choices supports the EU's societal goals and values by upholding human rights and strengthening cohesion while building resilience. Since climate impacts and risks are spread unevenly across populations and regions, targeted support is key for reducing inequalities. This includes addressing the root causes of vulnerability through redistributive policies and supporting Member States overwhelmed by extreme events, in line with the EU solidarity principle. Just resilience also demands cross-border coordination to prevent the unintended transfer of risks and to ensure burdens are fairly shared among people, places and generations. Decision-making processes need to recognise heterogeneous vulnerabilities and adaptive capacities, along with involving stakeholders in meaningful participation that supports locally-led adaptation.

Just and fair resilience in the EU requires proactive action, coordination across space and time, and inclusiveness, as current mechanisms can prove insufficient. Fair adaptation covers a wide spectrum of actions that bring adaptation and social policies closely together, especially through EU cohesion policy, to address the root causes of vulnerability and to build capacities. However, relevant funding and social and sectoral policies often lack explicit and transparent considerations for just resilience, with the danger that support does not always reach those most in need. Mechanisms to support Member States harmed by acute events, such as the Union Civil Protection Mechanism and Solidarity Fund, are also in place, yet they are under financial pressure, and incentives for proactive measures and building back better are limited. Cross-border coordination of the sharing of benefits and burdens in a fair way remains difficult, even though several local and regional initiatives to address this challenge are emerging. Intergenerational fairness is present on the EU agenda but currently lacks clear-cut responsibilities in EU decision-making. Finally, limits to participation, inclusiveness and transparency in climate governance across administrative levels can undermine the EU's capacity to deliver just and fair resilience.

The EU's adaptation policy framework needs fairness checks, targeted funding and crisis tools linked to proactive adaptation to better support vulnerable groups and strengthen long-term resilience. Embedding just and fair resilience as a guiding principle in its adaptation framework could help ensure that policies and measure reduce root causes of climate vulnerabilities and support the most vulnerable people and most exposed regions. This requires fairness assessment to underpin the relevant decision-making, connected with the EU principles of 'do no significant harm' and climate resilience by design, supported by clear definitions, indicators and participatory processes that reflect local needs and capacities and intergenerational fairness. To be effective, the fairness assessment needs to connect the assessed policy and measures with funding to address regressive impacts, regional hotspots and capacity building. In addition, EU crisis mechanisms can be improved by linking emergency support to proactive adaptation by requiring preventive measures and obligations to build back better. Aligning these tools with insurance policies would strengthen solidarity, resilience, and long-term sustainability.

7.1. Why this guiding principle?

Ensuring adaptation is fair is necessary for strengthening societal resilience and upholding EU's values and principles.

Climate change threatens human rights (see Chapter 3) that are guaranteed by the TEU and the EU Charter of Fundamental Rights. At the same time, while some benefit from adaptation, others do not or are even disadvantaged as the result of adaptation measures (Mikkaelsson and Lager, 2024; Zahnow et al., 2025). Therefore, implementing adaptation in a fair way that leaves no one behind supports access to basic needs, basic rights and decision-making for everyone (Grecksch and Klöck, 2020) by, for instance, making sure critical infrastructure is resilient enough to provide basic services when climate hazards strike and by closing the climate insurance protection gap (see Chapter 8). The recent advisory opinion of the International Court of Justice on climate change (ICJ, 2025) illustrates the close link between climate policies and human rights, including the right to a clean, healthy and sustainable environment (Eckes, 2024). In EU law, such as in the updated Aarhus convention and the EU Charter of Fundamental Rights, fundamental rights also include the value of democracy and deliberation. Climate change is also threatening the EU security objectives, for example by disturbing supply chains and reinforcing societal unrest (EPRS, 2022). In the face of such threats, deliberately considering fairness when adapting to climate change is about building resilience for all to ensure inequalities do not increase and no significant harm is done.

Just resilience is promoted by EU policy to address the multiple facets of fairness in adaptation policies.

Taking fairness into consideration in order to align with EU goals and values means conducting the climate transition in a way that is socially just, inclusive and supportive, where no person or place is left behind and where the costs and benefits of climate action are shared and managed in a way such that vulnerable or exposed groups are helped and not unfairly burdened (Paavola and Adger, 2006). With climate change mitigation, this can be seen through dedicated EU funds (e.g. Just Transition Fund) and a focus on vulnerable groups. For adaptation, policymakers employ the term just resilience to operationalise fairness, as a counterpart of the just transition for mitigation (Lager et al., 2023). The European Commission defines just resilience as follows:

> 'Just resilience is a concept to help address the uneven impacts of climate change and ensure that vulnerable individuals or social groups benefit fairly from adaptation responses and are not disproportionately burdened, including tackling systemic inequalities, ensuring fair access to resources and decision-making and ensuring recognition of diverse perspectives and values' (EC, 2025c, p. 134).

This definition involves multiple interconnected and overlapping dimensions that are relevant for both the just transition and just resilience, such as distributive, procedural, recognitional, corrective, restorative, retributive, compensatory, intergenerational and transitional justice (Cañizares et al., 2024; Juhola et al., 2022; Zimm et al., 2024). Just resilience is an enabling and fundamental condition for climate-resilient development and adaptation (IPCC, 2022f; Klinsky et al., 2017), and it supports transformational adaptation by addressing entrenched systemic vulnerabilities (Fisher et al., 2025; UNFCCC, 2025a). Fairness is a way to ensure better civil society support for adaptation implementation, and the perception of fairness influences the extent to which stakeholders are willing to take complementary measures (De Goër De Herve, 2022; EC, 2025v).

7.2. Reducing inequalities by supporting the people and areas most in need

Various parts of the EU are differently exposed and vulnerable to climate hazards, and they also vary in how well they can adapt and take advantage of any new opportunities climate change may create. This heterogeneity stems from and results in inequalities between people and areas, which can be exacerbated by climate change through negative feedback loops (IPCC, 2022b; Song et al., 2024) and as a result of climate measures (Araos et al., 2021). Fair adaptation contributes to reducing current and future inequalities and therefore helps the EU deliver on its long-term societal goals and fundamental values such as promoting solidarity (Article 2 TEU) and ensuring sustainable development (Article 3 TEU).

Addressing the root causes of vulnerability and supporting the capacity building of those most exposed and vulnerable

Adaptation needs to address the root causes of vulnerability to reinforce the capacity building of the people most in need and ensure climate change does not exacerbate societal inequalities and that no one is left behind.

Vulnerability to climate change is determined by socioeconomic factors, such as income, social networks, gender, health and age group (Sibilia et al., 2024; Turesson et al., 2024), which make some communities and individuals more vulnerable and less able to adapt to climate hazards than others. Vulnerable groups face higher negative impacts from these hazards, which will likely further exacerbate existing inequalities and their vulnerability in a vicious circle. Addressing the root causes of vulnerabilities is therefore a way to build capacities in the face of climate risks and reduce inequalities and losses and damages, as well as generating synergies (Jessen et al., 2025). Addressing entrenched vulnerability drivers in current systems requires transformational adaptation approaches (Fedele et al., 2019) that incremental measures cannot overcome, including through distributive measures. Therefore, fair adaptation policies go hand in hand with social policies (Advisory Board, 2024b).

The EU plays an important role in considering the most vulnerable populations in adaptation-related initiatives through the cohesion policy.

To implement just resilience, vulnerable groups are in particular targeted in EU policies (EEA, 2025f). For example, Article 5 of the European Climate Law explicitly supports a fair and just transition, requiring that EU measures focus on vulnerable populations, and refers to the need to engage with all parts of society and to the need for the Member States to prepare vulnerability assessments. The EU adaptation strategy aims at 'achieving resilience in a just and fair way' to ensure that the benefits of climate adaptation are widely and equitably shared, with a focus on the most vulnerable both within and outside the. The preparedness Union strategy (EC and HR/VP, 2025b), the communication on managing climate risks (EC, 2024e), and the Union disaster resilience goals (EC, 2025e) similarly highlight the need to focus on vulnerable groups in particular to address the root causes of vulnerability and increase resilience, as some sectoral initiatives do, such as the EU water resilience strategy. A range of existing and announced EU social policies also target various root causes of vulnerability, such as poverty, as poverty or a lack of accessibility to energy or to affordable housing.

The EU cohesion policy is the main redistributive policy that addresses economic, social and regional disparities across the EU, contributing to the EU's societal goals, such as sustainable development, well-being, poverty eradication and gender equality. With a EUR 392 billion budget for 2021–2027, representing around one third of the MFF, the cohesion policy is key for reducing vulnerability (EC, 2024e; EP, 2024). It comprises diversified instruments encompassing funding programmes, information

and knowledge platforms, legislation and regulatory frameworks, strategies, plans, and guidelines, initiatives and networks, skills and education programmes, research and innovation, specialised agencies and bodies and emergency response mechanisms. In the 2021–2027 period, EUR 118 billion of the cohesion policy funds are planned to be spent on climate adaptation and mitigation, although only EUR 17 billion in total is for projects directly tagged as adaptation, representing around 3 % of the total allocations for the period (EP, 2024; see Section 9.3).

Even when EU sectoral and social policies address the root causes of vulnerability, they rarely explicitly tag it as just resilience, which can lead to limited implementation and monitoring.

Just and fair resilience is not monitored at the EU level due to a lack of dedicated mandates, common definitions, or established indicators to do so (EEA, 2025d; German Environment Agency, 2025b; Lager et al., 2023; see Chapter 6). While some EU initiatives address vulnerability concerns through the cohesion policy and sectoral policies, the EU climate and social policies are not yet sufficiently integrated as to fully implement just and fair resilience (Advisory Board, 2024b; EEA, 2024a). In addition, issues of justice are still often not explicitly identified as such. This is evident in sectoral policies such as the Floods Directive and the Water Framework Directive, which address many distributive and procedural concerns, without explicitly labelling them in terms of justice or fairness (De Goër De Herve et al., 2025). The lack of an explicit consideration of justice and fairness can lead to limited participation or inclusivity in the underlying processes, and to the risk of not generating the relevant facts and figures to make decisions promoting just and fair resilience (Kaufmann et al., 2018).

There is no dedicated fund for just and fair resilience, and current funding instruments may not always reach the communities most vulnerable to climate change.

The broad range of policies that can address the root causes of vulnerability without being labelled as just resilience can explain why no dedicated EU funding mechanisms have specifically been established for just resilience, while in the context of climate mitigation, the Social Climate Fund and the Just Transition Fund have explicitly sought to promote fairness in the transition to climate neutrality. The boundaries of a specific just resilience fund can be difficult to establish given that social and sectoral policies cover large areas that can be seen as contributing to addressing the root causes of vulnerability. Even so, enabling access to funding is needed to strengthen just resilience at the EU level (EEA, 2025f) because the most vulnerable often lack the capacity to navigate funding application processes, and therefore the current funding landscape for adaptation may inadvertently fail to prioritise the most vulnerable populations and regions (Bachtler et al., 2024; Venner et al., 2025a, 2025b; see Chapter 9).

For instance, southern European local urban administrations report more extreme funding shortages for adaptation than northern European ones do (Venner et al., 2025b), while being, in general, more exposed and vulnerable to climate hazards (EEA, 2024a). Specifically for EU funding, one study shows that its competitive access and award criteria often favour municipalities with already existing capacities (administrative capacity, committed leadership, established networks and proven track records), and that are already performing in terms of adaptation, which can reduce funding opportunities for others that might be most in need of support and increase inequalities in adaptation progress among cities (Venner et al., 2025a). Such phenomena can result in limited support to those most in need of strengthening capacity building (see also Section 9.3).

Supporting hotspot regions to avoid increasing territorial inequalities

Given the uneven climate risks and adaptive capacities across EU regions, solidarity and fair support are essential to preventing territorial divides and ensuring no place is left behind.

In addition to unequal vulnerabilities, the frequency of and exposure to climate hazards are spread unevenly across geographical areas (see Section 1.3). EUCRA identifies hotspot regions, such as southern Europe for heat and drought, low-lying coastal regions for flooding, erosion and salt-water intrusion, and the EU's outermost regions, which are often highly exposed and vulnerable to various climate-related hazards (EEA, 2024a). Member States have different levels of both: (i) readiness and capabilities to adapt to and manage climate hazards (Biella et al., 2025; ETC CA, 2024a), and (ii) access to funding (Venner et al., 2025b). The Member States most at risk are among those with the least fiscal space to invest in adaptation, which can lead to aggravating national and regional disparities within the EU (EEA, 2024a).

Similarly, Member States have different levels of preparedness to face acute climate events, which may overwhelm national capacities and require immediate and decisive interventions to avoid substantial losses and damages (Lenaerts et al., 2022). When such events strike, affected Member States may need assistance to boost their own responsive capacities, limit impacts and recover from the disaster. Pooling financial and technical resources to support each other is aligned with the EU solidarity principle.

The EU provides support for Member States and regions that are overwhelmed at the time of disasters, implementing the EU principle of solidarity, notably via the Union Civil Protection Mechanism and the Solidarity Fund.

The Union Civil Protection Mechanism and the EU Solidarity Fund are the main mechanisms for providing physical and financial assistance to harmed places. The Union Civil Protection Mechanism aims to prepare and respond to disasters within and outside of the EU through a coordinated joint approach by pooling resources, tools, knowledge and skills. Several initiatives are part of the Union Civil Protection Mechanism to:

- coordinate emergency support (Emergency Response Coordination Centre);
- pool staff and equipment resources (European Civil Protection Pool);
- establish strategic reserves such as medical stockpiles and firefighting aircraft (RescEU);
- provide medical assistance (European Medical Corps); and
- facilitate partnerships and training (EU Civil Protection Knowledge Network).

The EU Solidarity Fund is one of the most concrete expressions of EU solidarity. It assists Member States and candidate countries that have been impacted by large disasters via grants that supplement public spending. For instance, it can finance essential emergency and recovery measures, such as the consolidation and restoration of critical infrastructure, the provision of temporary accommodation and the funding of rescue services to assist the population's emergency needs. The EU Solidarity Fund has been deployed in 30 disaster-hit countries between 2002 and 2024 supplying over EUR 8.6 billion, with flood being the most recurrent trigger for the fund intervention (EC, 2024n). Reforms over time have strengthened the links between the EU Solidarity Fund, climate adaptation and disaster risk management (Hochrainer-Stigler, 2022). The next MFF is expected to strengthen this support (EPRS, 2025b), which is an opportunity to ensure that the most vulnerable communities are not disproportionally affected by disasters and to shorten the time they need to recover.

However, increasing impacts and a lack of adequate incentives for proactive adaptation threaten the ability of such mechanisms to effectively respond to future disasters.

Climate change will exacerbate pressures faced by the EU Solidarity Fund, which has insufficient capital and flexibility to deal with more frequent and severe disasters, particularly when they occur simultaneously or in quick succession (Ciullo et al., 2021; Hochrainer-Stigler et al., 2023; World Bank, 2024). The Union Civil Protection Mechanism also faces general capacity constraints (World Bank, 2024), as well as increased demand for various types of support that are currently not fully covered by the existing mechanisms. For instance, despite the general success in enhancing solidarity when responding to disasters, recent assessments of the Union Civil Protection Mechanism highlight some remaining capacity gaps such as socio-psychological assistance to the victims and first responders (EC, 2024f, 2025h; Malešič, 2025).

These increasing needs, combined with financial pressures, highlight the importance of proactive adaptation, along with effective early warning systems that can reduce damage once the hazard occurs. There is a risk that, in the absence of incentives and enablers, some beneficiaries may gain from the shared resources without adequately trying to reduce the risks prior to or after a disaster (Hochrainer-Stigler et al., 2017). The Union Civil Protection Mechanism, for example, is mostly used for reactive support despite having been designed to support both proactive and reactive measures. Only a fraction of their actions have so far been dedicated to prevention of and preparedness for disasters (Malešič, 2025). In the future, EU support for Member States in the face of extreme events could be more effective if the EU incentivises proactive adaptation through the early identification of risk hotspots and targeted action (Lenaerts et al., 2022).

Proactive adaptation before extreme events and building back better afterwards can reduce future crisis response needs, but EU-level incentives for these actions remain limited.

To ensure the capacity of the EU to assist disaster-hit areas, and to protect the EU budget (EU, 2021, 2020), EU safeguards could include identifying relevant *ex ante* disaster risk measures when Member States request crisis response (ECB and EIOPA, 2023; Lenaerts et al., 2022). Coupling emergency support with requests for proactive efforts, as done for climate mitigation, is a way to incentivise Member States to anticipate and act (Aklin et al., 2023), provided that incentives take into consideration the different adaptive capacities (Guillaumont et al., 2023) and institutional barriers of each Member State and hotspot region. Such a safeguard also requires the monitoring and evaluation of adaptation efforts (see Chapter 6). The call to strengthen prevention and preparedness in the Commission's proposal for transforming the Union Civil Protection Mechanism goes in that direction (EC, 2025y). Addressing gaps in insurance protection may also reduce pressures on EU-level mechanisms and allow for crisis response to be more effectively targeted (ECB and EIOPA, 2024; World Bank, 2024) (see Chapter 8).

For example, as an entry point for transformational adaptation, emergency support can be coupled with requirements to build back better or use the space differently in order to support long-term adaptation goals, as the recovery phase is also a window of opportunity to proactively seek to increase resilience to future events (Birkmann et al., 2023). The Recovery and Resilience Facility is an example of an EU programme for recovering from the COVID-19 pandemic while aiming for a more resilient and fairer society by requesting that Member States allocate at least 37 % of the funding of their national recovery and resilience plan to measures that contribute to climate objectives (EC, 2024h, 2024k). This requirement can inspire similar initiatives dedicated to the recovery of climate-induced disasters. The EU Solidarity Fund currently lacks conditions that promote building back better, prompting the European Parliament to call for stronger risk-prevention and reconstruction-quality criteria,

complementary instruments such as European Investment Bank (EIB) framework loans, and greater synergies with cohesion policy funds when fund disbursement mechanisms are activated (EC, 2022).

The next MFF proposes a larger financial envelope for disaster response and process changes that embed preparedness by design, with the aim to have 'a more agile budget, better equipped for both the known – and the unknowns' (EC, 2025, preamble; see also Section 9.3). In the proposal, emphasis is placed on all aspects of disaster risk management: prevention, preparedness, response and recovery, with a five-fold increase in financial support for civil protection and health emergencies. The new budget could therefore be in a better position to use recovery funding as an opportunity to build back better or differently in a way that catalyses transformational adaptation (see Section 9.3). However, long-term adaptation planning, including transformational changes in the post-disaster period, are not explicitly mentioned in the proposal.

7.3. Fairly coordinating the share of adaptation burdens among people, places and generations to reduce impacts and avoid maladaptation

Just and fair resilience requires avoiding increasing inequalities through the unfair redistribution of risks or financial burden.

Adaptation policies and measures can redistribute vulnerabilities and risks beyond borders, across different places and over time (Andrews et al., 2023; Atteridge and Remling, 2018; Nilson and De Goër De Herve, 2023). If not transparently addressed and planned for, this can lead to maladaptation by worsening the conditions of already-vulnerable people or eroding the conditions for sustainable development, and conflict with EU broader goals of cohesion and leaving no one behind (Juhola et al., 2016; Schipper, 2020).

The question of responsibilities for funding adaptation is therefore central to fair adaptation (Grecksch and Klöck, 2020). In the case of mitigation, several EU instruments aimed at ensuring a just transition apply the 'polluter pays' principle, such as in the use of EU emissions trading system auctioning revenue to finance the Social Climate Fund and the Modernisation Fund. While these funds can finance adaptation, funding responsibilities for just resilience are not yet clear (EEA, 2025f). Advances in attribution science (see for example, Sparks and Toumi, 2025) could guide fair burden sharing in just resilience solutions (Thornton, 2021). Such discussions are particularly important in light of the growing demands from civil society for climate litigation, with 99 cases recorded before European judiciary bodies as of June 2025, most of them claiming a violation of the human rights of the most vulnerable people (UNEP, 2025c; see also Chapter 3).

To ensure just resilience, negative spillover effects and the financial burdens of adaptation have to be distributed fairly between people, places and generations (IPCC, 2022a). The EU needs to coordinate the distributional impacts of adaptation, which necessitates avoiding working in silos (see Chapter 9) and managing climate risks over spatial and temporal scales (Aubrecht et al., 2013; Sandoval et al., 2023). This includes using in policy design methodologies that account for the narrowing solution space for adaptation option at different timescales and using a range of climate scenarios (see Chapter 5).

Ensuring fairness between places

Adaptation efforts need to be coordinated across national borders to ensure that benefits and burdens are fairly spread.

Ensuring adaptation is fair requires that the implementation of adaptation policies and measures in one place do not unwillingly lead to the transfer of risk to another place. Similarly, a Member State lagging behind in its adaptation efforts can affect other Member States by jeopardising the effects of investment and planning in those countries (Rayner, 2023). Since the literature shows an increasing need to implement adaptation across geographical borders (Benzie et al., 2019; Talebian et al., 2025), Member States' cooperation needs to be at the core of the European integrated framework for climate resilience, and the EU can help coordinate stakeholders' needs to help spread the benefits and burdens of adaptation fairly.

Several EU policies call for the transboundary governance of adaptation and already benefit from regional initiatives.

The need for Members States' cooperation in facing cross-border risks is highlighted in the adaptation strategy. Some sectoral EU policies also point out the importance of explicitly considering the threat of maladaptation and the redistribution of risks among Member States. For instance, the Water Framework Directive recommends managing water bodies at the basin level, as they often extend across national borders in Europe, and the Floods Directive mentions that no redistribution of flood risk should happen between countries without the explicit agreement of both Member States. However, examples of transboundary water governance illustrate the difficulties in the application of such recommendations; for example, at the Dutch–German border, those two directives have been supporting cross-border collaboration efforts but have not immediately resulted in a transformational change in practice (Renner et al., 2018; Van Eerd et al., 2017). The main challenges to be overcome for transboundary efforts in water governance and climate change adaptation are divergent policy arrangements across Member States (Dieperink et al., 2016; Van Eerd et al., 2014), the prevalence of informal coordination (Pitzén et al., 2025), the limited implementation of actual problem-solving activities (Renner et al., 2018), and knowledge gaps about the cross-border climate impacts and risks (Benzie et al., 2019).

To overcome these difficulties, several European initiatives have been implemented to improve regional collaboration and coordinate actions between Member States. For example, Interreg is an EU initiative co-funding shared solutions for common challenges that extend across borders and require cooperation between organisations from different countries. Several Interreg projects focus on adaptation, as illustrated in Box 8. Another example of regional collaboration with adaptation benefits is the EU strategy for the Alpine region, which aligns with the Alpine Convention (treaty aimed at the sustainable development and environmental protection of the Alps), features a Climate Adaptation Platform for the Alps. Another example is the EU strategy for the Danube region, which initiated a flagship process on adaptation to climate change. Member States around the Baltic Sea, the Mediterranean region and the Carpathians have also created such initiatives (Biesbroek and Swart, 2019).

Box 8 Examples of Interreg projects for transboundary climate adaptation

The Interreg project '**Responsive local action for climate change adaptation and disaster risk reduction**' (2025–2028) helps municipalities and regional authorities of the Baltic Sea region to build long-term regional climate resilience. Among other key activities, this project aims at strengthening cross-border collaboration between municipalities, researchers and civil society. Nearly two thirds of the project budget of EUR 3.09 million is co-funded by the European Regional Development Fund.

The Interreg project '**Streamlining cross-border cooperation: Joint approach in disaster resilience STREAM 2 (2024–2028)**' aims to strengthen safety and disaster response capacity in the Romania-Bulgaria cross-border area through joint emergency management and capacity-building activities. The project budget is EUR 24.3 million, including EUR 19.5 million co-funded by the European Regional Development Fund.

The Interreg project '**Co-creating climate adaptation in coastal zones – ClimateBlue (2025-2028)**' strengthens German-Danish cooperation to co-create room for water in coastal areas in the face of sea level rise and risks of extreme weather events. It focuses on active citizen participation to develop sustainable solutions for costal adaptation and retreat. The project budget is EUR 2.4 million (Interreg Baltic Sea Region, 2026).

Ensuring fairness between generations

The benefits and burdens of climate change adaptation span generations.

Just as future generations bear the debt of inaction today, adaptation measures can result in negative spillovers over time, with impacts on future generations (Gajjar et al., 2019). Therefore, an important concern for fair adaptation is the impact of present choices on future generations, who are expected to face more climate extremes during their lifetimes than previous generations and have fewer options of measures to adapt (Grant et al., 2025). At the same time, the benefits of transformational adaptation are not always felt in the short term, while the financial costs are often felt immediately (Swart et al., 2023), spreading benefits and burdens unevenly over time. For adaptation to benefit both the current and future generations, the needs of today need to be taken care of while also progressing towards a long-term vision (Pot et al., 2023; see also Chapter 4), building back better or differently, as well as addressing path dependency (Hanger-Kopp et al., 2022) and considering impacts on future generations (UN, 2024, 2023a).

Intergenerational fairness is a core principle of the EU but has no practical implementation levers and considerations relating to adaptation are limited.

Globally, considerations for intergenerational fairness are growing, as illustrated by the UN System Common Principles on Future Generations (UN, 2023b). At the EU level, several concepts in EU primary law reference intergenerational fairness (EPRS, 2025a; Sulyok, 2025): the solidarity between generations (Article 3(3) TEU) and the solidarity and well-being of people (fundamental values of the EU according to Article 2 TEU); the fight against discrimination (Article 3(3) TEU; Article 10 TFEU); sustainable development (Article 3(3) TEU; Article 11 TFEU; Article 37 of the Charter of Fundamental Rights of the European Union); the protection of human rights (Article 3(3) TEU; the European Convention on Human Rights); and the protection of the rights of the child (Article 3 TEU; EU Charter of Fundamental

Rights). In addition, a Commissioner for Intergenerational Fairness was appointed in 2024 (EC, 2024g) and an EU strategy on intergenerational fairness is currently being drafted, with the participation of an intergenerational council for its formulation (JRC, 2025b, 2025a). It is 'a unique opportunity not only to embed [intergenerational fairness] principles across sectors, but to identify and act on the synergies between adaptation and other priorities' (Moore, 2025, p. 1).

However, in spite of these initiatives, institutional challenges to integrating intergenerational fairness into adaptation remain: there is no explicit legal obligation for the EU to protect the long-term needs of future generations, and the latter lack some form of representation in EU decision-making (Sulyok, 2025). This is mirrored by limited considerations for future generations in policies directly related to climate, with only one mention of them in the key objectives of the European Green Deal and no mention in the European Climate Law (Sulyok, 2025). Likewise, the final recommendations of the European citizens' panel on intergenerational fairness (EC, 2025r) do not directly refer to climate change more than in the context of the energy transition.

7.4. Ensuring decision-making processes support just resilience

Supporting locally-led adaptation and strengthening just resilience require procedures and decision-making processes that recognise the needs and capacities of communities and encourage stakeholders' participation.

Procedures that empower people and promote participation, transparency and good communication are essential, along with the co-production of knowledge are essential to identify needs and solutions in line with the capabilities of communities (Byskov and Hyams, 2022; Parviainen et al., 2025). Assessments of climate risks and resilience should also provide details at the local level to inform decisions based on granular and localised data (EC, 2024, preamble; see Chapter 6) about both the vulnerabilities and the capacities of communities. In addition, opportunities for public participation are essential for fair procedures and require, among other things, transparency and representativeness to be successful (German Environment Agency, 2018), aligning with the EU values and principles related to transparency and democracy. The involvement of concerned stakeholders in policymaking through, for instance, climate assemblies and participatory budgeting, is a way to ensure ownership of adaptation solutions and preferences, prevent maladaptation and support systemic changes (Parsons et al., 2025b; Prutsch et al., 2018). However, it requires balancing stakeholders' participation and responsibilities to avoid transferring risk ownership and management responsibilities to the local level at the expense of the power to influence decisions (Begg, 2018).

The recognition of inequalities in the face of climate change is well established at the EU level, notably through vulnerability assessments, and can be taken further when establishing adaptation indicators.

Recognition of unequal climate change risks and impacts is well established at the EU level, with the adaptation strategy acknowledging the unequal exposure and vulnerability of different regions and socioeconomic groups to climate impacts, along with several mechanisms in place to address those inequalities (see Section 7.2). Under the European Climate Law, vulnerability analyses are required as a basis for the NASs and NAPs. The Disaster Risk Management Knowledge Centre contains a vulnerability dashboard within its risk data hub. Similarly, vulnerability assessments inform social climate plans in the context of climate mitigation (EC, 2025d). The recognition of both vulnerability and strengths of local communities can be taken further in monitoring and evaluation systems (see Chapter 6).

Public participation in EU climate governance is encouraged but still faces several challenges.

The Eurobarometer survey provides an opportunity for the EU to identify European citizens' concerns and preferences when it comes to climate change, and the Covenant of Mayors for Climate and Energy is a channel that brings attention to local needs on the European stage. The European Climate Pact goes a step further to engage with individuals, communities and organisations, as part of the European Green Deal (EC, 2020). Furthermore, the Governance Regulation establishes multilevel climate and energy dialogues to actively engage stakeholders within the NECP process. However, multi-level dialogues are often insufficiently inclusive and are not always set up early enough by Member States to ensure proper access (EC, 2024k). At EU level, in 2022 the Commission has established a temporary Climate Resilience Dialogue for stakeholders and organisations to discuss ways to close the climate protection gap and increase climate resilience (EC, 2024a).

While acknowledging the existence of a wide range of participatory mechanisms in EU governance that can and have been meaningful for climate policy decision-making, Oberthür et al. (2025) point out key challenges that should be addressed to enhance public participation in climate governance in the EU, such as a lack of proof of public participation impacts on policy decisions and the imbalance in the involvement of stakeholders, with more participation by private companies than civil society because of the low visibility and awareness of public consultations outside specialised stakeholders. Other levels of governance (local and national levels) sometimes also struggle with facilitating truly participatory processes (Oberthür et al., 2025), which can undermine coordination and the societal trust in EU climate policies (Advisory Board, 2024b, p. 269). For instance, formalised approaches to the identification and involvement of socially vulnerable groups at the regional level are lacking (Jessen et al., 2025), and national reports on NAPs and NASs submitted under the Governance Regulation often mention who is disproportionally affected by climate change impacts but rarely recognise structural inequalities or consider engaging with socially vulnerable groups for planning and policymaking (EEA, 2025f).

Strengthen private adaptation

Ensure that the private sector contributes to reducing risks, mobilising investment, and managing costs of climate-related impacts – enabled and supported by public policies.

8. Strengthen private adaptation

Ensure that the private sector contributes to reducing risks, mobilising investment, and managing costs of climate-related impacts – enabled and supported by public policies.

Adaptation is a shared responsibility, requiring efforts from both the public and private sectors. As many climate risks originate as physical or financial risks to households, businesses, and financial institutions, early and proactive action – including through proactive climate risk management, improved alignment of financial flows with climate objectives, and resilient insurance systems – can help to limit broader risks to financial and economic stability. As well as strengthening their own climate resilience, greater engagement of the private sector may create opportunities as a source of finance, goods, services and innovation, that enable others to adapt. However, this potential depends on public policies to enable, support and incentivise adaptation efforts, at different sectors and scales.

Businesses and financial institutions still underestimate climate risks, and strengthening adaptation in EU reporting, disclosure, and financial supervision frameworks can strengthen climate resilience. The private sector has been increasingly recognising and reporting climate risks, driven by stronger EU sustainable finance policies and supervisory expectations. Climate risk assessment, disclosure and stress testing practices have improved, but companies may still not fully capture the sources and scale of climate risks. Recent changes to EU corporate reporting rules also threaten to undermine progress. Reinforcing EU efforts to embed climate risks and adaptation considerations into corporate governance, business planning and investment decisions, is necessary to build climate resilience and limit risks to financial and economic stability.

Adaptation incentives, blended finance and other innovative financing mechanisms could contribute to mobilising private adaptation investment and finance, which to date, have remained low. While EU sustainable finance policies have aimed to increase transparency and mobilise private investments towards EU climate and environment goals, impacts on adaptation investments have been limited to date. Mobilising private adaptation investments faces numerous barriers, including low awareness and visibility, limited incentives, and unclear commercial business cases. Public funding is often necessary to crowd-in and de-risk private investments, and there are opportunities for the EU to explore options for blended finance models and other innovative financing mechanisms.

EU-level action could improve the availability, affordability and adaptation potential of insurance, in order to reduce risks arising from the EU's large climate insurance protection gap. With only one quarter of climate-related economic losses insured, the EU's climate insurance protection gap leaves households, businesses and public finances vulnerable to the growing costs of climate-related and extreme weather events. Addressing this gap requires greater public and private efforts, including at the EU level, although it also requires careful coordination with other funding and crisis response mechanisms to avoid conflicting incentives. There are opportunities to leverage EU insurance regulations to support the systemic integration of adaptation incentives across standard insurance policies and underwriting practices. Developing mechanisms to pool or diversify climate risk at the EU level could also strengthen the resilience of national insurance systems to climate change and improve insurance availability and affordability.

8.1. Why this guiding principle?

Adaptation is a shared responsibility, requiring the engagement of both the public and private sectors to strengthen individual and collective climate resilience.

The multilevel governance of adaptation reflects the fact that actors at different levels and scales – public, private, community and individual – share responsibilities for adaptation according to their respective risks, influence and capacities. Governments have critical responsibilities to manage systemic risks, to strengthen adaptive capacity, and to create the enabling conditions that allow adaptation to take place at all levels. However, the scale of the challenge means that they cannot do this alone, and the 2021 EU adaptation strategy aimed to foster greater engagement of individuals and the private sector in adaptation (EC, 2021c). The Paris Agreement also calls for public and private financial flows to be aligned with climate mitigation and adaptation goals, which requires strengthening climate risk management by both public and private actors, as well as mobilising and aligning financial flows to be consistent with and contribute to climate resilience (OECD, 2022).

The private sector is exposed to climate risks, yet the scale of climate risks and adaptation needs remains a blind spot.

Many climate risks originate as physical or financial risks to households, businesses or financial institutions, where EU businesses and financial institutions are exposed and contribute to material climate and ecosystem degradation risks in their day-to-day operations, assets and investments (EEA, 2024a). This includes both 'transition risks', which are financial risks linked to the transition to a climate-neutral economy, and 'physical risks', which stem from the physical impacts of climate change and ecosystem degradation (ECB, 2020). For example, banks are exposed to physical climate risks through many channels (ECB, 2025c; Nieto and Papathanassiou, 2025; D'Orazio, 2025), most notably in their lending: for instance, 60% of euro-area bank loans are to companies with unmet flood protection needs, and 40% to companies with high exposure to drought (Ceglar et al., 2025). EUCRA identified numerous sectors - ranging from food production, forestry, energy, finance, insurance, pharmaceuticals, to tourism (among others) - that are increasingly impacted by climate change and will need to adapt, often with increasingly transformational strategies and business models (EEA, 2024a).

Private sector awareness of climate risks has improved, with progress made in managing these risks due to policy and regulatory drivers, particularly in the financial system (Wright and Nyberg, 2024). Despite this, climate risk has been described as a relative 'blind spot' in corporate planning, risk management and investment decisions (Goldstein et al., 2019). Many businesses still underestimate the scale of climate change and impacts; their vulnerabilities to indirect, cascading and ecosystem risks; and the need for long-term and transformational adaptation to many business models (Spacey Martín et al., 2025; Wright and Nyberg, 2024; Goldstein et al., 2019). Given that risks to businesses can compound and cascade to create systemic risks, proactively identifying and managing climate risks is crucial to strengthening both individual and collective climate resilience.

Adaptation investment remains limited and fragmented, especially in the private sector.

Although adaptation costs and investments are hard to track, global evidence generally points to significant finance and investment gaps (UNEP, 2025a; EC, 2026a). A recent European Commission study estimated adaptation investment needs of around EUR 70 billion per year based on an intermediate warming scenario up to 2050 (i.e. RCP4.5), which is likely to be substantially higher when

accounting for higher warming levels, or for complex and cascading risks. The current levels of adaptation finance from both the public and private sectors was described as 'insufficient' (EC, 2026a).

While most adaptation needs will likely require public funding, there is growing focus on the potential to mobilise private funding and finance to contribute to addressing adaptation needs. In addition to helping to meet certain immediate adaptation needs within the private sector (e.g. climate-proofing assets and supply chains), greater private sector engagement may create opportunities as a source of finance, goods, services and innovation, that enables others to adapt (UNEP, 2025a; OECD, 2022; Tall et al., 2021). In Europe, private adaptation investments have increased, but unevenly across countries and sectors. Some sectors with significant adaptation needs, such as retail trade and manufacturing, continue to underinvest in adaptation (Cortés Arbués et al., 2025).

While barriers to mobilising adaptation investment and finance exist at both public and private levels (see Section 9.3 on the role of the EU budget and fiscal frameworks), private investments and finance have tended to be especially-challenging to scale. These barriers include low awareness of climate risks and adaptation options, limited incentives, unclear commercial business cases, and skills or resource constraints (EC, 2026a, 2025aa; UNEP, 2025a; Tall et al., 2021). Blended finance and innovative financing mechanisms have been highlighted as promising levers to crowd in and de-risk private investments (EC, 2026a, 2025aa), although their potential is still unclear (UNEP, 2025a).

A large and growing climate insurance protection gap leaves households and businesses economically vulnerable, exacerbating systemic economic, financial and fiscal risks.

As not all risks and impacts can be prevented, insurance, risk transfer and other crisis response mechanisms play important roles in managing growing residual risks and climate-related costs. Despite rising business disruptions and economic losses affecting property and assets, there is a large and growing climate insurance protection gap in the EU. Just one quarter of extreme weather- or climate-related economic losses are insured in the EU, with wide disparities across Member States. Low-income households are particularly affected by insurance availability and affordability constraints, with just 8 % covered by insurance for these losses (ECB and EIOPA, 2024).

In addition to leaving individual households and businesses vulnerable in the face of rising losses and damages from climate change, gaps in private sector adaptation and insurance are likely to create and exacerbate systemic risks. This includes higher fiscal costs, risks to debt sustainability, impacts on asset values and the financial system, and pressures to mechanisms supporting EU's principle of solidarity (EEA, 2024a; ECB and EIOPA, 2023; Knittel et al., 2024). Addressing the EU's climate insurance protection gap has therefore emerged as a key policy priority (Council of the EU, 2025d; EC, 2024e, 2021c; ECB and EIOPA, 2024, 2023).

8.2. Integrating climate risk into reporting, disclosure and financial supervision

Integrating climate risk management in reporting, disclosure and financial supervision strengthens businesses' climate resilience, and can improve financial alignment with climate resilience goals.

As climate, nature and broader sustainability factors are increasingly recognised as a source of financial risk, expectations for the private sector to report, disclose and integrate these considerations into their financial decision-making have grown. This reflects increased demands from companies, investors, and consumers, as well as stronger climate-related financial policies and regulatory expectations, including

reporting, disclosure and financial supervision policies (OECD, 2022). Climate-related financial policies can have a 'stabilising' effect on businesses and economies by promoting proactive climate risk management and reducing risks and disruptions (D'Orazio, 2025), and can consequently contribute to improved business profitability and financial performance (Doan et al., 2025; D'Orazio, 2025; Chalabi-Jabado and Ziane, 2024).

Transparent, reliable information is a critical input that allows businesses, regulators and investors to manage climate and other sustainability risks, and to enable more efficient pricing and allocation of investments. While companies may voluntarily disclose information on climate risks, voluntary reporting and disclosure of corporate information can suffer from inconsistent, partial or self-selective reporting, due to both inadequacies in reporting practices, and incentives to under-report risk or other information if it may harm short-term financial performance. Mandatory reporting and disclosure frameworks aim to overcome such information asymmetries, improving reporting practices and the quality, quantity and comparability of information available to markets and regulators (Hummel and Jobst, 2024; Christensen et al., 2021). Compared to voluntary frameworks, there is evidence that mandatory reporting and disclosure can have a larger influence on how businesses manage climate and sustainability risks, as well as on their investment decisions (Christensen et al., 2021), although improved transparency alone may not be sufficient without stronger instruments and regulatory frameworks (Ameli et al., 2021).

In particular, risks to large financial institutions – such as insurers, banks or pension funds – require stronger regulatory oversight and instruments. Financial supervision and prudential frameworks complement disclosure by requiring that significant institutions actively manage risks, including through robust supervision, stress testing and capital requirements aimed at ensuring solvency and limiting systemic vulnerabilities. As the financial system is both exposed and contributes to climate risks through their operations and investments, regulators around the world increasingly require that institutions integrate climate-related risks into governance and risk management arrangements, and actively engage in transition and adaptation planning (Hidalgo-Oñate et al., 2023; ESRB and ECB, 2023; Smoleńska and Van 'T Klooster, 2022).

EU legislation and financial supervisors have significantly strengthened requirements for climate risk assessment and disclosure, particularly in the financial sector.

Since the launch of the EU's sustainable finance action plan (EC, 2018) and sustainable finance strategy (EC, 2021d), legislative changes and stronger supervisory expectations have placed strong emphasis on identifying, managing and disclosing economic, social and governance risks to the EU's financial sector, including climate risks. In particular, amendments to the Capital Requirements Directive (Directive (EU) 2024/1619), Capital Requirements Regulation (Regulation (EU) 2024/1623) and Solvency II Directive (Directive (EU) 2025/2) now require banks, insurers and investment firms to explicitly integrate both physical and transition risks into their risk management and disclosure processes, often using climate scenarios (see Table 3, Section 5.2).

The ECB and European Supervisory Authorities[9] have further strengthened their activities and supervisory expectations regarding the treatment of climate and sustainability risks, issuing guidelines and in some cases binding decisions to financial institutions and national supervisors to improve the quality and consistency of climate risk assessments (ECB, 2025a, 2020; EIOPA, 2022; EBA, 2025b, 2025a;

9 Consists of the European Systemic Risk Board, responsible for macroprudential supervision, and institutions for microprudential supervision, including European Banking Authority (EBA), European Insurance and Occupational Pensions Authority (EIOPA), and European Securities and Markets Authority (ESMA)

EBA et al., 2025). As a result, practices are improving and financial institutions are achieving closer alignment with progressively-strengthening supervisory expectations (ECB, 2026, 2025a; EIOPA, 2025; UNEP, 2025c). For instance, the ECB reported that most banks now have foundational elements in place to identify and manage climate and nature-related risks, with the share of them having no or only basic practices in place falling from around 80% to 20% between 2022 and 2024 (ECB, 2025a).

Climate scenarios are increasingly required and used as input for risk assessments and stress testing, particularly in assessing the resilience of financial institutions to more adverse climate-related financial shocks (Agostini and Galasso, 2025). This includes ongoing work to integrate climate risk into banks' regular stress-testing processes (ECB, 2025c), along with system-wide stress tests to improve the overview of systemic climate risks facing the EU's financial system and public finances (EEA, 2024a). EU supervisors further participate in the Network for Greening Financial Supervision to develop and improve data, scenarios and practices for climate risk assessment in the financial sector.

The EU has increasingly widened the scope of reporting and disclosure of climate risks beyond the financial sector, especially with the adoption of the Corporate Sustainability Reporting Directive (CSRD) (Directive (EU) 2022/2464) in 2022 to replace the narrower Non-Financial Reporting Directive (Directive 2014/95/EU). In its original scope, the CSRD extended sustainability reporting requirements to all large companies and listed small-medium enterprises – around 50,000 companies across the EU – requiring them to report on sustainability factors material to their business, including provisions related to climate risk assessments and adaptation plans. The CSRD was accompanied by the establishment of the European Sustainability Reporting Standards, with the aim of providing harmonised reporting standards under the CSRD and to improve coherence with other EU legislation[10] (Hummel and Jobst, 2024). In the same period, the EU also adopted the Corporate Sustainability Due Diligence Directive (CSDDD) (Directive (EU) 2024/1760), which established due diligence obligations for large companies to identify and address human rights and environmental impacts in their operations and supply chains.

However, changes introduced in the recent Omnibus I package may weaken the oversight and management of climate risks in the wider EU economy.

This transition from voluntary to mandatory sustainability reporting was intended to foster 'transparency and long-termism' (EC, 2018), by greatly increasing the quantity, quality and comparability of climate and sustainability information available to markets, and fostering a systemic approach to identifying risks and steering investments across the private sector (EC, 2021c). This was also expected to become a key input for financial supervisors to assess the exposure of the financial system and regulated entities to climate risk (ECB, 2025d). At the same time, the effectiveness of reporting and disclosure mandates depend on how well they balance their objectives with reporting burdens and feasibility, particularly for smaller businesses (Hummel and Jobst, 2024). While many companies had made significant investments and improvements in their reporting practices and systems in advance of the CSRD's expected entry into force, many also experienced implementation challenges, particularly in terms of the number of data points required, coherence with other legislation, and access to tools, digital infrastructure, and other supports (Sharma, 2025; Pizzi and Coronella, 2025).

10 This includes the EU taxonomy for sustainable activities (Regulation (EU) 2020/852) and Sustainable Finance Disclosures Regulation (Regulation (EU) 2019/2088), which introduced transparency and disclosure requirements in relation to sustainable investments and financial flows, including those contributing to climate adaptation (Hummel and Jobst, 2024).

As part of the broader Omnibus I package that aims to simplify EU legislation, the scope of the CSRD has again been significantly reduced. In the final agreement between the co-legislators reached in December 2025 (EP, 2025b), only companies with at least 1,000 employees and annual net turnover of EUR 450 million will be required to report under the CSRD. With most businesses no longer subject to mandatory, harmonised reporting requirements, the agreement also empowers the European Commission to introduce a simplified, voluntary reporting standard for out-of-scope businesses, while also requiring it to re-examine this scope every three years. The agreement also makes extensive changes to the CSDDD, reducing the scope to only the largest companies, and removing certain due diligence obligations (EP, 2025b).

While acknowledging the need to simplify requirements and support businesses in implementation, several authors and institutions have expressed concerns over the scale and lack of proportionality in these changes, particularly in the significant reduction in scope (ECB, 2025d; Hielkema, 2025; Rasche et al., 2025; Bertram, 2025; Baumuller, 2025). The revised CSRD threshold is expected to reduce the number of businesses covered by around 90%, exempting most businesses from mandatory and harmonised EU-level reporting rules. Furthermore, the use of a single threshold based only on business size and turnover does not account for differences in structure, risks or reporting needs between different sectors (Rasche et al., 2025). As climate risks are not necessarily proportionate to business size (ECB, 2025d) – for instance, small banks are often relatively more exposed to physical climate risks given the nature of their lending (e.g. in the property or agriculture sectors) (de Bandt et al., 2025) – this threshold can lead to uneven and disproportionate coverage of climate risk information.

For example, the ECB has highlighted that the revised threshold would result in a significant number of large banks, and the vast majority of smaller institutions, being exempt from CSRD reporting requirements, leading to 'an incomplete set of publicly available ESG information from the banking sector, thus impeding the objective of the Union's sustainable finance framework of guaranteeing comprehensive transparency to the financial markets' (ECB, 2025d, p. 8). Furthermore, some key sectors facing substantial mitigation and adaptation needs, including real estate, construction and agriculture, may become almost entirely excluded from reporting requirements (Rasche et al., 2025). These consequences are compounded by the lack of a clear impact assessment or climate consistency assessment accompanying the Omnibus I proposal, especially in the context of a broader finding of 'maladministration' by the European Ombudsman (2025) against the European Commission. It is therefore not clear whether other options to simplify reporting while maintaining broad coverage – such as tiered approaches (Rasche et al., 2025), or streamlining the number of required data points (ECB, 2025d; Hielkema, 2025) – were adequately assessed.

Greater efforts are needed to improve and address ongoing challenges in climate risk assessments practices across EU businesses.

As reporting, disclosure and financial supervision practices have advanced, various assessments from the literature and financial supervisors have identified ongoing challenges in identifying and quantifying climate and other sustainability risks (Baer et al., 2023; Spacey Martín et al., 2025; ECB, 2025a; UNEP, 2025c; EEA, 2024a). For instance, existing scenario-based methodologies and stress tests still face limitations in certain key risk categories, particularly those associated with tail risks, cascading risks (e.g. via supply chains), or nature-related risks; meaning that material exposure to climate risk is still likely to be underestimated (Baer et al., 2023; ECB, 2025a; UNEP, 2025c). This often reflects broader challenges in terms of the availability, quality and usability of scientific data and scenarios to support climate risk assessments (Baer et al., 2023), which further contributes to incomplete or inconsistent risk assessments.

Differences in legal requirements and practices may also contribute to inconsistencies in how different financial institutions assess climate risks or use climate scenarios (e.g. as shown previously in Table 3, and as discussed in Section 5.2). While flexibility is important to reflect different needs and capacities, it may also contribute to 'inconsistent and unreliable assessments of climate and environmental risks', especially complicating their use in financial supervision (Agostini and Galasso, 2025). For instance, an EIOPA monitoring exercise on the use of scenarios in insurers' risk assessments reported how 'even insurers with comparable exposures may apply different thresholds, methodologies, or levels of ambition when evaluating climate risks' (EIOPA, 2025, p. 3), highlighting the importance of continuing to develop and clarify regulatory guidance for businesses and financial institutions (Agostini and Galasso, 2025). Developing common EU approaches to climate risk assessments and scenario analysis can also support a level playing field for businesses and the financial sector (see Chapter 5).

Implementation challenges, including resource, skills, or capacity constraints, frequently constrain businesses' ability to identify and assess climate risks effectively, especially for small- to medium-sized businesses as highlighted above in the context of the CSRD. The Omnibus I agreement requires the European Commission to identify options to address reporting challenges faced by businesses, particularly through improved data collection and digital infrastructure (EP, 2025b). Authors have also highlighted options to address gaps and facilitate sustainability reporting in different business contexts, such as developing tools and templates, improving data collection and infrastructure, and capacity-building (Sharma, 2025; Pizzi and Coronella, 2025). Advances in digital technologies and artificial intelligence may similarly enable faster and comprehensive climate risk assessments, if leveraged and tailored to meet the different business needs and use cases (UNEP, 2025c; Parsons et al., 2025a).

Other regulatory and prudential instruments can increasingly ensure that climate risks are considered in adaptation planning and investment decisions.

Greater reporting and transparency on their own do not necessarily induce a step change in how businesses manage risks or make investment decisions, especially when there are conflicting financial incentives or long-term or other systemic considerations they do not fully consider (Ameli et al., 2021). Other microprudential and macroprudential tools, such as capital requirements, systemic risk buffers or refinancing operations, are important in actively steering risk management and investment to limit the build-up of systemic risk in the financial system (Hidalgo-Oñate et al., 2023). These tools have wide-ranging impacts on financial markets and capital allocation decisions. While this means that integrating climate risk factors could have a profound impact on how the financial system views and manages climate risk, equally, this requires robust methods and reliable data, and is partly dependent first on improvements in climate risk assessment and disclosure (ECB and ESRB, 2023; Smoleńska and Van 'T Klooster, 2022).

Balancing the 'costs of early action based on imperfect information, against the risk of acting too late', EU supervisors have therefore generally favoured a 'gradual, targeted, and scalable' approach (ECB and ESRB, 2023, p. 6), integrating explicit factors for climate risk into prudential instruments as the underlying evidence base and methods have improved (ECB, 2026; Smoleńska and Van 'T Klooster, 2022). Most notably, the ECB announced the introduction of a 'climate factor' in the Eurosystem's refinancing operations to adjust the value of assets pledged as collateral. This would build on results of the system-wide stress tests by identifying assets exposed mainly to transition risks, but it does not yet appear to account for physical risks (ECB, 2025d). Beginning in 2026, the Capital Requirements Directive also requires that banks produce prudential transition plans, outlining for supervisors their plans to monitor and address climate transition and physical risks in the short, medium and long-term.

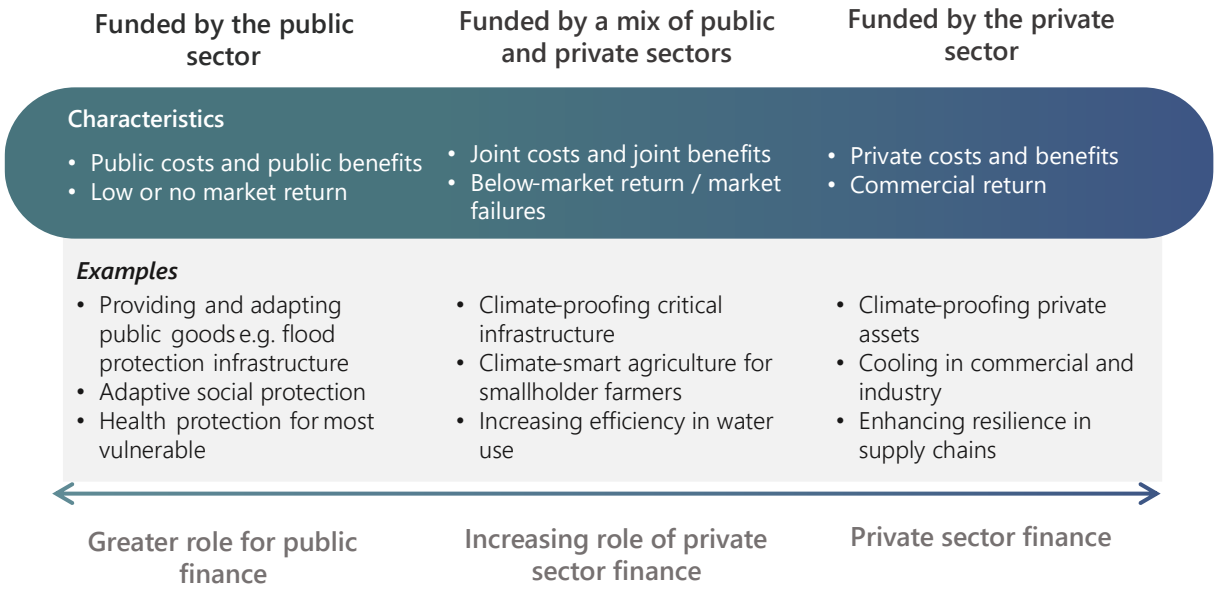
These and other initiatives can continue to strengthen incentives to manage climate risks facing the EU economy and financial system.

8.3. Developing roles and opportunities for private finance

Public policies are necessary to create the conditions and incentive structures that enable and mobilise private investments.

Reflecting broader challenges with establishing ownership of climate risks and adaptation, the role of the public and private sectors for funding and financing adaptation is relatively unclear and dynamic. While the nature of and barriers to adaptation mean that public sources are likely to account for the majority of funding needs (see Section 9.3 for discussion on the EU's budget and fiscal frameworks), there is potential for the private sector to play a greater role. These include funding adaptation solutions that increase their own immediate adaptation needs, such as climate-proofing private assets. The potential opportunities from greater private sector engagement in adaptation have also been highlighted, such by creating and providing new products (e.g. drought-resistant crops), services (e.g. insurance), innovation and sources of finance that enable others to adapt (UNEP, 2025a; OECD, 2022; Tall et al., 2021) (see Figure 16).

Figure 16 Roles of public and private sector in adaptation finance



Source: Adapted from UNEP (2025a).

However, even in cases where there are possible commercial business cases, public policies are often necessary to create enabling conditions to mobilise private adaptation investments and finance, and to align financial flows with climate resilience goals. For example, as described in the previous section, reporting, disclosure and financial supervision framework can contribute to greater resilience-alignment in the financial sector through improved information, pricing and incentives to manage risks (OECD, 2022). Incentive structures created by broader public and sectoral policies – such as product standards, building codes, subsidy schemes, or spatial planning regulations – can also be similarly leveraged to support adaptation. However, public policies may just as well create conflicting or maladaptive incentives, if adaptation needs are not adequately integrated into policy design and implementation (OECD, 2022; Kuhl et al., 2021) (see Chapter 9 on the role of policy integration).

Targeted public funding, blended finance and other innovative financing mechanisms could contribute to mobilising greater levels of private adaptation funding and finance in the future.

The EU adaptation strategy sought to increase private adaptation investments and finance mainly in the context of wider EU sustainable finance policies and instruments (EC, 2021c). As sustainable finance markets have grown in importance globally and in Europe, policies and instruments under the EU's sustainable finance strategy (EC, 2021d) have focused on improving the transparency and consistency of green financial products, aiming to reduce greenwashing and to stimulate market demand for investments that contribute to the EU's climate and environment goals.

Most notably, the EU taxonomy for sustainable activities (Regulation (EU) 2020/852) and delegated acts form the core of EU sustainable finance policies by providing harmonised and detailed criteria for classifying investments and financial flows that contribute to (or harm) climate and environmental goals, including adaptation. Building on the EU taxonomy, the EU green bond standard (Regulation (EU) 2023/2631) and the Sustainable Finance Disclosure Regulation (Regulation (EU) 2019/2088) aim to improve transparency and facilitate continued growth in sustainable investment products. Such standardised products and taxonomies can be important to enabling adaptation investments, given persistent challenges in identifying adaptation investments (EC, 2025aa; UNEP, 2025a), and the EU adaptation strategy has also highlighted the need to further develop the EU Taxonomy to enable greater adaptation investments (EC, 2021c). However, there is limited evidence of the contribution of EU sustainable finance policies in mobilising adaptation investment and finance to date. Reporting is still relatively fragmented overall, and early data indicates that adaptation-aligned financial flows are still limited, such as in taxonomy-aligned flows (PSF, 2025; Morningstar Sustainalytics, 2024) or in green bond allocations (EC, 2025u).

Certain adaptation solutions face distinct financing challenges, such as nature-based adaptation solutions, which are rarely considered in corporate investment strategies despite their benefits (Goldstein et al., 2019). The EU adaptation strategy aimed to leverage private finance for nature-based solutions (EC, 2021c), through instruments like the Carbon Removal and Carbon Farming (CRCF) Regulation (Regulation (EU) 2024/3012) and the recently-proposed roadmap for 'nature credits' (EC, 2025j). While such instruments may help to strengthen the business case for nature-based projects that generate direct or co-benefits for adaptation[11], these benefits often depend on context, as well as robust certification and sustainability safeguards that are still being developed for different activities. Furthermore, the generally small size of voluntary markets for carbon or nature credits may limit their potential (Advisory Board, 2025a; Wunder et al., 2025), and the Advisory Board has previously highlighted the need for additional funding and financing instruments to meet the EU's climate and nature objectives in the land sector (Advisory Board, 2024).

Public funding and finance also plays an important role in crowding-in private investments in many policy areas, with emerging evidence showing that public funding can similarly crowd in adaptation investments (Cortés Arbués et al., 2025). Public funding often serves a purpose of de-risking private investments, particularly for innovative or early-stage projects where commercial returns are uncertain. There is considerable interest in the potential from innovative financial instruments and blended finance to contribute to mobilising private investments, particularly in meeting adaptation needs in sectors such as water, agriculture or infrastructure (UNEP, 2025a; Tall et al., 2021). The Reflection Group on Mobilising Climate Resilience Financing (EC, 2025aa), convened by the European Commission, has presented options for such financing mechanisms to contribute to addressing the EU's adaptation

11 For example, the CRCF regulation requires carbon farming activities to generate sustainability co-benefits, including (at least) benefits for biodiversity and ecosystem restoration.

financing gap, including public-private partnerships, blended finance, green bonds or impact loans. While their potential remains unclear, and depends also on improving adaptation investment readiness among public and private bodies, they could be further considered in the context of the next Multiannual Financial Framework or activities of the EIB (see also Section 9.3).

8.4. Addressing the EU's climate insurance protection gap

Resilient insurance systems help to limit the financial and economic risks of climate change, yet climate change threatens to make insurance less affordable and available across the EU.

Insurance and risk transfer mechanisms reduce economic vulnerability to disasters, including climate-induced events. By providing financial security to those experiencing economic losses, insurance enables faster recovery following disasters, and limits their impacts on living standards, productivity and the wider economy (Jarzabkowski et al., 2019). Not all climate risks are measurable or insurable, nor is it feasible for all risks to be fully privately insured given affordability and fairness limits. However, as non-insured economic losses and damages are often passed on to governments, resilient insurance systems play an important role within a broader policy framework in alleviating the economic and fiscal burdens of disasters, and allowing for more effective targeting of public resources to meet public needs (Jarzabkowski et al., 2019; Knittel et al., 2024).

As hazards become more frequent and severe, climate change may threaten the viability of traditional private insurance markets, with insurance coverage becoming more expensive and/or less available. When risks increase, insurers typically respond by increasing premiums or limiting payouts to maintain solvency, in line with principles of risk-based pricing. However, rising premiums can push affordability limits among policyholders, particularly those already at high risk, and further exacerbate the protection gap due to lower demand these products (Jarzabkowski et al., 2019).

Insurers typically diversify risks further through reinsurance markets. As hazards tend to become weakly correlated over larger geographic or hazard ranges, purchasing reinsurance allows insurers to diversify by ceding some risks in their portfolio to other insurers. By spreading risks across a larger range of geographies and hazards, this can reduce premium costs, capital requirements, and increase resilience to large shocks (Ciullo et al., 2023). However, the wide-ranging impacts of climate change and the presence of correlated and cascading risks could make this more difficult and expensive. These factors can compound to result in insurance becoming non-viable, and for certain hazards and places, the withdrawal of insurers has already left households, businesses and ultimately governments vulnerable to higher losses and damages (ECB and EIOPA, 2023; Jarzabkowski et al., 2019).

Incentives for adaptation are still not widely integrated in standard insurance contracts, despite their potential to reduce risk.

Insurability ultimately depends on reducing risks before they materialise, and insurance can also be a tool to better foster and encourage adaptation efforts by policyholders. While insurance premiums may provide broad price signals for climate risk, such as by discouraging building in flood-risk zones, small-scale adaptation measures and behaviours implemented at the policyholder level can also be effective in some circumstances at reducing risk and impacts (Hudson et al., 2014; Poussin et al., 2015). Integrating explicit incentives for adaptation measures into insurance policy design (e.g. through premium discounts or policy conditions) and payouts (e.g. through conditions to build back better) could contribute to strengthening climate resilience and insurance affordability (Hudson et al., 2020, 2016; Knittel et al., 2024; Jarzabkowski et al., 2019).

However, 'impact underwriting' – the explicit integration of adaptation incentives into insurance contract design and pricing (EIOPA, 2023) – is still at an early stage, and not yet widely or consistently implemented across standard non-life insurance contracts in the EU. This reflects several barriers, including low climate risk awareness among policyholders, lack of explicit financial incentives, data constraints, and challenges in recognising and certifying effective risk reduction measures (EIOPA, 2023). This type of risk-based pricing may also create additional affordability challenges, particularly for low-income households and policyholders who are unable to implement adaptation measures on their own, and needs to be accompanied by additional supports and social policies (Hudson, 2020; Hudson et al., 2020).

While market structures and products are diverse, certain key design features can contribute to improving the affordability, effectiveness and resilience of insurance systems in a changing climate.

Insurance market design for climate-related risks differs across the EU, including how they approach insurance coverage requirements, the degree to which premiums reflect policyholders' risk, and in particular, the role of the state. Systems implemented across Member States range from fully private systems, where coverage is voluntary and premiums tend to fully reflect policyholders' risk, to solidarity-based systems, with publicly provided insurance and premiums that are less sensitive to risk. Many Member States operate mixed models, where the specific design often involves policy choices informed by each country's exposure and history of hazards, economic conditions and values (Paleari, 2019; Hudson et al., 2019).

While this can make it challenging to identify a single preferred model for insurance design, the literature increasingly identifies a number of key design features that may contribute to greater affordability and sustainability of insurance systems under climate change in the long run (ECB and EIOPA, 2024, 2023; Knittel et al., 2024; Hudson et al., 2019; Paleari, 2019). These are currently addressed at different levels of governance, and include:

1. **Push factors to expand private insurance coverage.** Systems with high insurance penetration rates have generally put in place explicit legal requirements (e.g. requirements to buy or provide insurance), or other strong push factors (e.g. linking insurance to mortgage requirements) to achieve a high insurance penetration rate, resulting in a larger, diverse and more resilient insurance pool (Paleari, 2019; Hudson et al., 2019).
2. **Public involvement or reinsurance to promote affordability.** Most systems achieving high insurance penetration rates have put in place some form of state involvement to address affordability challenges (Paleari, 2019). In the EU, these most commonly operate as national public-private reinsurance schemes to support primary insurance markets and improve affordability through greater diversification, economies of scale, and by taking on some of the risk associated with the highest loss layers (ECB and EIOPA, 2024; Knittel et al., 2024; Hudson et al., 2019). They may also involve explicit subsidies or vouchers aimed at improving affordability, although this requires carefully balancing of trade-offs between improved affordability and maintaining consistent awareness and incentives for risk management (Hudson, 2020; Hudson et al., 2020). Public mechanisms also require clear delineation of public–private costs and responsibilities, and careful coordination with other funding and disaster relief mechanisms to preserve risk reduction incentives and avoid conflicting policy signals (Paleari, 2019).
3. **Insurance- and price-based incentives to support risk reduction.** In parallel, maintaining incentives and price signals that reflect both individual risk and adaptation actions are crucial to incentivise adaptation and risk reduction, contributing to the long-term sustainability of insurance

systems (Hudson et al., 2016; Tesselaar et al., 2023). These can include explicit policy-level pricing and incentives (e.g. premium discounts if homeowners implement prevention measures, conditions to carry out sustainable agricultural practices) (Hudson et al., 2016; Müller et al., 2017), and support for portfolio-level initiatives (e.g. by pooling insurance premiums or other funding to invest in landscape-level adaptation measures) (Reguero et al., 2020).

4. **Consistent public policy and planning to avoid maladaptation.** Insurability depends on broad public policy signals, planning and investment, such as spatial planning policies and building codes that shape the exposure and vulnerability of populations to climate hazards. Promoting risk reduction and avoiding conflicting incentives in these wider policies in crucial; otherwise, improving insurance availability and affordability on its own may even be maladaptive by facilitating additional risk-taking or moral hazards. For example, without coherent spatial planning policies, improving insurance affordability may simply encourage settlement in flood risk areas (Tesselaar et al., 2023). Similarly, expanding agricultural insurance to cover climate-related losses in the absence of a wider transformation may incentivise existing 'risky' production choices, such as drought-sensitive crops (Müller et al., 2017).

5. **Innovative and tailored insurance products.** While insurance policies and most national schemes in the EU have traditionally been based on the principle of indemnification (i.e. where payouts are based on actual losses), promising design innovations could allow insurance to be tailored to a range of circumstances and an evolving risk landscape (Jarzabkowski et al., 2019). For instance, parametric or index-based insurance products – where payouts are trigged according to pre-agreed event or climatic thresholds, rather than actual losses – could provide more rapid and flexible payouts for some types of losses. Improvements in monitoring systems, data, and technology may also facilitate further design innovations (EC, 2024a; Jarzabkowski et al., 2019).

EU policy promotes consistency in insurance regulation and product design, which could similarly be leveraged to strengthen the implementation of adaptation in insurance systems.

EU policy already shapes insurance market design in multiple ways. Most notably, the Solvency II Directive (Directive 2009/138/EC) provides a common regulatory and financial supervisory framework for EU insurers, aimed at promoting financial stability through robust, risk-based capital requirements, governance and reporting standards. The Insurance Distribution Directive (Directive (EU) 2016/97) focuses on the sale and transparency of insurance products aimed at protecting consumers by harmonising standards and information requirements. Many wider and sectoral EU policies implicitly affect insurance provision in different contexts, such as by providing risk information (e.g. risk mapping under the Floods Directive), or policies that affect incentives for insurance coverage (e.g. insurance subsidies under the CAP, disaster assistance under the EU Solidarity Fund) (Surminski et al., 2015).

EU policies can be better leveraged to promote more consistent standards for risk management and adaptation across the EU, building on ongoing efforts to develop and standardise impact underwriting practices in the EU (EIOPA, 2023). For instance, although insurers are responsible for designing, pricing and underwriting insurance policies, they must do so within the framework of Solvency II's capital requirements, which require them to maintain sufficient capital reserves to ensure their solvency in the event of extreme losses. Capital requirements are based on the level of risk across an insurer's portfolio, and as adaptation measures can be effective in reducing risks and impacts, implementing adaptation measures more widely could have a measurable effect on capital requirements (EIOPA, 2024b). However, methods for calculating capital requirements under Solvency II do not yet explicitly account for the effects of adaptation. Under its Solvency II mandate, EIOPA is advancing efforts to integrate adaptation incentives into these frameworks, emphasising the need to do so in a consistent

and actuarially sound manner across the EU, although initial exercises also present challenges linked to limitations in current risk and adaptation data (EIOPA, 2024b).

As the information on climate risks and adaptation effectiveness remains a broad constraint (EC, 2024a), improvements in risk assessments, monitoring, reporting and learning systems (see Chapter 6, and Sections 5.2 and 8.2) could therefore facilitate the integration of adaptation into insurance product design. These challenges have been highlighted by the Reflection Group on Mobilising Climate Resilience Financing (EC, 2025aa), which has called for the establishment of an EU 'observatory' on insurability, to monitor trends in risks, exposure, vulnerability; and to identify where adaptation can strengthen insurability. Other initiatives have been ongoing at the EU level that may strengthen the evidence base for insurance. For example, EIOPA has examined options to develop an EU-level 'awareness tool for natural catastrophe risks and prevention measures' (EIOPA, 2024a), while the European Union Agency for the Space Programme has also highlighted the potential to leverage earth observation data from the Copernicus programme to support the development of new parametric insurance products, particularly in the LULUCF sector (EUSPA, 2025).

Despite the potential to increase the affordability and resilience of EU insurance systems, there are currently no mechanisms to pool or diversify risk at the EU level.

Mechanisms to pool risks at the EU level could further contribute to insurance affordability and coverage, with a number of estimates pointing to potential cost savings due to increased geographic and hazard diversification, and economies of scale (ECB and EIOPA, 2024; Ciullo et al., 2023; Prettenthaler et al., 2017). Similar schemes to pool climate-related risk have been developed in other parts of the world, with apparent success in reducing (re)insurance costs; for example, the Caribbean Catastrophe Risk Insurance Facility is estimated to have reduced insurance premium costs by 50 % for Caribbean governments facing hurricane and cyclone risks, compared to fragmented efforts (EC, 2024a).

However, the EU lacks comprehensive mechanisms to pool climate- or disaster risk at the EU level. While the EU Solidarity Fund provides fiscal support to governments dealing with disaster costs, its small size, and limited incentives for disaster risk reduction or coordination with insurance systems make it unlikely to meaningfully address the growing costs of disasters, including from climate hazards (EEA, 2024a; ECB and EIOPA, 2024, 2023; Hochrainer-Stigler and Lorant, 2018) (see also Chapter 7). The EU's common agricultural policy offers a risk management toolbox and an agricultural crisis reserve, however those are limited (INRAE and IDDRI, 2025).

Several options for risk transfer or reinsurance mechanisms at the EU level are available (see, for example, ECB and EIOPA (2023) and Hochrainer-Stigler and Lorant (2018) for detailed reviews), and each requires careful consideration and coordination with respect to both existing national and EU-level schemes crisis response mechanisms. As a starting point for further consideration, the ECB and EIOPA (2024) have put forward proposals for a European system for natural catastrophe risk management, comprising primarily an EU-level reinsurance scheme to complement existing national schemes, combined with reforms to the EU Solidarity Fund to better clarify its public role and strengthen incentives for risk reduction, as highlighted in Box 9. By pooling risks at an EU level and taking advantage of greater diversification and economies of scale, such an EU-level system could complement national insurance systems to make them more resilient to climate impacts, contributing to improved insurance affordability and availability across the EU (ECB and EIOPA, 2024).

Box 9 ECB-EIOPA proposal for a European system of natural catastrophe risk management

Pillar 1: An EU public–private reinsurance scheme aimed at complementing national arrangements in order to increase insurance coverage for disaster risk, and to improve affordability through greater economies of scale and diversification across hazards and Member States. Access to the scheme would be voluntary, and funded by full or partial risk-based payments. It would be open to existing national reinsurance schemes (wherever established), and also to private (re)insurers in Member States that have not yet established similar schemes.

Pillar 2: An EU fund for public disaster financing aimed at helping Member States to manage public recovery costs and non-insured economic losses following high-loss disasters. Membership would be mandatory for all Member States, which would make contributions adjusted to reflect their respective risk profiles, including exposure to climate hazards, insurance coverage and the planning/implementation of risk reduction strategies. Fund payouts would be made when disaster costs exceed a pre-defined threshold and be similarly based on conditions aimed at incentivising risk reduction measures.

	Pillar 1: EU reinsurance scheme	Pillar 2: EU disaster fund
Goal	Increase insurance coverage and supply	Incentivise risk mitigation and limit public outlays
Participants	(Re)insurers and national schemes	Governments
Set-up	Public–private	Public
Membership	Voluntary	Mandatory
Funding	Risk-based premiums from participants (and capital market funding)	Risk-adjusted contributions from governments (and possibly debt issuance)
Payouts	Payout according to contract conditions	Payout calibrated to event and dependent on implementation of national plans

Source: ECB and EIOPA (2024).

Integrate policies

Improve the mainstreaming of climate resilience across EU and national policies, including the fiscal rules and the EU long-term budget.

9. Integrate policies

Improve the mainstreaming of climate resilience across EU and national policies, including the fiscal rules and the EU long-term budget.

Addressing climate risks requires coordinated action across all levels of governance and across sectors, with clear lines of accountability and active participation from private stakeholders. To move beyond fragmented efforts, climate resilience must be embedded in legal and economic frameworks at the EU and national levels. Aligning financial flows with climate objectives is also essential to supporting a systemic response that integrates security, climate resilience and long-term investment. At the EU level, this requires, as a first step, using information from EUCRA, along with common EU climate scenarios.

Currently, the EU frameworks for climate, the long-term budget and economic governance do not adequately integrate climate resilience. EU climate legislation does not clearly define adaptation needs or responsibilities, nor does it embed these in governance mechanisms that involve relevant sectors, levels and actors. Insufficient accountability and resources are undermining the effective integration of climate resilience into EU policy resulting in, for example, timely crisis responses or use of the up-to-date climate data in infrastructure planning. In addition, despite a spending target and tracking of funding towards it, the EU's long-term budget's estimated contribution to climate resilience is limited and not fully transparent. The effectiveness of the do no significant harm principle and infrastructure climate proofing in the EU long-term budget framework has not yet been fully assessed, but it has already been called into question, as their application is fragmented. Similarly, EU economic governance only partially mainstreams climate resilience.

The forthcoming European integrated framework for climate resilience and the next MFF offer an opportunity to close these gaps. The EU should define adaptation needs, roles and responsibilities based on evidence and through targets, then translate them into obligations and incentives, assigning accountability and resources across institutions and actors. A horizontal principle of climate resilience by design should guide policy consistency checks and foster cooperation across sectors. It should also apply on the economic side to mainstream climate resilience into financial flows, including measures to crowd in private finance. This can be supported by improved tracking of climate-aligned and harmful investments as well as EU support to public reform and investment at national level. Together, these steps can align EU domestic action with science, EU values and principles, and international commitments, ensuring a proactive and fair approach to climate security.

9.1. Why this guiding principle?

Adaptation to climate change is a complex challenge that cuts across policy areas and governance levels.

Climate change impacts create complex, cascading and compounding risks that cannot be managed effectively in isolation, as highlighted in EUCRA and in Chapters 1 and 3 of this report. The existing fragmentation of policy (Hedlund, 2023) and the need to ensure effective, comprehensive risk management across the continent (IPCC, 2022b) call for the integration of climate adaptation into EU policymaking. Comprehensive risk management using an all-hazards approach, which strengthens preparedness and resilience to all kinds of threats, has been a standard practice in disaster planning

and response globally (Bodas et al., 2020) and advised as relevant for future EU policy by Sauli Niinistö (2024).

EUCRA (EEA, 2024a) noted that several EU policies can help reduce multiple major climate risks, thereby supporting the system-wide and cross-sectoral integration of adaptation. It emphasised that fully realising the potential of EU policies on biodiversity, food and agriculture, infrastructure, water management, civil protection, health and funding programmes is essential for strengthening policy coherence and coordinated action across sectors.

Effective adaptation both depends on and contributes to progress in other policy areas such as mitigation and civil protection, highlighting the need for integrated and mutually reinforcing EU policies.

In line with the concept of effective adaptation, adaptation policies need to pay attention to their effects on greenhouse gas emissions to avoid maladaptation (see Section 2.1), and to leverage the synergies with mitigation where possible, such as through scaling nature-based solutions and climate-smart urban planning (EEA, 2024a; IPCC, 2022e). Similarly, several key mitigation policies, including the objectives and the robustness of measures laid out in the CRCF Regulation, depend on strong adaptation policies and measures (e.g. in protecting forest carbon sequestration from wildfires).

Furthermore, the interdependence of adaptation, the SDGs and disaster risk reduction (see Chapter 4) highlights the need for integrated approaches across EU policies (Breuer et al., 2023). For instance, initiatives in civil protection or any of the 17 SDGs, such as 'no poverty' or 'no hunger', impact and are impacted by the EU's climate resilience efforts. Similarly, by attenuating the impacts of the climate crisis on peace (SDG 16), for example through the EU's international partnerships, effective adaptation is an important part of the broader security agenda (Amakrane and Biesbroek, 2024; Bedoya Taborda et al., 2025; UNDP, 2023).

The integration of adaptation into policymaking aims at achieving policy coherence and effectively managing climate risks.

The integration of adaptation objectives and climate risk considerations into the established functions, policy and practice of government institutions to build climate resilience (UNEP, 2025a) is often referred to as adaptation mainstreaming. Such integration implies coordination across sectors and governance levels to align on sectoral policy goals, instruments and implementation structures (Candel and Biesbroek, 2016; Rietig and Dupont, 2023). It comes through the whole-of-government approach, denoting collaborative public management with the aim of achieving shared goals and an integrated government response to particular issues (Christensen and Lægreid, 2007). 'Strong' integration of adaptation into EU policymaking would require that climate resilience objectives become central or even take precedence, or priority, in the development of policies in other domains (Rietig and Dupont, 2023). According to the IPCC (2022e), such a 'sectoral approach to climate change legislation grafts climate-related provisions into existing laws … collectively creating an aggregated legal landscape'. In addition to efficiency gains, integrating adaptation into existing governance structures can contribute to expanding the solution space and support efforts to deliver transformational adaptation (EEA, 2024a; IPCC, 2022e) (see Chapter 5).

Accountable, well-resourced and integrated governance that ensures coordinated action across all levels and sectors is needed to overcome risks of integrated policymaking.

The risks of integrated policymaking need to be addressed: integration can diminish the visibility of dedicated strategies, reinforce an unequal distribution of responsibilities and weaken coherence

between planning, funding, and implementation (Cairney, 2025; IPCC, 2022a; Runhaar et al., 2018). Failure to systematically address these risks can lead to maladaptation, fragmented governance and an implementation deficit (Fleckenstein, 2024).

These risks can be addressed through strong governance arrangements involving actors at all scales – from individuals and communities to governments, businesses, non-governmental organisations and social movements – to meet the goals of the Paris Agreement and other international commitments, notably the Sendai Framework and the SDGs (IPCC, 2022a); see also Chapter 4. To be effective such governance arrangements need to ensure:

1. **accountability**, that is, relying on clear, consistent and evidence-based problem definition, with key actors sharing both responsibility for challenges and ownership of solutions (Cairney, 2025; Rogers et al., 2024);
2. **resources**, that is, mobilising investment and reform, and aligning public and private financial flows with climate resilience (OECD, 2022) see also Chapter 8 to ensure sufficient resources, including access to information, skills and finance (Vince et al., 2024); and
3. **integration**, that is, delivering through multilevel, cross-sectoral and polycentric governance (IPCC, 2022a) in line with the whole-of-government, all-hazards and whole-of-society approaches.

9.2. Improving integration in the EU policy framework

The EU's integrated policymaking approach to adaptation has resulted in cross-sectoral expansion.

The EU has pursued a form of integrated policymaking approach to climate change as part of the wider environmental policy integration since the early 2000s (Rietig, 2012). The cross-sectoral expansion has led to a wide range of EU legislation containing provisions on climate risk management (see also Table 3, Section 5.2). It covers framework laws such as the Water Framework Directive, along with legislation that strengthens EU resilience to crises, such as on critical entities (Directive (EU) 2022/2557) and transboundary health threats (Regulation (EU) 2022/2371). Related laws on energy, land use, biodiversity and economic governance also shape climate risk management by influencing local capacities, exposure and vulnerabilities. The Commission aims to continue with this approach by ensuring that the proposed integrated framework for climate resilience is coherent and synergistic with other EU initiatives and policies, while embedding climate resilience into the new MFF (EC, 2025b).

This approach has not resulted in sufficient action.

As elaborated in Chapter 4, while adaptation considerations are increasingly reflecting in policies, adaptation efforts are still out of pace with intensifying impacts and increasing risks (Biesbroek, 2021). The Commission consistently points out that 'the EU's and the Member States' climate adaptation policies and measures are insufficient' (EC, 2024e). This policy gap was highlighted by the Advisory Board in 2025 (Advisory Board, 2025b).

The first report on the implementation of the EU disaster resilience goals (EC, 2025h) sheds further light on 'the need for a more proactive, more comprehensive and better integrated approach to resilience and preparedness'. These conclusions are largely based on the findings of the first EUCRA (EEA, 2024a). In addition, in 2025, the European Court of Auditors pointed to the shortcomings in multilevel and cross-sectoral governance, whereas 'the priorities of the regional/sectorial plans sometimes conflicted with those of the EU/national strategies or plans, particularly regarding

agriculture and forestry. For example, the objective of increasing the irrigated area could conflict with the objective of reducing water consumption' (ECA, 2024).

The European Climate Law in its current form is not a sufficient overarching driver of the successful integration of adaptation into policymaking.

As an anchor point for the coordinated preparation of NAPs, the European Climate Law advances adaptation and resilience integration into policymaking across sectors and levels of governance (e.g. connecting the international level under the UNFCCC and national-level obligations). Among other measures, the European Climate Law (article 5.3) stipulates that EU institutions and Member States must ensure adaptation policies are coherent and mutually supportive, deliver co-benefits and integrate climate adaptation consistently across all policy areas – including socioeconomic, environmental and external actions, with a focus on the most vulnerable and impacted populations and sectors.

Despite this obligation, the European Climate Law – weakened by its lack of concrete adaptation targets (see Chapters 3 and 4) and the absence of supporting governance structures – is not, in its current form, a sufficient driver for integrating adaptation into policymaking (Advisory Board, 2025b).

This policy gap needs urgent attention as many climate impacts hurting Europe could have been reduced or avoided if more effective adaptation had been in place. This includes more adequate early warning systems relying on strong governance and institutional arrangements, as well as monitoring combined with timely warnings and strong response capacities to address increasingly extreme weather events and intensifying hazardous trends (Golding, 2022).

Horizontal principles, targets and procedures that enable cooperation within and across institutions and with all relevant stakeholders can help improve policy integration.

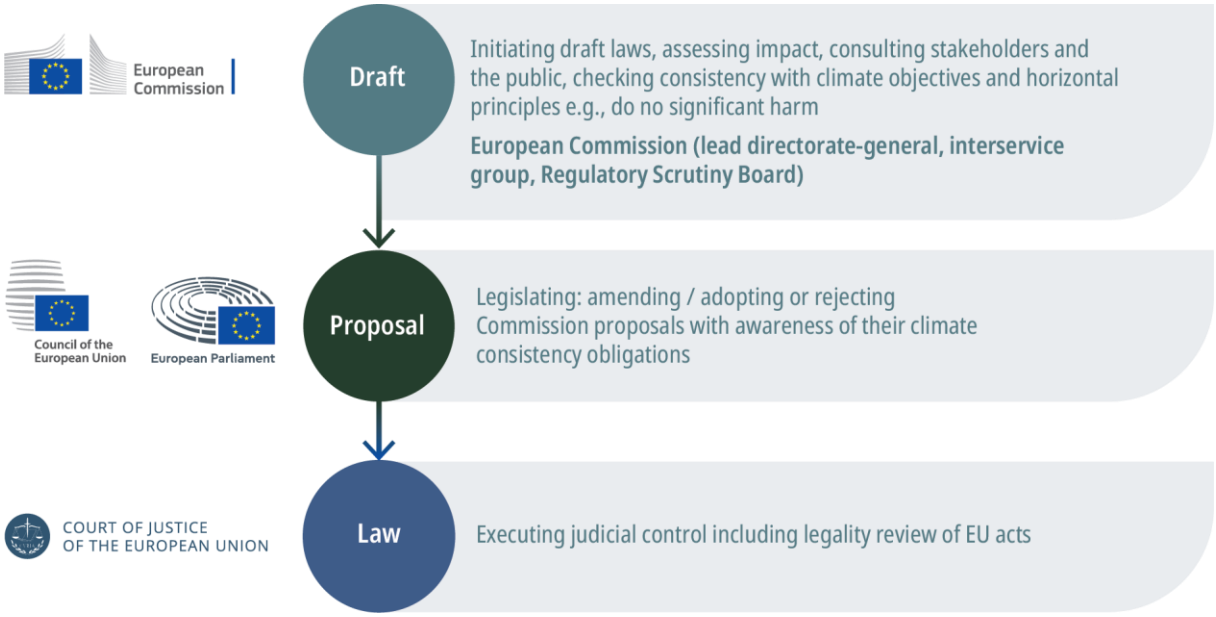
Cooperation and conflict resolution within the Commission and between EU institutions, across multiple governance levels, and through stakeholder and interservice consultations during the drafting of laws (see Figure 17) are essential for building consensus on contested interests, rather than imposing solutions or risking legal inconsistencies (Advisory Board, 2025b; Biesbroek and Lesnikowski, 2018).

The Commission's preparation of draft laws and the subsequent legislative process are guided by the horizontal principle of 'do no significant harm' (DNSH), which guides impact assessments and is supported by the climate consistency checks required under the European Climate Law. The relevant procedures and principles are defined in the Commission's toolbox developed under the Interinstitutional Agreement on Better Law-Making (EP et al., 2016). There is limited evidence on how effective this procedural requirement is overall or how consistently it is implemented by the Commission and its Regulatory Scrutiny Board, which oversees the quality of impact assessments and evaluations. Regarding climate consistency checks, the European Ombudsman has identified procedural shortcomings in how legislative drafts were prepared for the CSDDD (Omnibus I) and CAP (European Ombudsman, 2025). Even when effective, the current scopes of the climate consistency checks (see Chapter 3), and the applicable DNSH principle (see Section 9.3) are limited.

It remains to be seen how the consistency checks and the horizontal principles will be applied once the adaptation targets and the climate resilience by design principle are concretised at the EU level, and how the Commission services will deal with managing the synergies and trade-offs (McDonald and McCormack, 2021) between climate and sectoral policy objectives (see Figure 17). The forthcoming

revisions to the better regulation guidelines and toolbox, along with the wider climate-resilience framework, provide an opportunity to tackle these issues.

Figure 17 Key EU entities responsible for ensuring the consistency of EU laws with EU climate goals and horizontal principles



Notes: The interservice group is an internal Commission group, made up of representatives from different directorates-general; the Regulatory Scrutiny Board is an independent body within the Commission that scrutinises the quality of impact assessments, fitness checks and selected evaluations.

Source: Adapted from the better regulation toolbox (EC, 2023b).

To prevent future misalignment between intentions and action, the EU adaptation policy framework needs accountability frameworks that specify policy-consistent obligations and include effective compliance mechanisms.

Accountability for the relevant obligations helps to avoid a mismatch between intentions and action across the governance arrangements. Accountability requires clarity on what obligations are created, who is accountable to whom, how compliance is assessed and what consequences follow from non-compliance (Higham et al., 2021). These elements are crucial to ensuring that policy commitments go beyond rhetoric and translate into enforceable responsibilities. Yet, the existing adaptation efforts tend to be ambiguously embedded into broader governance structures, diluting responsibilities and accountability (Cairney, 2025; Runhaar et al., 2018), as it ends up weakened in the web of overlapping and competing policy objectives (Vij et al., 2018).

The overall gaps in governance cannot be bridged by EU-level strategies alone, for example the EU adaptation strategy (EC, 2021c) or EU preparedness Union strategy (EC and HR/VP, 2025b). Adaptation strategies are relatively weak coordination tools that cannot compel decision-makers to prioritise adaptation; they largely depend on sectors acting out of their own self-interest, driven by the pressures they face from climate impacts (Clar, 2019).

9.3. Mobilising climate resilience investment and supporting reform through economic governance and the long-term budget

The EU's progress towards climate resilience faces structural and resource-related challenges, especially at subnational levels.

The integration of adaptation into policymaking needs to overcome structural, resource-related and political challenges that systematically hinder policy coherence and implementation (Street et al., 2025). Persistent barriers include insufficient financial resources, lack of staff and technical expertise, inadequate coordination between administrative departments, poor access to adaptation knowledge, and conflicting political and sectoral interests (Runhaar et al., 2018). Resource constraints are particularly acute at subnational levels, where local authorities are tasked with ambitious goals but lack sufficient means to coordinate or deliver them (Pröbstl et al., 2025). This structural mismatch is reinforced by chronic underfunding, especially among municipalities (Brullo et al., 2024; see also Chapter 5). At the EU level, the resource constraints can be tackled through, among other things, the economic governance framework and the EU's MFF.

Within its economic governance framework, EU-level coordination between national policies encourages Member States to consider adaptation in their fiscal and structural planning.

The EU addresses structural and resource challenges at national and subnational levels through its economic governance framework, centred on the European semester. Since 2010, the semester has served as an annual planning cycle that aligns the timelines of multiple coordination processes, allowing national economic, social and budgetary policies to be assessed together (EC, 2026e). Designed to support coordinated action on shared challenges, it is increasingly relevant for climate resilience. Within this cycle, the Commission analyses key economic and social issues across the EU and informs the Council, which then issues policy guidance to Member States to strengthen competitiveness, prosperity, and resilience[12] (EC, 2025a).

Under the semester, the EU-level guidance provided through country-specific recommendations (CSRs) can encourage Member States to consider adaptation in their budgetary, investment and infrastructure planning (EP, 2025). Nearly half[13] of the 27 recommendation reports issued to Member States in July 2025 (Council of the EU, 2025c) include explicit climate risk diagnoses and advice. For example, one of the CSRs adopted in July 2025 recommends that a Member State 'address climate-related risks and mitigate their economic impact, through more institutional coordination, nature-based solutions and climate insurance coverage' (Council of the EU, 2025a). All Member States are invited to implement their respective CSRs, with the euro-area countries expected to use them when preparing their annual budgets. Since 2024, under the new governance framework, the CSRs are expected to guide the new medium-term fiscal-structural plans of all Member States (EU, 2026).

While some progress in integrating climate resilience into national budgetary frameworks has been made, the EU's economic governance does not fully incorporate the all-hazards risk management approach and the need to align financial flows with climate resilience.

Acknowledging the link between climate hazards and the EU's economic stability is a step in the right direction. It is also positive that in 2024, the EU updated its budgetary framework rules for Member

12 In the context of the European Semester, the term 'resilience' tends to refer to societal resilience and economic growth, regardless of the nature of the setbacks.

13 Belgium, Croatia, Cyprus, Germany, Greece, Hungary, Ireland, Italy, Poland, Portugal, Slovakia, Slovenia and Spain.

States (Council Directive 2011/85/EU) to better integrate climate-related fiscal risks. Starting in 2026, all Member States must assess and report in their budget documents how climate change could affect medium- and long-term public finances, including disaster-related liabilities and fiscal costs. These requirements aim to improve the understanding and management of climate impacts on national budgets, encourage more proactive, risk-aware budgeting and support evidence-based policy and investment decisions (EC, 2025c).

However, the current economic governance framework falls short of both the all-hazards risk management approach and the overall commitment to aligning financial flows with climate resilience, i.e. shifting financial flows and investment away from potentially maladapted activities towards those that contribute to climate-resilient economies and societies (OECD, 2022). For example, defence-related CSR and spending rules are formulated in isolation from climate security considerations (Box 10), focusing instead on immediate security challenges arising from geopolitical tensions (see, for example, (European Fiscal Board, 2025).

Amakrane and Biesbroek (2024) found that Member States rarely make a link between climate and defence policies, even though these links are increasingly well understood in the literature and their importance recognised at the EU level, for example in the Commission's Joint communication on the climate–security nexus (EU, 2023), the report by Sauli Niinistö (2024) and the EU preparedness Union strategy (EC and HR/VP, 2025b). In the context of the massive investment mobilisation across the EU (see Box 10), the lack of an integrative approach in defence and adaptation policies will likely lead to further fragmentation of EU preparedness and resilience efforts, locking the EU into:

- maladaptive investments (e.g. military installations and mobility plans based on outdated climatic information);
- forgone synergies between military and civil protection, for instance military logistics inapt to support climate-hazard responses (Krampe, 2025; Middendorp, 2022) and
- a widened funding gap in adaptation and mitigation due to a lower availability of funding.

Box 10 EU's fragmented approach to security: the case of defence and adaptation investment

As outlined in the EU defence readiness roadmap presented by the Commission in October 2025 (EC and HR/VP, 2025a), the EU is planning to leverage over **EUR 800 billion between 2025 and 2030 in defence spending** through: national fiscal flexibility, a new EUR 150 billion loan instrument (Security Action for Europe) for joint procurement, the redirection of cohesion funds and expanded EIB support (EPRS, 2025a). Defence spending aims to increase military capabilities (i.e. investment in new military equipment, infrastructure and personnel) to deter aggression (EC and HR/VP, 2025a).

The **multiple synergies and trade-offs between defence investment and climate risk management** (Elveren, 2025; Middendorp, 2022; Von Boemcken and Bolaños Suárez, 2025) are not explicitly addressed within the roadmap. Similarly, while the Commission's proposed defence readiness omnibus (EC, 2025q) seeks to foster critical value and supply chains as well as synergies between civil and defence innovation, for example in AI and connectivity, it does not consider the overlapping needs between defence and climate security.

Regarding **national spending**, most Member States run a significant public debt, often exceeding the limits set by the EU's fiscal rules (Larch et al., 2023). Under the Stability and Growth Pact (Regulation (EU) 2024/1263), the Member States can use a national escape clause for additional budgetary flexibility to boost defence spending. Within the European semester, it is recommended that Member States 'activate the national escape clause in a coordinated

manner to support the EU efforts to achieve a rapid and significant increase in defence spending', but the integrated all-hazards approach to risk management is not explicitly encouraged. Sixteen Member States have activated the clause as of October 2025 (Council of the EU, 2025e),

Regarding the **long-term EU budget**, the EU's Security Action for Europe programme, launched in 2025, will make up to EUR 150 billion available in loans to Member States investing in defence capabilities, and the European Defence Fund has a budget of nearly EUR 7.5 billion. The funding conditions are not linked to climate risk management (Council of the EU, 2025b), apart from the European Defence Fund's aim to contribute to the mainstreaming of climate measures with around 4 % of its budget until 2024 (i.e. around EUR 180 million; (EC, 2025g). In addition, the proposed MFF increases the budget for the defence sector but excludes it from the DNSH requirement and the climate spending goal (Article 5, (EC, 2025x). These exclusions suggest the EU perceives the defence and climate resilience objectives as potentially conflicting rather than synergetic (Engström and ECFR, 2025).

The EU integrates adaptation and resilience into its long-term budgetary framework by setting an overarching spending target contributing to climate objectives.

Within the EU long-term budget, the EU has largely relied on mainstreaming to mobilise public funding for climate- and environment-related objectives, including for adaptation. Advanced since 2014, mainstreaming requires EU funding programmes in all policy areas to consider climate priorities in their design, implementation and evaluation phases (EC, 2026b). The 2021–2027 MFF set a target for at least 30 % of funding to contribute to climate mitigation and/or adaptation objectives, along with a 37 % climate spending target under the Recovery and Resilience Facility.

Funding for adaptation in various contexts is therefore available through a range of cross-cutting and sectoral programmes, especially the cohesion policy funding, CAP, Horizon Europe and the LIFE programme (EC, 2021c). A small number of programmes directly fund adaptation measures as a core objective, such as the Horizon Europe Mission on Adaptation fostering multilevel governance (see Box 11).

Determining the contribution of EU spending to adaptation remains challenging.

Overall, climate mainstreaming under the current MFF is projected to contribute around EUR 662 billion to climate objectives over 2021–2027, representing about 34% of the EU long-term budget, according to a recent study carried out for the Commission (EC, 2026a). Within this amount around one fifth (around EUR 139 billion) is cautiously identified as adaptation spending (EC, 2026a). When climate-relevant expenditure delivering adaptation benefits but not specifically tagged as adaptation is included, the study estimates that adaptation-relevant spending could reach up to EUR 231 billion, equivalent to around 12% of the total 2021-2027 EU budget envelope (EC, 2026a). While not directly comparable, estimates from other sources and programmes generally point to much smaller contributions, in the order of 1-3% of EU spending[14]. In practice, determining the contribution of EU spending to adaptation remains subject to high uncertainty, particularly due to budget tracking limitations, as will be outlined below.

14 The European Court of Auditors (2024) estimated that EUR 14 billion of spending across Cohesion, LIFE, and research funds (1% of the 2021-2027 MFF), and 12 billion in the Recovery and Resilience Facility (2%), were flagged as adaptation spending. A report by the European Parliament (2024) estimate that 3% of the Cohesion Policy funding contributes to adaptation.

Box 11 Examples of EU funding for mission-led adaptation in the urban and territorial contexts

The **EU Mission on Adaptation to Climate Change**, established in 2021 under Horizon Europe, supports 'all stakeholders committed to building climate resilience' (EC, 2026c). Its objective is to support at least 150 regions and communities towards achieving climate resilience by 2030. Climate-ADAPT platform acts as the mission knowledge hub for regions and local authorities to strengthen adaptation planning, develop adaptation projects and include stakeholders in planning and implementation.

The **Mission on Climate Neutral and Smart Cities** is mitigation-focused but also works as a vehicle to deploy concrete adaptation solutions in selected cities. A 2023 joint funding opportunity between this mission and the Mission on Adaptation to Climate Change covered urban greening and re-naturing for urban regeneration, resilience and climate neutrality (EC, 2026d)

The **Covenant of Mayors**, supported directly by the European Commission's budget, requires cities and smaller municipalities to commit to increasing resilience and preparing for adverse climate change impacts. Signatories benefit from technical guidance, feedback on their sustainable energy and climate action plans and access to knowledge resources (EEA, 2024b).

The impact of the next MFF hinges on mainstreaming of adaptation across all financial flows amid budget and programme uncertainties.

The proposed 2028-2034 MFF retains a spending target approach, setting an overall goal of at least 35% of expenditure, excluding defence and security, towards climate mitigation, adaptation or environmental objectives (EC, 2025x). This merges the previous 30 % climate target and 10 % biodiversity target. While this integration could encourage projects delivering joint climate and nature benefits, it risks diminishing the visibility or priority given to some projects and objectives. Importantly, synergies between mitigation, adaptation and biodiversity are not automatic. For example, monoculture forestry for carbon sequestration may lack adaptation and nature benefits (EEA, 2025e).

In addition, there is uncertainty around the future of key funding programmes dedicated to climate and environment, such as LIFE, which under the Commission's proposal would be subsumed into the broader MFF architecture. In addition, due to the massive increase in defence spending (see also Box 10) and the size of the Recovery and Resilience Facility repayment, the actual funding to which the climate spending target applies may also be lower than in the current financial framework.

The new approach to the spending targets is not necessarily a major concern, however. Progress towards climate resilience requires more than increasing adaptation-specific funding; it demands mainstreaming adaptation across all financial flows. In this context, the spending target complements a broader systemic shift away from investment that undermines resilience and towards that which supports climate-resilient development, as mandated by Article 2.1(c) of the Paris Agreement.

Weak identification and tracking of adaptation spending under the current MFF undermine EU climate ambitions, prompting proposed methodological improvements for the next MFF.

The low adaptation contribution under the current MFF reflects challenges in identifying adaptation measures more generally, along with weaknesses and a lack of granularity in the budget tracking methodology used in the MFF (Advisory Board, 2024b; ECA, 2024). The tracking is considered a fundamental challenge undermining EU's climate ambitions, for example by leading to overestimation in the CAP contribution to adaptation and resilience (Advisory Board, 2024b; Reininger, 2021).

Ultimately, inappropriate budget tracking hinders the capacity to assess how climate resilience is mainstreamed in EU funding (see also Chapter 3).

Changes to the tracking methodology proposed under the 2028–2034 MFF aim at improving its granularity, such as through the disaggregation of spending coefficients for (i) mitigation and (ii) climate adaptation and resilience (EC, 2025x).

So far, the measured effectiveness of EU spending on climate resilience shows mixed results, with some reported cases of maladaptive projects.

Due to the limitations in tracking outlined above, the actual overall effects of EU spending on climate resilience are difficult to measure and therefore remain unclear. To get some specific insight, the European Court of Auditors (2024) examined a sample of 36 EU-funded adaptation projects. It found that only 19 of these projects addressed climate risks effectively. The remainder did not increase adaptive capacity or reduce vulnerability, and some were even maladaptive. Adaptation measures often clashed with other policy objectives (e.g. economic competitiveness, regional development), leading to inadequate planning and design, such as investing in artificial snow cannons to boost seasonal tourism instead of developing year-round tourism strategies (ECA, 2024).

Similarly, an evaluation of the 2014–2020 CAP highlighted that CAP spending was generally not designed in line with adaptation objectives, meaning that most identified adaptation effects were largely unintended. In some cases, the CAP contributed to maladaptation (e.g. by subsidising water-intensive crops in water-stressed regions), pointing to issues with policy consistency (EC, 2019).

Alongside the spending target, the EU integrates adaptation into its long-term budget through a principles-based approach. If applied effectively, the approach could help align EU financial flows with climate resilience objectives.

The climate and environment spending targets are supported by another mainstreaming tool that aims to ensure that wider EU spending effectively contributes to, or at least does not harm, climate and environment goals. Most notably, a significant share of EU spending is required to comply with the DNSH[15], applied as an eligibility criterion at project or programme level. Since 2024, the principle has been embedded in Article 33 of the Financial Regulation governing the overall EU budget, stating that:

> 'programmes and activities shall, where feasible and appropriate in accordance with the relevant sector-specific rules, be implemented to achieve their set objectives without doing significant harm to the environmental objectives of (…) climate change adaptation (…).' (Regulation (EU, Euratom) 2024/2509)

To comply with the DNSH on adaptation, it suffices that the activity or programme does not increase the negative impacts of climate change on people, nature or assets (EC, 2023c). The principle also extends to the Recovery and Resilience Facility, a requirement that Member States have welcomed as both important and impactful (EC, 2024d).

However, ensuring that EU funding at least avoids maladaptation represents a minimal standard, underscoring an ambition gap in the current approach. As the applicability of DNSH to EU funding depends on sector-specific rules, there are inconsistencies and a lack of coordination in how it has been applied to EU spending (EC, 2024b, 2023f; Famà, 2025). In addition, actors involved in the

15 This approach to EU funding mirrors the rules in Article 9 of the EU Taxonomy Regulation, which in turn is inspired by the 'no-harm' principle in customary international law (Kentache, 2024).

implementation of the Recovery and Resilience Facility and InvestEU programmes have pointed to the heavy administrative burden linked to the different approaches to sustainability proofing, which includes the DNSH principle alignment (EC, 2024c).

Apart from the DNSH principle, the climate proofing of infrastructure and EU values and principles also apply to EU spending.

In terms of sector-specific rules, several EU funding programmes, such as InvestEU, the Connecting Europe Facility (CEF), the cohesion policy funds and the Just Transition Fund, require the climate proofing of the relevant infrastructure projects. To support climate proofing, the Commission has issued technical guidance, which involves, among other criteria, the use of climate scenarios (EC, 2021a). Effects of the climate proofing have yet to be assessed, with initial anecdotal evidence pointing to implementation successes but also challenges (GreenGov - Interreg, 2025; MIP4Adapt, 2025). It is also unclear how stringent the climate-proofing requirement is, for example the CEF transport programme has applied it since 2023 (CINEA, 2021), and the CEF energy 2025 call document does not link to climate proofing or broader climate resilience in the project eligibility criteria (CINEA, 2025). Beyond the updating of the climate-proofing guidance as part of the integrated framework for climate resilience, the Commission intends to integrate climate adaptation and resilience considerations into European standards for the design of infrastructure with a life cycle of more than 30 years, such as power stations or railways (EC, 2024e).

In addition to the DNSH and climate proofing, Article 6 of the Financial Regulation tasks the Member States and the Commission with ensuring that the budget is spent according to the values and principles set out in the EU treaties and Article 2 TEU in particular (see Chapters 3 and 6). These include the rule of law principle that 'requires that all public powers act within the constraints set out by law, in accordance with the values of democracy and the respect for fundamental rights'. Since 2021, a dedicated regulation has established accountability measures such as suspending, interrupting or correcting payments if the rule of law is not upheld (Regulation (EU, Euratom) 2020/2092).

The horizontal principles-based approach is expected to be continued and expanded to climate resilience by design in the next MFF, but its consistent application remains uncertain.

The Commission's proposal for the 2028–2034 MFF requires the DNSH principle to apply across the EU budget, accompanied by future guidance on the proposed application of the principle (EC, 2025x). However, there is a risk that large parts of the EU budget will be subject to inconsistent or ineffective requirements, due to the proposed exemptions of certain spending categories, notably defence and security activities (EC, 2025x), and because rules for agriculture spending would depend on the yet-to-be-defined national 'farm stewardship requirements' (EC, 2025z),

This inconsistency could be addressed by the proposed climate resilience by design principle proposed by the Commission (EC, 2025x) and endorsed by the Council (Council of the EU, 2025d). The Commission defines this principle as a proactive effort to consider and prevent plausible high-impact risks and losses from the very beginning when conceiving policies, investments and other measures (EC, 2025t). It proposed this principle to:

> 'ensure that relevant programmes and activities support reforms and investments that strengthen disaster risk and crises management, invest in climate resilience, enhance the resilience of vital societal functions, and build a more resilient, secure, and prepared societies (EC, 2025x).'

This emerging principle could align EU policies and investments with climate resilience - provided its scope, obligations, coherence, and accountability are clearly defined.

The effectiveness of the climate resilience by design principle, which could leverage anticipatory and proactive approaches in policy (see Section 9.2) and investment decision-making, depends on how EU policymakers will address the following aspects:

- connection to the common reference and harmonised climate scenarios, ensuring that all policies and measures are planned and implemented based on a robust identification of risks;
- the scope of its application being reflective of the whole-of-government, whole-of society and all-hazards approaches, for example its direct application to all relevant EU policies and funding, including in agricultural sector;
- the clarity of the resulting obligations and responsibilities of public and private stakeholders, for example adjusting the conditions under an EU funding programme based on a relevant climate risk assessment using common climate scenarios (see Chapter 5);
- the shared understanding of the principle's relevance to climate impacts and risks, given that references to climate resilience by design (EC, 2025x); Council of the EU, 2025) are not always explicit in recent Commission proposals, for example emphasis is placed on preparedness by design in the MFF documentation (EC, 2025f, 2025s) and security and resilience by design in the grids package (EC, 2025n);
- consistency and synergies with other horizontal tools, for example the DNSH principle, the fairness assessment (see Chapter 7), spending targets and tracking and the ease of administrative compliance;
- accountability mechanisms to measure how it is implemented and how to deal with non-compliance (EC, 2025f), for example funding suspension for a non-compliant project or legal amendments to a non-compliant act.

EU adaptation investment faces many challenges, including limited expertise and a lack of institutional readiness that can be addressed through targeted technical assistance and capacity building.

Limited agency, capacity and knowledge remain major barriers to accessing and using targeted EU adaptation funding, a problem observed across governance levels and sectors (ECA, 2024). These barriers include insufficient information and skills for preparing funding applications, along with low administrative capacity and political leadership (Advisory Board, 2024b; Bachtler et al., 2024; EEA, 2025a; EP, 2024; Venner et al., 2025a). An evaluation of the EIB's adaptation finance (2015–2020) identified similar capacity challenges within both the EIB and its clients (EIB, 2021a). In response, the EIB combined higher spending ambitions with stronger upstream engagement and targeted knowledge- and capacity-building measures (see Box 12) (EIB, 2021b).

Since limited capacity to obtain funding often reflects broader economic and social vulnerabilities, EU adaptation funding may inadvertently fail to reach the most vulnerable populations and regions (Bachtler et al., 2024; Venner et al., 2025a, 2025b); see also Chapter 7). If applied across all sectors, climate resilience by design could help address challenges in accessing EU funding for adaptation and enable measures that are adequate for regional and local vulnerability hotspots. Even so, dedicated capacity building will be essential for their effective implementation (see Box 12).

Box 12 Overcoming knowledge and capacity barriers: the EIB's progress on adaptation finance

As a pivotal part of EU climate governance (Mertens and Thiemann, 2023), the EIB has adopted a climate bank roadmap and the EIB climate adaptation plan to guide its investment decisions and operations (EIB, 2021b).

In the first phase set by the roadmap 2021–2025 (EIB, 2020) the EIB aimed to grow the share of the EIB climate action for adaptation to 15 % of EIB's climate finance by 2025. The bank allowed higher rates for its co-financing of adaptation-focused investments compared to standard practice. In addition, it provided training to develop in-house awareness and expertise, engaged upstream and organised outreach events. These actions have shown positive results: climate adaptation funding has more than tripled in three years – rising from EUR 1.3 billion in 2021 to EUR 4.6 billion in 2024 (EIB, 2025b). As a share of the EIB's overall climate action financing, climate adaptation has risen from 5 % in 2021 to 10.7 % in 2024, although the share has been diluted due to the take-up of the REPowerEU financing by the EIB in 2022.

The second phase of the climate bank roadmap (2026–2030) commits to an aggregate of EUR 30 billion of finance for climate adaptation over the 2026–2030 period. The bank plans to support sectors and regions most affected by climate change, particularly agriculture, land use, oceans and integrated water management. It will also channel financing to SMEs through banking partners and prioritise assistance for climate-vulnerable cities and regions via cooperation with national and multilateral development banks (EIB, 2025a).

The EIB's climate adaptation plan (EIB, 2021b) lists the tools and practices that help the EIB overcome knowledge and capacity barriers in scaling up adaptation finance. These include the assessment of physical climate risks across all direct lending operations; technical and financial support throughout the project cycle to strengthen adaptation design and implementation; early engagement with national and local authorities to build bankable project pipelines; the tracking of adaptation investment through process, output and results-based indicators; collaboration with climate service providers, research institutions and financial actors to enhance data access, the sharing of best practices; the mobilising of finance; and build-up of internal knowledge, skills and training to strengthen institutional capacity.

Overall, the EIB approach to adaptation finance aligns with the needs of multilevel, polycentric and cross-sectoral policy integration, with attention to both the problem definition (e.g. using climate risk assessments) and delivery methods (e.g. capacity building). The EIB expects to update its climate adaptation plan in response to the European integrated framework for climate resilience due in 2026.

Acronyms and abbreviations

CAP	Common Agricultural Policy
CRCF	Carbon Removals and Carbon Farming (certification framework)
CSR	Country-specific Recommendation
CSDDD	Corporate Sustainability and Due Diligence Directive
CSRD	Corporate Sustainability Reporting Directive
EBA	European Banking Authority
EC	European Commission
ECA	European Court of Auditors
ECB	European Central Bank
EIB	European Investment Bank
EIOPA	European Insurance and Occupational Pensions Authority
EUCRA	European Climate Risk Assessment
DNSH	Do no significant harm
GGA	Global Goal on Adaptation
LULUCF	Land Use, Land Use Change and Forestry
MEL	Monitoring, Evaluation and Learning
MFF	Multiannual Financial Framework
NAP	National Adaptation Plan
NAS	National Adaptation Strategy
NECP	National Energy and Climate Plan
RCP	Representative Concentration Pathway
SDG	Sustainable Development Goal(s)
SSP	Shared Socioeconomic Pathway
TEU	Treaty on European Union
TFEU	Treaty on the Functioning of the European Union
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

Glossary

Adaptation limits	The point at which an actor's objectives (or system needs) cannot be secured from intolerable risks through adaptive actions. This can refer to hard limits – no adaptation options are possible – and soft limits – options may exist but are currently not available due to e.g. institutional, financial, social and cultural barriers.
Adaptation options	The array of strategies and measures that are available and appropriate for addressing adaptation. They include a wide range of actions that can be categorised as structural, institutional, ecological or behavioural.
Adaptation	In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects.
Adaptive capacity	The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities or to respond to consequences.
Adaptive governance	An emerging term in the literature for the evolution of formal and informal institutions of governance that prioritise social learning in planning, implementation and evaluation of policy through iterative social learning to steer the use and protection of natural resources, ecosystem services and common pool natural resources, particularly in situations of complexity and uncertainty.
Build Back Better	The use of the recovery, rehabilitation and reconstruction phases after a disaster to increase the resilience of nations and communities through integrating disaster risk reduction measures into the restoration of physical infrastructure and societal systems, and into the revitalisation of livelihoods, economies and the environment. Associated emerging concepts are "build back different" and "build back elsewhere" to highlight the opportunity for transformational approaches in a post-disaster setting.
Cascading and compounding risks	Cascading impacts from extreme weather/climate events occur when an extreme hazard generates a sequence of secondary events that result in physical, natural, social or economic disruption, with the resulting impact being significantly larger than the initial impact. While cascading risks often stress the potential for a chain reaction, compounding risks stress the potential for the amplification of multiple overlapping hazards, without presupposing a causal link between the hazards.
Climate governance	The structures, processes and actions through which private and public actors seek to mitigate and adapt to climate change
Climate hazard	Climate condition with the potential to harm natural systems, people or society. Examples include heatwaves, droughts, heavy snowfall events and sea level rise.

Climate proofing	In EU law, it refers to a process that integrates climate change mitigation and adaptation measures into the development of infrastructure projects. It enables European institutional and private investors to make informed decisions on projects that qualify as compatible with the Paris Agreement.
Cross-border effect	Effects originating in one country and experienced by one or more other countries.
Disaster risk management	Processes for designing, implementing, and evaluating strategies, policies, and measures to improve the understanding of disaster risk, foster disaster risk reduction and transfer, and promote continuous improvement in disaster preparedness, response, and recovery practices, with the explicit purpose of increasing human security, well-being, quality of life, and sustainable development.
Disaster	A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts.
Exposure	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.
Impacts (consequences, outcomes)	The consequences of realised (climate-induced) risks on natural and human systems e.g. effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure.
Incremental adaptation	Adaptation that maintains the essence and integrity of a system or process at a given scale. Incremental adaptations to changes in climate are understood as extensions of actions and behaviours that already reduce the losses or enhance the benefits of natural variations in extreme weather/climate events.
Losses and damages	Impacts of climate change that have not been, or cannot be, avoided through mitigation or adaptation efforts. Losses and damages can result from both sudden-onset events (e.g. cyclones, heatwaves and flooding) and slow-onset events (e.g. sea-level rise, increasing temperatures and desertification).
Mainstreaming	In adaptation literature, it refers to the process of embedding crosscutting policy issues across typically compartmentalised institutional sub-systems (e.g. across sectoral regulation). Also referred to as policy integration.
Maladaptation	Actions that may lead to increased risk of adverse climate-related outcomes, including via increased greenhouse gas (GHG) 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.
Nature-based solutions	Actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.

Pathways	The temporal evolution of natural and/or human systems towards a future state. Pathway concepts range from sets of quantitative and qualitative scenarios or narratives of potential futures to solution-oriented decision-making processes to achieve desirable societal goals. Pathway approaches typically focus on biophysical, techno-economic, and/or socio-behavioural trajectories and involve various dynamics, goals, and actors across different scales.
	Adaptation pathways: A series of adaptation choices involving trade-offs between short-term and long-term goals and values. These are processes of deliberation to identify solutions that are meaningful to people in the context of their daily lives and to avoid potential maladaptation.
	Climate-resilient pathways: Iterative processes for managing change within complex systems in order to reduce disruptions and enhance opportunities associated with climate change.
	Emission pathways: Modelled trajectories of global anthropogenic emissions over the 21st century.
	Representative Concentration Pathways (RCP): Scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases (GHGs) and aerosols and chemically active gases, as well as land use/land cover. The word representative signifies that each RCP provides only one of many possible scenarios that would lead to the specific radiative forcing characteristics. The term pathway emphasises that not only the long-term concentration levels are of interest, but also the trajectory taken over time to reach that outcome.
	Shared socio-economic pathways (SSP): Shared Socio-economic Pathways have been developed to complement the RCPs. Different levels of emissions and climate change along the dimension of the RCPs can hence be explored against the backdrop of different socio-economic development pathways on the other dimension in a matrix.
Residual risk	The risk related to climate change impacts that remains following adaptation and mitigation efforts. Adaptation actions can redistribute risk and impacts, with increased risk and impacts in some areas or populations, and decreased risk and impacts in others.
(Climate) resilience	The capacity of social, economic and environmental systems to cope with climate hazards, responding or reorganising in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation. As a policy goal, it often implies both the result of and capacity for adaptation.
(Climate) risk	The potential for adverse consequences for human or ecological systems, resulting from the interaction of vulnerability, exposure, and hazard. This potential recognises the diversity of values and objectives associated with such systems. In the context of climate change, risks can arise from potential impacts of climate change, as well as human responses to climate change.
Risk assessment	The qualitative and/or quantitative scientific estimation of risks.

Risk ownership	Governance concept that, in the EU adaptation context, defines the responsibility for managing climate risks, particularly the division of responsibility between the European Union and its Member States. It is strongly related to accountability.
Tipping points	A critical threshold beyond which a system reorganises, often abruptly and/or irreversibly.
Transboundary risk/ impact	Risk or impact that propagates through interconnected systems such as trade, finance, ecosystems, infrastructure and human mobility, usually leading to cross-border effects.
Vulnerability	The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

Consulted organisations and experts

During the analysis, the Advisory Board consulted experts from the following organisations:

- European Commission Directorate-General for Climate Action
- European Environment Agency
- Copernicus Climate Change Service
- European Central Bank
- European Investment Bank
- Climate Legal Network
- United Nations University, Institute for Environment and Human Security
- UK Climate Change Committee
- Robbert Biesbroek, Wageningen University
- Timo Leiter, Grantham Research Institute
- Paul Watkiss, Stockholm Environment Institute
- Mikael Allan Mikaelsson, Stockholm Environment Institute
- Johan Munck af Rosenschold, Finnish Environment Institute (Syke)

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