EEA Report | No11/2022

Advancing towards climate resilience in Europe — Status of reported national adaptation actions in 2021

European Environment Agency

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Key messages

Climate-related hazards, vulnerabilities and risks

- Despite the variation in current and future climate change impacts across Europe, there are no significant differences between the key sectors affected in different Member States. Health, agriculture and food, forestry, water management and biodiversity are most often reported.
- New, multi-sectoral risk assessments were reported by a significant number of countries. However, they were complemented frequently by risk assessments that are sector-based or thematically-focused studies in scope.
- Legal requirements or political commitments to institutionalise periodic updating of national climate risk assessments are in place in several Member States. However, their systematic, comprehensive and regular renewal is the exception rather than the rule.

Adaptation policies and priorities

- Various policy instruments addressing climate change adaptation have been adopted. They reflect each country's specific national circumstances in terms of governance structure and institutional frameworks.
- Most countries still rely on rather soft policies without legally-binding commitments, and on voluntary, informal, non-hierarchical cooperation. More and more Member States are using national climate laws to have more stringent legal instruments available to enforce their adaptation objectives and strategies.
- The social justice aspects of adaptation are not yet integrated in all countries. However, these increasingly important aspects aim to address the uneven distribution of climate risks, which affect vulnerable groups the most.

Adaptation governance

- The diversity of institutional arrangements and processes for steering adaptation policies across different government levels and sectors has increased, depending strongly on countries' overall governance set-up.
- Legal requirements to enforce horizontal policy integration are in place in only a minority of countries. The situation is the same for binding vertical governance frameworks engaging regional and local authorities into adaptation planning.
- Effective, multi-level governance embodies a variety of networks and a set of collaborative mechanisms across sub-national governments. Those networks and collaborations play an essential role in supporting local governments to develop and implement their local adaptation strategies and action plans.

Implementation and financing

- Mainstreaming of climate change adaptation into sectoral policies and regulatory frameworks is increasing. Adaptation is becoming an integral part of agricultural, urban, water, and disaster risk management policies, and sustainable development. Despite being embraced at the project level, integration into strategic environmental impact assessments at the programme or plan level is only partial when adaptation is mainstreamed.
- The most reported measures deal with increasing adaptive capacity: activities that support awareness raising, capacity building, education and training, strategic project implementation, and adaptation at regional and local levels.
- Only a minority of national adaptation strategies and plans have budgets earmarked for financing the implementation of adaptation actions. Most Member States do not have dedicated national funds to finance the implementation of national or sectoral adaptation plans.

Monitoring, reporting and evaluation

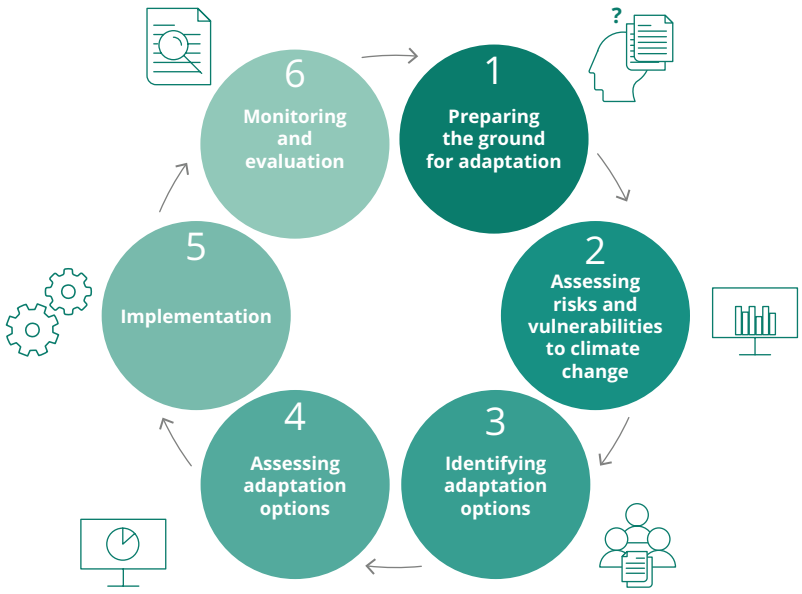
- Monitoring, reporting and evaluation (MRE) is mainly used for the following three objectives: to gain a better understanding of policy implementation, to identify climate risks, and to measure the effectiveness of policies in reducing climate change impacts, risks and vulnerabilities.
- Using various methodological approaches and combining qualitative and quantitative data are key for effective MRE. However, few Member States report using or planning to use mixed methods, or participatory and indicator-based approaches to MRE.
- MRE has the potential to influence decision-making throughout the adaptation policy cycle. However, few Member States explicitly report how MRE is supposed to feed back into policy. More careful consideration of the role of MRE in the adaptation policy cycle would be beneficial.

Executive summary

This EEA report provides an overview of how all EU Member States and Türkiye are adapting to climate change and are reporting on their adaptation actions. The report summarises how these countries are progressing through the adaptation policy cycle. It gives a snapshot of the situation in 2021, but where possible, compares this with earlier information to describe progress throughout recent years.

By 15 March 2021, Member States had reported information on their national adaptation actions to the European Commission, following the provisions of Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action (GovReg), for the first time. Non-EU EEA member countries were invited to provide the same information on a voluntary basis. The information reported by EU Member States and Türkiye was presented in a structured way in the country profiles on Climate-ADAPT (2022b). To provide a consistent overview of the reporting, the information in this report is structured in accordance with the steps in the Adaptation Support Tool (Figure ES.1). The report assesses what was reported under the selected elements of the GovReg reporting and how these elements were interpreted by country (but does not perform a compliance check).

Figure ES.1 **Adaptation policy cycle, based on the Climate-ADAPT Adaptation Support Tool**



Source: Climate-ADAPT (2022a).

Countries are at different stages along the adaptation policy cycle, implementing their national adaptation strategies (NASs), national adaptation plans (NAPs), sectoral adaptation plans (SAPs) or regional adaptation plans (RAPs) — while facing different national and sub-national policy contexts and climate risks. Because of the heterogeneity of the information provided and potentially different interpretations of it, this EEA report has to be seen as a **baseline assessment**. This is also because the report reflects the first round of reporting, following a new schema that is going to improve over time.

The EU strategy on adaptation to climate change (EC, 2021b) sets out how the EU can adapt to the unavoidable impacts of climate change and become climate resilient by 2050. The strategy is guided by four principles: to make adaptation smarter, swifter and more systemic, and to step up international action on adaptation to climate change. The policy was published only a few weeks before the 2021 reporting concluded, in February 2021. Although Member States did not reflect on the four principles of this strategy in their reporting, some preliminary observations can be made related to the EU ambition anchored in the strategy on adaptation to climate change.

Climate-related hazards, vulnerabilities and risks

The knowledge base on risks has progressed over time because of advances in all kinds of climate risk assessments (CRAs) — be they national, sectoral or sub-national CRAs. Heatwaves, droughts, floods, heavy precipitation and changing temperatures are the most frequently reported climate-related hazards, and only very few are specific to a geographical area. Health, agriculture and food, forestry, water management and biodiversity are most often reported as key affected sectors, without significant differences between European regions.

Almost all countries report recent efforts and further progress on enhancing and updating their CRAs to inform adaptation policy development. This underpins the earlier finding that substantial progress has been achieved in recent years. Centrally-coordinated CRAs predominate, but sector-driven, project-based and bottom-up scientific assessment initiatives also occur. Over time, many countries have renewed, complemented and deepened existing multi-sectoral risk assessments with more targeted sectoral, thematic and issue-specific assessments. These more targeted CRAs are the most frequently conducted assessments over recent years.

Knowledge gaps related to non-climatic factors, cross-border and international climate risks, cross-sectoral interactions and complex, compound and cascading risks tend to persist. Addressing these knowledge gaps is needed to pave the way for more systemic adaptation.

Legal requirements or political commitments to institutionalise periodic updating of national CRAs are in place in a number of Member States. However, their systematic, comprehensive and regular renewal is the exception rather than the rule.

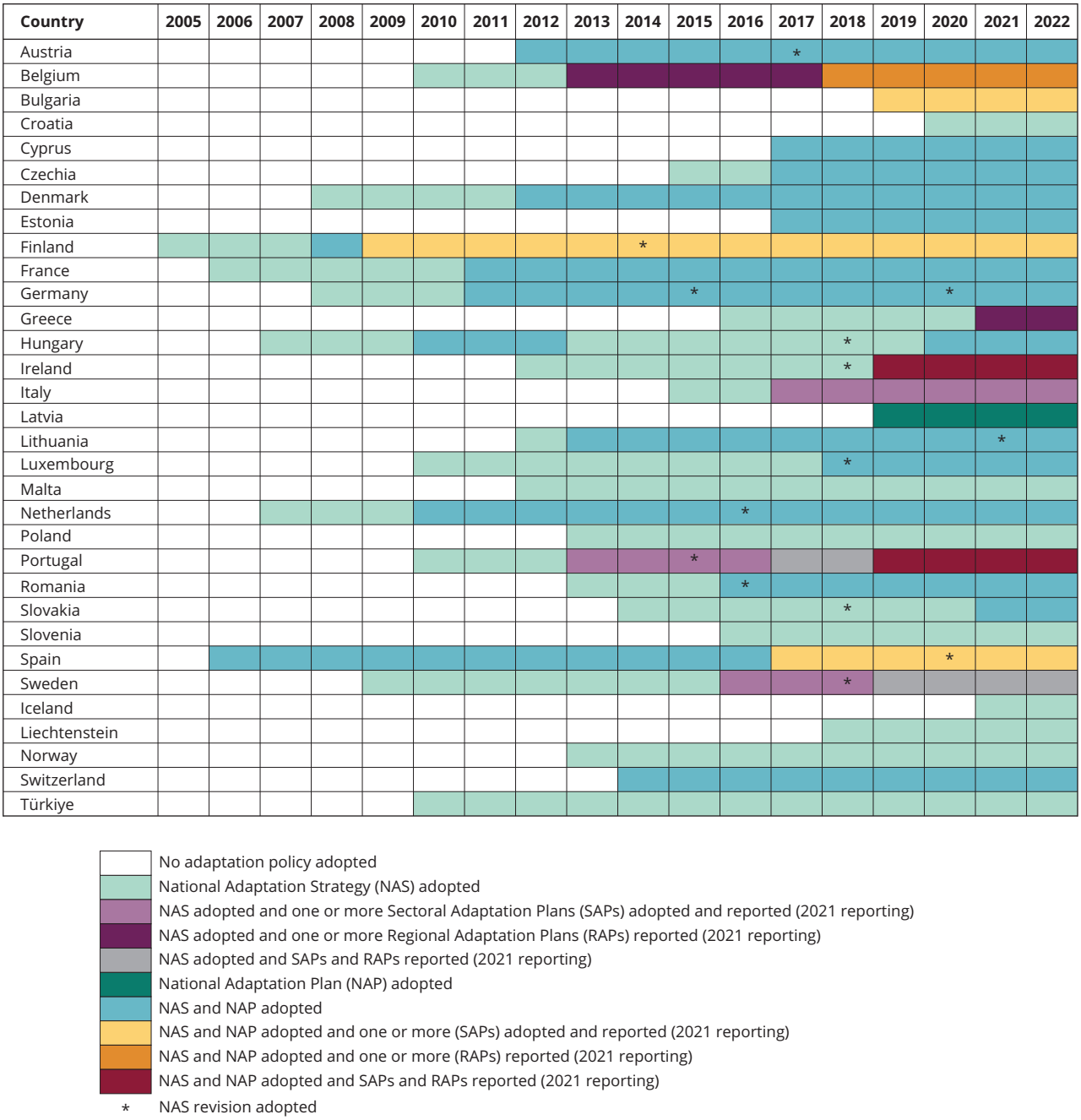
Adaptation policies and priorities

Various policy instruments addressing climate change adaptation have been adopted, reflecting each country's specific (national) circumstances in terms of governance structure and institutional frameworks (Figure ES.2). Adaptation strategies and plans remain soft, non-binding policies in most countries. Climate laws play an increasing role in institutionalising national adaptation policies and embedding NASs, NAPs and SAPs in binding regulatory frameworks.

In the country reports, the prevailing strategic approach is based on avoiding and reducing climate risks and favouring 'no-regret' and 'soft' measures to address the knowledge gap, lack of climate awareness and lack of management capacity.

The social justice aspects of adaptation are not yet integrated in the reporting of all countries. However, these increasingly important aspects aim to address the uneven distribution of climate risks, which affect vulnerable groups the most. More positively, vulnerable groups have a role in developing national and regional adaptation policies in several countries and are involved in the prioritising of adaptation measures.

Figure ES.2 Overview of adaptation policy instruments in EEA member countries, 2005-2022



Note: Based on reporting under the Monitoring Mechanism Regulation ((EU) No 525/2013) Art. 15 in 2015, 2016 (voluntary) and 2019, the 2018 country scoreboards are prepared for the evaluation of the 2013 EU adaptation strategy and the reporting under GovReg Art. 19 in 2021.

Sources: Eionet (2019), EC (2018a), EEA (2020a, 2022b).

Adaptation governance

Institutionalised coordination mechanisms and national coordination or advisory bodies have been further developed and strengthened in many Member States. The diversity of institutional arrangements and processes for steering adaptation policies across different levels and sectors has increased at transnational, national and sub-national levels. There has also been some increase in the engagement of private sector actors, and all developments depend strongly on countries' overall governance set-up.

Legal requirements to enforce horizontal policy integration and binding vertical governance frameworks that require regional and/or local authorities to engage in adaptation planning are in place in only a minority of Member States. Soft, collaboration-based forms between governance levels and supportive governance frameworks at sub-national levels are more common than top-down, regulatory approaches.

Multi-level governance arrangements at the sub-national level have increased in several countries. They require a variety of networks and a set of collaborative mechanisms across sub-national governments to be effective. Those networks and collaborations play an essential role in supporting local governments in developing and implementing their local adaptation strategies and plans.

EU funding instruments, macro-regional strategies, international conventions and transboundary cooperation bodies strongly enable transnational adaptation efforts. They have directly supported national adaptation policy processes in a number of Member States, as demonstrated by the large number and diversity of forms and modes of transnational cooperation.

Implementation and financing

Mainstreaming adaptation into a broad range of sectoral policies, programmes, and legal and regulatory frameworks has progressed further. Several Member States reported that many of their adaptation measures are about increasing adaptive capacity; specifically, activities that support awareness raising, capacity building and training, inclusion of climate change in educational programmes, strategic project implementation, and support adaptation at regional and local levels. The assessment of the voluntary reporting on key types of measures shows that 'capacity building, empowering and lifestyle practices' is the most frequently reported type of measure.

Ten Member States report that a national overview of progress on increasing adaptive capacity is currently not available, but several of them are developing a methodology to do so. A common methodology to track the financing of implementing adaptation strategies and plans is currently not available. Adaptation is being increasingly financed, but several methodological aspects have not yet been solved e.g. related to counting 'adaptation relevance' for measures that also support other economic, societal and environmental objectives beyond adaptation. Only a few Member States reported dedicated national adaptation funds for financing the implementation of NAPs or SAPs. Only a minority of NASs and NAPs have budgets earmarked for financing the implementation of adaptation actions.

Monitoring, reporting and evaluation

A growing number of EU Member States are conducting monitoring, reporting and evaluation (MRE) activities. A formal evaluation occurs less often than monitoring and reporting activities are set up, but the number of Member States engaging in MRE is growing. Countries mainly use MRE to gain a better understanding of (adaptation) policy implementation, to identify climate risks and vulnerabilities, and to measure policy effectiveness in reducing climate change impacts, risks and vulnerabilities.

A clear understanding of the role and use of MRE still remains a challenge. For example, the use of indicators or criteria varies greatly between Member States. Yet relying on indicators or criteria, especially to track social, economic, health and ecological vulnerability, helps identify adaptation needs and evaluate how they should be addressed.

Many Member States report challenges in the MRE systems related to their immaturity, which inhibits effective tracking of implementation and financing. Some Member States report quantitative adaptation finance information, mainly from EU and other (research) funds, but also from public budget annual expenditure.

MRE has the potential to influence decision-making throughout the adaptation policy cycle. However, few Member States explicitly report how MRE is supposed to feed back into making or revising policy. In addition, effectively feeding MRE findings back into the next adaptation policy cycle remains a challenge. This highlights the limited progress taken towards systemic adaptation.

Future directions

Adaptation is already happening across Europe. However, it needs new momentum to ensure quality of life and secure the sustainable development of economic and social systems. Countries are at different stages along the adaptation policy cycle. Some have already completed the cycle and are building their future adaptation policies on lessons learned, best practice and knowledge gained from putting strategic planning into practice. The information from the 2021 reporting clearly demonstrates that all EU Member States and Türkiye have well-established adaptation policy frameworks which have been in place for many years or decades.

Learning from experience, successes and challenges is key to establishing a much-needed adaptive policy system that is swift (i.e. supporting fast implementation and avoiding maladaptation), smart (i.e. integrating and reacting to new information and knowledge) and systemic (i.e. enabling effective mainstreaming in all key sectors and policy domains in a multi-level governance setting). The recent manifestations of climate change — long-lasting heatwaves, severe droughts, devastating forest fires, melting glaciers, cloudbursts and flash floods etc. — indicate the 'new normal' and inevitability of adaptation. This points to both a pivotal and a challenging period: implementing adaptation policies and measures which emerge from principles of good adaptation will be essential for progress.

In 2023, Member States will update their reporting on their national adaptation actions. Non-EU EEA member countries will be invited to report on national adaptation actions on a voluntary basis. For the first time, EU Member States will provide a progress report on adaptation against the different dimensions of the energy union: decarbonisation, energy efficiency, energy security, the internal energy market and research, innovation and competitiveness. Updated assessments will be needed to describe the key aspects of adaptation in Europe and provide input to different EU and international policy progress reports.

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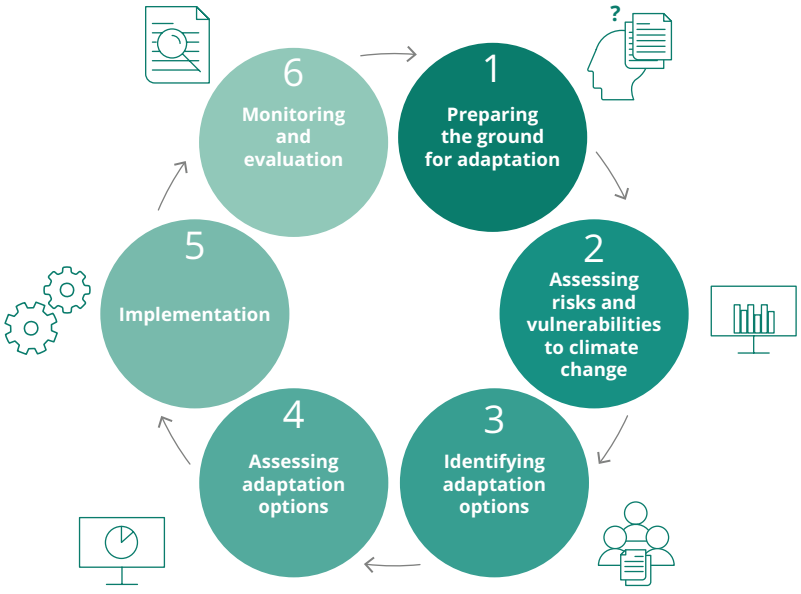
1 Introduction

This EEA report provides an overview of the collective state of play on the adaptation actions reported by all EU Member States and Türkiye ([1]). This analysed and structured information supports the EU when implementing related policies such as the EU strategy on adaptation to climate change (EC, 2021b) or the European Climate Law (EU, 2021b). It also supports the EEA in its knowledge development and capacity building. The assessment of the reported information also aims to support and inspire countries throughout their activities linked to the various stages of the adaptation policy cycle (Figure 1.1). Additionally, it can support and encourage EU funding directed towards meeting Member States' needs for further developing their adaptation actions and programmes of measures.

Figure 1.1 Adaptation policy cycle, based on the Climate-ADAPT Adaptation Support Tool



Note: The Adaptation Support Tool (AST) on Climate-ADAPT assists national policymakers and coordinators in developing, implementing, monitoring and evaluating climate change adaptation strategies and plans. The AST was developed as a practical guidance tool to all the steps needed to develop, implement, monitor and evaluate a national adaptation strategy. As the reporting of national adaptation actions under the Regulation on the Governance of the Energy Union and Climate Action largely follows the same structure as the AST, it will be used to guide the reader through this report.

Source: Climate-ADAPT (2022a).

([1]) Reporting national adaptation actions under the Regulation on the Governance of the Energy Union and Climate Action is mandatory for EU Member States and voluntary for EEA member countries that are not EU Member States. Of those non-EU EEA member countries, only Türkiye reported by the cut-off date of 31 May 2022. In this report, the information from the reporting that covers only the EU-27 is referred to as 'Member States'. Elsewhere, the more general terms 'countries' is used, where necessary specifying which countries this refers to (e.g. EEA-32 member countries).

1.1 Reporting requirements, EU regulation and reporting status

In 2018, the Regulation on the Governance of the Energy Union and Climate Action (GovReg) (EU, 2018) repealed the previous EU greenhouse gas Monitoring Mechanism Regulation (MMR) (EU, 2013).

The first MMR Article 15 reporting took place in 2015, and — apart from a voluntary update at the end of 2016 — the second and last one was in 2019. From March 2021 onwards and every two years after, national adaptation actions will be reported under the GovReg Implementing Regulation, Article 4, Information on national adaptation actions (EU, 2020). That regulation builds on the main elements of the previous MMR Article 15, while additional details of the reporting are specified in the annex of the implementing regulation (EU, 2020) ([2]).

By 15 March 2021, Member States had reported to the European Commission for the first time following the new GovReg provisions information on their national adaptation actions. For each country, Information provided by Member States in this reporting round is presented in EEA's Reportnet 3 portal (EEA, 2022b) and in a structured way in the country profiles on Climate-ADAPT (2022b). To provide a consistent overview of the reporting, information follows the structure of the Adaptation Support Tool (AST) in each country profile.

On a voluntary basis, countries can update this information at any time so that it better reflects recently adopted work. Therefore, the cut-off date for 'voluntary resubmissions' for this report was 31 May 2022.

1.2 Aim and scope of the report

This report summarises where Member States are in terms of their progress along the adaptation policy cycle. It gives a snapshot of the situation in 2021. Where possible, it also compares this with earlier information to describe progress that has taken place over recent years.

The adaptation reporting by EU Member States and Türkiye is a snapshot in time. It gives a sense of how countries take action to become more climate resilient by reviewing the situation on 15 March 2021 (and updates until 31 May 2022). The reported information does not cover all the adaptation policies and actions ever taken throughout these countries' histories.

Although this report uses the 2021 GovReg reporting as a starting point, it also includes information from other published sources where relevant. These sources include the 2019 MMR reporting on adaptation (Eionet, 2019), the countries' adaptation scoreboards (EC, 2018a, 2018b) and the Commission staff working document *Overview of natural and man-made disaster risks the European Union may face* (EC, 2021d). In addition, previous EEA activities and work by the European Topic Centre on Climate Adaptation (ETC/CA) are used to complement the picture on adaptation in Europe, such as *National climate change vulnerability and risk assessments in Europe* (EEA, 2018), *Adaptation policies and knowledge base in transnational regions in Europe* (ETC/CCA, 2018a), *Monitoring and evaluation of national adaptation policies throughout the policy cycle* (EEA, 2020a), *Using key type measures to report climate adaptation action in the EEA member countries* (ETC/CCA, 2021) or the EEA Briefing on economic losses and fatalities (EEA, 2022a). Where relevant, the Working Group II Contribution to the sixth assessment report of the Intergovernmental Panel on Climate Change was also used (IPCC, 2022).

Countries in Europe are facing different climate risks and have different national and sub-national policy contexts. In addition, since countries are at different stages of the adaptation policy cycle in terms of implementing their national adaptation strategies (NASs), national adaptation plans (NAPs), sectoral adaptation plans (SAPs) and regional adaptation plans (RAPs), the situation in each country is different. Because of the heterogeneity of the information provided and potentially different interpretations of what is requested and delivered, this EEA report must be seen as a baseline assessment. This is the first round of reporting following a new schema that is repeated every second year and going to improve over time.

1.3 Report structure

The information provided in this EEA report follows the logic outlined in the steps in the adaptation policy cycle (Figure 1.2). The report assesses what was reported under the selected elements of the GovReg reporting and how these elements can be interpreted by country but does not perform a compliance check. Country examples are provided throughout the report in groups that only partly highlight country-specific issues.

([2]) As this report largely builds on the adaptation information reported under the GovReg, the annex of the implementing regulation describing the structure and details of this reporting is included in Annex 2: Information on national adaptation actions.

Figure 1.2 Adaptation policy cycle outlined in this report

Chapter 1
Introduction

2 Chapter 2
Climate-related hazards, vulnerabilities and risks

3 4 Chapter 3
Adaptation policies and priorities

5 Chapter 4
Adaptation governance

5 Chapter 5
Implementation and financing

6 Chapter 6
Monitoring, reporting and evaluation

Chapter 7
Conclusions and future directions

Chapter 2 focuses on climate impacts, vulnerabilities and risks. These include observed and future climate hazards and key affected sectors, the status of the climate risk assessments ([3]) across Member States, how governance mechanisms are functioning at the national level, and the reviews and updates envisaged for the climate risk assessments.

Chapter 3 provides an overview of adaptation policies and countries' priorities, showcasing a diverse landscape of approaches to tackling climate risks.

Chapter 4 focuses on adaptation governance. It assesses institutional arrangements, synergies and collaborations at national and sub-national levels, as well as participatory processes and stakeholders. All these elements are relevant throughout the adaptation policy cycle — from preparing the ground for adaptation to monitoring and evaluating adaptation actions and policy revisions.

Implementation and financing are at the core of Chapter 5. This chapter focuses on mainstreaming adaptation, provides insights into how to increase adaptive capacity and gives a brief overview of reporting on financing and funding.

Chapter 6 provides an overview of the landscape of monitoring, reporting and evaluation (MRE) activities, the methodological approach to MRE in Member States, and how MRE is used in to influence adaptation policy development and revision.

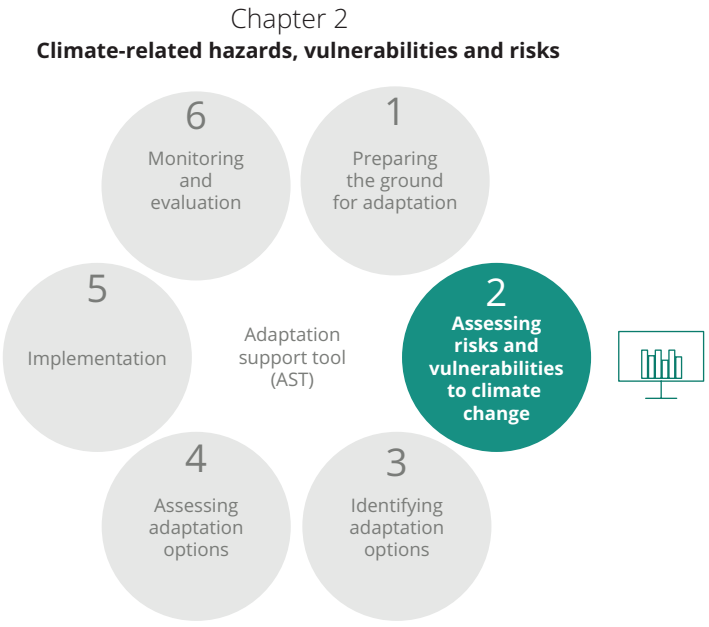
Lastly, Chapter 7 provides conclusions and lessons learned from the assessment of the information reported on national adaptation actions. It also looks at future directions.

([3]) Climate risk assessments as defined in this report are evidence-gathering activities that seek to assess climate change impacts, vulnerability and/or risks. They have evolved over the years and so has their use in adaptation policy development. See also Annex 1: Glossary.

2
Climate-related hazards, vulnerabilities and risks

- Heatwaves, droughts, floods, heavy precipitation and changing temperatures are the most reported climate-related hazards and highly relevant for (almost) all countries.
- Despite the variations in current and future climate change impacts across Europe, there are no significant differences across the key sectors affected in different Member States. Health, agriculture and food, forestry, water management and biodiversity are most often reported.
- Almost all Member States report recent efforts and further progress on enhancing and updating their climate risk assessments to inform adaptation policy development. This underpins the earlier finding that substantial progress in expanding knowledge about climate risks has been achieved in recent years.
- Over time, many Member States have complemented and deepened existing multi-sectoral risk assessments with more targeted sectoral and issue-specific assessments. Both new multi-sectoral risk assessments and sector-based studies were reported by significant shares and similar numbers of countries. In comparison with earlier generations of climate risk assessments, thematically-focused studies have become more frequent.
- National climate risk assessments that are initiated by government, centrally-coordinated and linked to the national adaptation policy process predominate. However, sector-driven, project-based and bottom-up scientific assessment initiatives also occur.
- National climate risk assessments rely heavily on domestic research capacities, the alignment of national research programmes with adaptation policy needs and stakeholder engagement.
- Knowledge gaps related to non-climatic factors, cross-border and international climate risks, cross-sectoral interactions, and complex, compound and cascading risks tend to persist.
- Legal requirements or political commitments to institutionalise the periodic updating of national climate risk assessments are in place in several Member States. However, the systematic, comprehensive and regular renewal of assessments is the exception rather than the rule.

Figure 2.1 **Content of Chapter 2**



Climate risk assessments (CRAs) ([4]) remain a key element of the national adaptation policy cycle. They provide crucial information for the development, implementation and revision of adaptation policies and measures. As countries have progressed through the steps of the adaptation policy cycle (see Figure 2.1), and some have completed it one or several times, updating and expanding knowledge about climate change risks, impacts and vulnerabilities becomes a recurring or continual task that can support most other steps of iterative adaptation processes. This makes CRAs a rather changeable process that can occur at different points along the adaptation policy cycle, depending on country practices.

Almost all countries have conducted at least one national CRA, either multi-sectoral or specific. These are often related to mainstreaming policy requirements in the water sector, but also address coastal erosion, health, agricultural systems, urban development, natural hazards, tourism and the socio-economic impacts of climate change. Legal requirements or political commitments to institutionalise the periodic updating of national CRAs are in place in some Member States. Yet across all countries, systematic, comprehensive and regular renewal of assessments is the exception rather than the rule.

In line with the diversity and country-specificity of adaptation governance systems at large, the ways of embedding CRAs into adaptation governance frameworks vary considerably across European countries. For example, high-level coordination bodies, sectoral national adaptation strategy (NAS) working groups or transnational cooperation bodies can have varying roles and responsibilities regarding CRAs. Dedicated scientific advisory bodies, which can be formalised in national climate laws, are sometimes involved in assessments and/or in the policy uptake of the knowledge produced (EEA, 2021c). Statutory requirements for the preparation of CRAs, which are sometimes directed to sectoral or sub-national authorities, are in place in several Member States.

Expanding knowledge in most countries predominantly happens through incremental, gradual and cumulative patterns that are strongly country-dependent. For example, some refer to comprehensive monitoring and reporting for programmes of measures of adopted adaptation activities, while others gather the results of individual research projects or new specific thematic/sectoral studies. Monitoring, reporting and evaluation (MRE) and revising national adaptation policies play an increasingly important role in updating knowledge on impacts, vulnerabilities and risks. MRE processes have become both a source of new CRA information and a driver for knowledge generation.

2.1 Key observed and future climate hazards

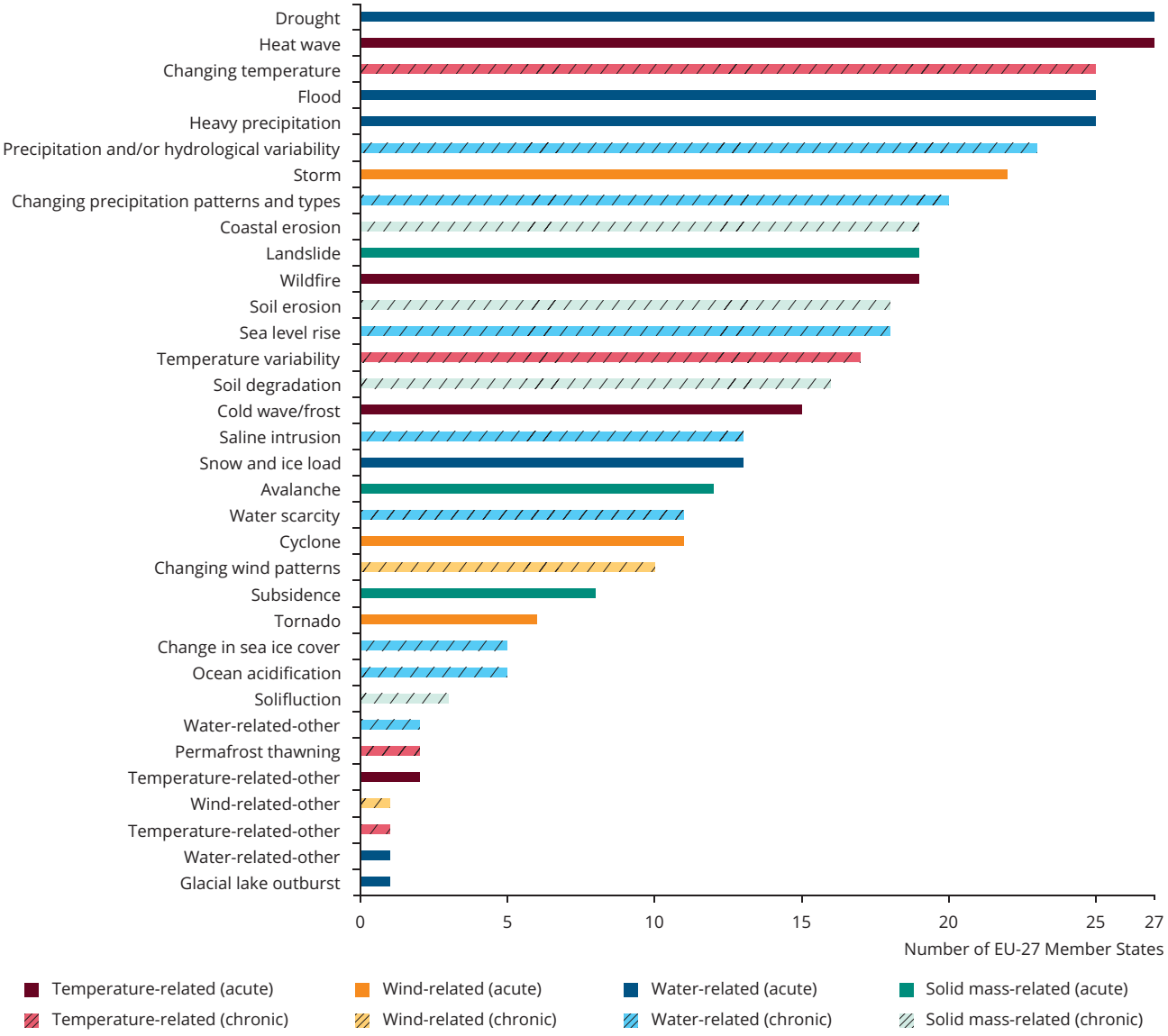
Climate change is happening and we need to prepare for more intense weather- and climate-related extremes and slow-onset events. Various climate-related hazards affect regions, sectors of the economy and layers of society in different ways (EEA, 2021b). Member States were asked to report observed and key future climate hazards based on a classification ([5]) in which hazards are split into temperature-, wind-, water- and solid mass-related hazards ([6]) — as well as acute hazards (extreme weather events) and chronic hazards (slow-onset events). Figure 2.2 gives an overview of the observed climate hazards reported by the 27 EU Member States (EU-27). The information gives a rather basic picture due to reporting limitations and some hazards needs to be more clearly defined; for example, the difference between changing temperature and temperature variability, or between sea level rise and coastal erosion. The notion of existing pressure is ambiguously understood. Nevertheless, it is a core element in the reporting related to the observed hazards and should cover environmental, economic and social pressures that are likely to be significantly affected by climate change (see Annex 2: Information on national adaptation actions, item 1.3a). While a common understanding of an environmental pressure ([7]) can be assumed, there does not seem to be a clear and commonly agreed-upon definition of how economic and social pressures can be affected by climate change.

The observed climate hazards reported as relevant for most or all Member States are mainly acute ones and water- and temperature-related hazards. As expected, the ice-related hazards (glacial lake outburst, permafrost thawing, solifluction) are only relevant for a limited number of Member States. An overview of the reported key future hazards looks very similar to Figure 2.2. This is mainly because the reporting asks about hazards' relevance in the future — but not about changes in the frequency, magnitude or impact of these hazards compared to the observed situation.

([4]) Climate risk assessment (CRA) is an umbrella term referring to evidence-gathering activities that seek to assess climate change impacts, vulnerability and/or risks. It covers a variety of types of such assessments occurring in Europe. See also Annex 1 Glossary.
([5]) Table 1 of Commission Implementing Regulation (EU) 2020/1208 (EU, 2020); see also Annex 2 Information on national adaptation actions in this report for details.
([6]) Countries can also add specific hazards not given in the list for each of these categories. Hazards can be classified in different ways: the same classification is used in the delegated acts for the taxonomy on sustainable finance (EU, 2021a) while global databases on economic losses and fatalities are structured in a slightly different way, e.g. in the EM-DAT international disaster database (UCLouvain, 2009).
([7]) A 'pressure resulting from human activities which bring about changes in the state of the environment', according to the General Multilingual Environmental Thesaurus (Eionet, 2021).

None of the hazards suggested in Implementing Regulation (EU) 2020/1208 (EU, 2020) were reported by any Member State. Three countries reported 'other hazards' that were not in the predefined list of hazards in the implementing regulation ([8]). While the spread of species is seen more as a secondary effect (a biological impact due to (mainly) changes in temperature), other hazards that were added were combinations of temperature-, water- and wind-related hazards, such as the compound risks of temperatures below 0°C and rain, of windstorms and snow or of specific temperature-related variability with freezing and thawing cycles. For chronic water-related hazards, water quality deterioration and ice cover were also mentioned as additional hazards to the predefined list. In the absence of information on the magnitude and frequency of hazards, the actual reporting does not allow us to connect regions in Europe with certain (groups of) hazards beyond the obvious groups. These include landlocked countries where all sea and coastal aspects are not relevant, or snow- and ice-related hazards that are only of relevance for Nordic and mountainous countries.

Figure 2.2 Observed climate hazards reported



Note: Based on EU-27 Member State reporting.

Source: EEA (2022b).

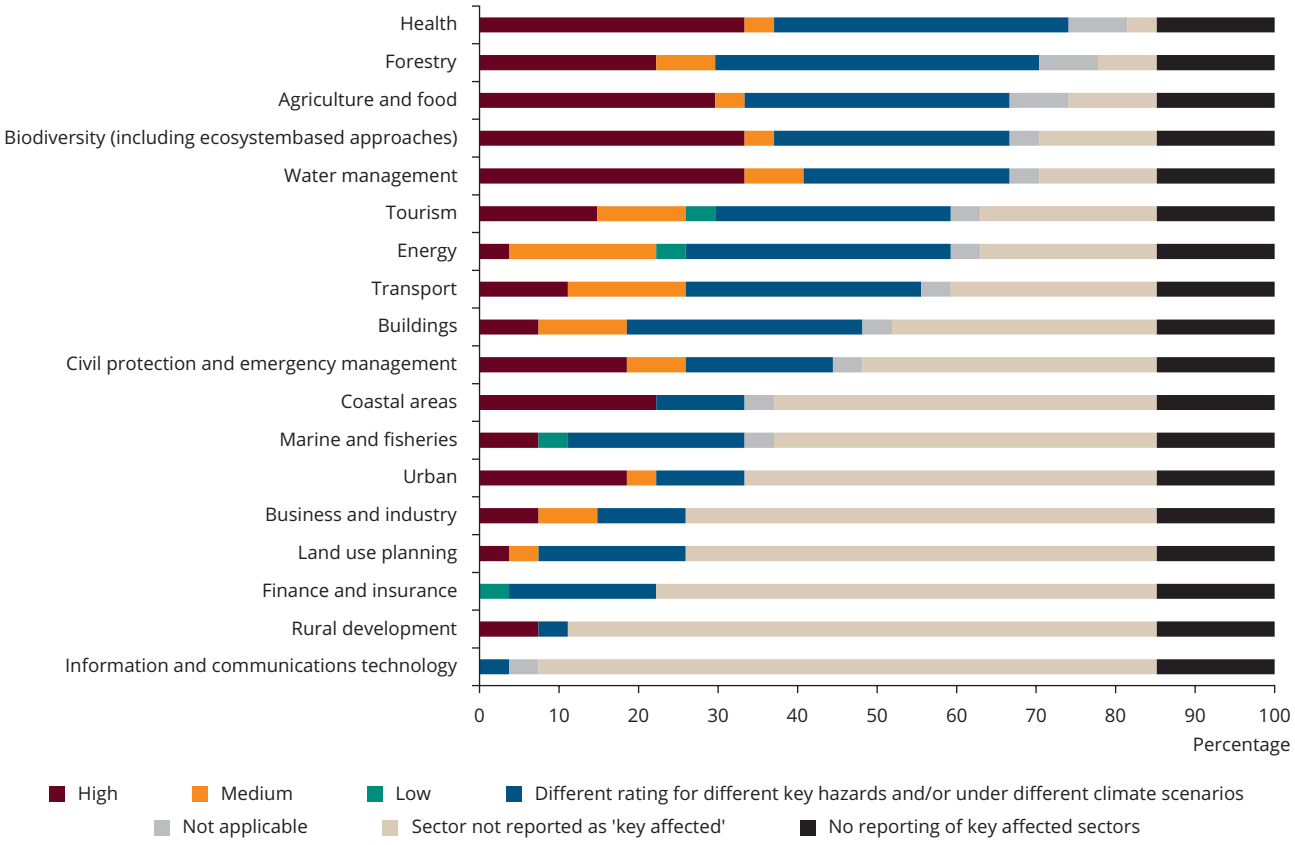
([8]) It needs to be kept in mind that only an overview list of the observed climate hazards was requested, without any additional information on frequency and magnitude of these events: not all hazards mentioned by a country might be of the same relevance.

2.2 Key affected sectors

The section on the key affected sectors is the most complex part of the reporting on national circumstances, impacts, vulnerabilities, risks and adaptive capacities. It unites elements of climate impacts, vulnerability (including adaptive capacity) and risks, split per sector. Member States were invited to select sectors from a list defined in the implementing regulation or to add other sectors where needed. There are no fixed criteria to include or exclude a sector in a country from the list of key affected sectors, but Member States were asked to use sectors where a CRA or a national or sectoral adaptation plan is available.

As a result, 23 countries ([9]) reported 249 sectors in total, ranging from two sectors reported by Cyprus and Estonia up to 17 by Spain and Sweden ([10]). The sectors most reported were health (see also ECHO, 2022a, 2022b), agriculture and food, forestry, water management and biodiversity (Figure 2.3).

Figure 2.3 Risk of future climate impacts on key affected sectors



Notes: Data are for the EU-27. The graph includes 236 out of 249 reported key affected sectors.

Source: EEA (2022b).

([9]) Four EU Member States (Belgium, France, Luxembourg and the Netherlands) did not respond to the detailed questions on key affected sectors in 2021, indicating that they will do so from the reporting in 2023 and onwards.

([10]) Of these 249 reported sectors, 36 are defined as 'other' (from 11 countries). Of those sectors defined as 'other', 23 (from seven countries) were assigned to one of the sector groups as defined in the implementing regulation. For example, a sector defined as 'Electricity production' was assigned to 'Energy'. The remaining 13 sectors (from eight countries) described as 'other' (e.g. reindeer herding, game management or cultural heritage) could not be assigned to any of the sectors and were left out of the analysis in this section.

The reporting for each of these sectors consists of four elements (EU, 2020):

1. observed impacts of key hazards, including changes in frequency and magnitude;
2. likelihood of the occurrence of key hazards and exposure to them under future climate, drawing upon the best available climate modelling science;
3. vulnerability, including adaptive capacity;
4. risk of potential future impacts.

The first two elements are related to the impact of and exposure to the key hazards, while the last two focus on the vulnerability and risk. Items 1 and 3 refer to the observed climatic situation, while items 2 and 4 relate to the future climatic situation.

For each of these four elements, the reporting consists of two aspects: classification on an ordinal scale ([11]), followed by a more detailed description. The qualitative assessment of the risk of potential future impacts is shown in Figure 2.3. Definitions describing the different elements as high, medium, low or not applicable were missing. The EEA added an extra option to this list for situations where the assessment shows a 'mixed picture' for different hazards ([12]). With relatively slight differences from item to item, half of the sector assessments were labelled as such — but with large differences between countries that used this option for all key sectors assessed. The reporting guidance states that if the picture is mixed for different hazards, regions or climate scenarios, the detailed text description should clarify this in more detail. Because it is a text field, it is not possible to use this information in a structured assessment at European level.

Because different Member States used the qualitative assessment in different ways, only high-level observations can be made. The total number of key affected sectors reported remains the same for all items 1-4 (Figure 2.3). Comparing the results for the observed impact of key hazards (1) with the risk of potential future impacts (4) shows that:

- the number of key affected sectors evaluated as mixed is around 50% for both questions;
- the number of key affected sectors evaluated as high is over twice as much for item 4 (30%) compared to item 1 (under 15%).

2.3 Status of climate risk assessments

Almost all countries have conducted at least one national CRA to inform adaptation policymaking and planning.
A significant share of all countries reported recent efforts and further progress on updating and expanding their respective knowledge bases, underpinning the earlier finding that sizeable progress has been achieved in recent years (EEA, 2020a). Since the EEA (2018) report on national climate change vulnerability and risk assessments in Europe, new assessment studies have been produced over the last five years, i.e. from 2017 onwards. These were explicitly reported by 11 countries (Austria, Belgium, Czechia, Denmark, Finland, France, Hungary, Ireland, Romania, Slovenia and Spain). More countries (e.g. Austria, Germany, Ireland, Italy, Sweden, Switzerland and Türkiye) have recently completed additional, multi-sectoral or thematic CRAs up to the end of 2021. Consolidating information drawn from four different sources, Table 2.1 gives an overview of national CRAs that:

- were reported in 2021 under the Regulation on the Governance of the Energy Union and Climate Action;
- have been reviewed already in the previous EEA (2018) report;
- have been published and were communicated voluntarily after the deadline of the 2021 reporting ([13]);
- are recent assessments known from other sources, not mentioned in the 2021 reporting.

([11]) In the implementing regulation (EU, 2020), an ordinal scale consisting of the risk categories 'high', 'medium', 'low' and 'not applicable' was suggested.
([12]) The option 'mixed impacts for different hazards' was added for items 1 and 3, and 'different likelihood of their occurrence and exposure for different key hazards and/or climate scenarios' for item 2. An explanation in the manual also explicitly refers to differences between regions in larger countries. The option 'different rating of risks for different key hazards and/or under different climate scenarios' was added for item 4.
([13]) If information became available after the reporting deadline, the overview might not be complete. For EEA Member countries that are not EU Member States, information since publication by the EEA (2018) and the reporting (for these countries voluntary) of 2019 (Eionet, 2019) has been added where available and might not be complete.

Table 2.1 National climate risk assessments in EEA member countries

Country	Year	Title of assessment report (in English)
Austria	2014	Austrian assessment report 2014 (AAR14)
	2015	Cost of inaction: assessing the costs of climate change for Austria (COIN)
	2018	Assessment report on extreme natural hazard events in the Austrian Alps
	2018	APCC Special report on health, demography and climate change (SR18) ([a])
	2020	APCC Special report on tourism and climate change (SR19) ([a])
	2021	Social impacts of climate change in Austria
Belgium	2011-2013 ([b])	Wallonia (2011): Adaptation to climate change in Walloon Region Flanders (2012): LNE adapt, impacts report Brussels Region (2012): Adaptation to climate change in Brussels: elaboration of a preliminary study of the regional adaptation plan Federal (2013): Exploring federal contribution to a coherent adaptation policy
	2020	Evaluation of the socio-economic impact of climate change in Belgium
Croatia	2017	Report on assessment of climate impacts and vulnerabilities in different sectors
Cyprus	2016	The climate change risk assessment
Czechia	2015	Comprehensive study on impact, vulnerability and risk sources connected to climate change in the Czech Republic
	2019	Updated comprehensive study on impact, vulnerability and risk sources connected to climate change in the Czech Republic
	2019	Vulnerability assessment of the Czech Republic related to climate change
Denmark	2012	Mapping climate change — barriers and opportunities for action
	2016	Detailed risk assessment regarding erosion and flooding for the entire coastline
	2021	Coastal planner — nationwide risk assessment of coastal risks
Estonia	2015	Adaptation instruments in the field of planning, land use, health and rescue management
	2015	Adaptation strategy and measures for thematic fields of natural environment and bio-economy
	2015	Adaptation measures in the economic and social fields
	2015	Estonian climate adaptation assessment for infrastructure and energy
	2017	Development plan for climate change adaptation by 2030
Finland	2013	The adverse impacts of climate change and the vulnerability of sectors
	2018	Weather and climate risks in Finland — national assessment
France	2009	Climate change: costs of impacts and lines of adaptation
	2019	ONERC annual reports to the Prime Minister and the Parliament, e.g. Extreme weather events in the context of climate change (2019) ([c])
Germany	2015	Germany's vulnerability to climate change
	2017	Climate change in Germany. Trends, impacts, risks and adaptation
	2021	Climate impact and risk analysis 2021 for Germany
Greece	2011	The environmental, economic and social impacts of climate change in Greece
Hungary	2016	National Adaptation Geo-Information System (NAGiS)
	2017	Second national climate change strategy 2017-2030, with an outlook until 2050
	2020	Scientific assessment of the effects of climate change on the Carpathian Basin

Country	Year	Title of assessment report (in English)
Ireland	2013	Current and future vulnerabilities to climate change in Ireland
	2017	Summary of the state of knowledge on climate change impacts for Ireland
	2020	National risk assessment of impacts of climate change: bridging the gap to adaptation action
Italy	2014	Report on the state of scientific knowledge on impacts, vulnerabilities and adaptation to climate change in Italy
	2021	Report on climate change impacts indicators (2021 edition)
Latvia	2016-2017	Risk and vulnerability assessment and identification of adaptation measures (six separate reports for the most vulnerable sectors)
Lithuania	2014	Risk assessment and vulnerability to climate change in the public health sector
	2015	Studies on the vulnerability of specific sectors to climate change, risk assessment, the most effective adaptation to climate change and evaluation criteria
Luxembourg	2012	Adaptation to climate change — strategies for spatial planning in Luxembourg
Netherlands	2015	Adaptation to climate change in the Netherlands: studying related risks and opportunities
Norway	2010 ([d])	Adapting to a changing climate. Norway's vulnerability and the need to adapt to the impacts of climate change
Poland	2013	Description of climate change impacts on sensitive sectors, included in the national strategy for adaptation to climate change 2020
Portugal	2006	Climate change in Portugal. Scenarios, impacts and adaptation measures
	2013	National adaptation strategy progress report
Romania	2014	Summary of sector rapid assessments and recommendations for incorporating climate actions in the 2014-2020 sectoral operational programmes
	2017	Analysis of vulnerability to drought
Slovenia	2010	Climate variability in Slovenia and its effects on the aquatic environment
	2014	Expert basis for risk and vulnerability assessment in Slovenia
	2018	Climate change assessment in Slovenia by the end of the 21st century
Spain	2005	A preliminary general assessment of the impacts in Spain due to the effects of climate change
	2013	Climate change adaptation needs in the transport infrastructure main network in Spain
	2014	Impacts of climate change on human health
	2014	Climate change impacts in the aquaculture sector in Spain
	2014	Climate change in the Spanish coast
	2014	Forest fires in Spain in a context of climate change: information and tools for adaptation
	2015	Forests and biodiversity: climate change impacts, vulnerability and adaptation in Spain
	2015	Adaptation to climate change in the Spanish energy sector
	2016	Health and climate change Indicators
	2016	Climate change and vineyards in Spain
	2016	Climate change impacts, vulnerability and adaptation in the agriculture sector
	2016	Climate change in the Spanish marine environment: impacts, vulnerability and adaptation
	2016	Impacts, vulnerability and adaptation to climate change in the tourism sector
	2016	Costs and benefits of climate change adaptation in the snow tourism sector in Spain
	2016	Impacts of climate change on desertification processes in Spain
	2017	Impacts, vulnerability and adaptation to climate change in Mediterranean beekeeping

Country	Year	Title of assessment report (in English)
Spain	2017	Impacts, vulnerability and adaptation to climate change in extensive livestock systems in Spain
	2017	Adaptation in urban coastal areas with tourist and cultural interest in Spain
	2017	Assessment of the impact of climate change on water resources and droughts in Spain
	2020	Impacts, vulnerability and adaptation to climate change in the insurance business
	2021	Impacts and risks associated to climate change in Spain
Sweden	2007	Sweden facing climate change — threats and opportunities
	2015	Documentation for control station 2015 for adaptation to a changing climate
	2019-2021	32 sectoral climate risk assessments by national sector authorities
Switzerland	2017 ([e])	Climate-related risks and opportunities. A national synthesis for Switzerland
	2020	Climate change in Switzerland: indicators of causes, impacts, measures
	2020	Impacts of climate change abroad — risks and opportunities for Switzerland
Türkiye	2015	Türkiye climate projections and climate change with new scenarios
	2016	Climate change impacts on water resources — sectoral vulnerability analysis in three river basins
	2019	Assessment of climate change impacts on snowmelt and streamflows

Legend:

	Newly reported under the Regulation on the Government of the Energy Union snd Climate Action in 2021
	Reported under the Regulation on the Governance of the Energy Union and Climate Action in 2021, plus previously covered in EEA (2018)
	Covered in EEA (2018), but not mentioned in the 2021 country reporting
	Completed after phase of 2021 reporting; not mentioned in 2021 reporting, but known from other sources be available and of more recent origin

Notes: ([a]) APCC, Austrian Panel on Climate Change.
([b]) While the EEA (2018) report had a general focus on climate risk assessments (CRAs) with national coverage, for Belgium, three regional studies were considered in addition to the federal assessment.
LNE: Vlaamse overheid Departement leefmilieu, natuur en energy (Flemish Government Department of environment, nature and energy).
([c]) ONERC, Observatoire national sur les effets du réchauffement climatique (National observatory on the effects of global warming).
([d]) Only the national CRA covered by the EEA report (2018) is listed. As a non-EU EEA member country, no updated reporting for Norway is available for 2021.
([e]) For Switzerland, as a non-EU EEA member country, no updated reporting for 2021 is available. The national CRAs are those covered by the EEA report (2018) and updated from other sources.

Sources: Based on 2021 reporting under Art. 19 of National adaptation actions under the Governance Regulation (EU, 2018), resulting country profiles (Climate-ADAPT, 2022b) and EEA (2018).

Producing the national assessments was not always directly linked to the NAS process. However, it has partly been sector-driven, project-based or initiated by the scientific community. In all cases, however, the CRA information generated is aimed at informing policy development and adaptation-related decisions. Policy uptake is either ongoing or seems likely. A few countries did not mention the existence of any kind of national assessment (Slovakia) or report respective efforts as ongoing (Malta). A small number of countries have not yet conducted proper, comprehensive national assessments and report either limited, sector-based vulnerability analyses (e.g. through a water management lens (Luxembourg) or from a civil protection perspective (Latvia)) or include sectoral climate impact information directly in their NAS documents (Bulgaria, Poland and Türkiye).

Compared to earlier generations of national CRAs, the scope of more recent assessments tends to be sector-based or thematically-focused more often than multi-sectoral. As has been reported in detail by the EEA (2018) and EC (2018b), most Member States have undertaken multi-sectoral assessments covering a broad range of climate change impacts — either on all vulnerable sectors or on prioritised, national key sectors. Over time, many countries

have complemented and deepened their knowledge base with more targeted sectoral and issue-specific assessments. These often relate to mainstreaming policy requirements in the water sector and are integrated into its planning processes, e.g. river basin management plans and flood risk management plans. Member-States reported country-wide assessments dedicated to specific topics such as coastal erosion, coastal and riverine flooding, drought and water resources, natural hazards, tourism, health, agricultural systems, the insurance business and urban development (as part of urban adaptation plans for larger cities). Sweden has prepared 32 sectoral and 21 regional CRAs, providing the knowledge base for sectoral and regional adaptation plans and addressing all key affected sectors. Some Member States report having assessed the (socio-)economic impacts and related costs of climate change, and using the information gained in adaptation planning (e.g. Austria, Belgium, France and Sweden).

Since 2017, comprehensive, multi-sectoral CRAs have been newly conducted or updated in at least nine EEA member countries (Belgium, Czechia, Germany, Finland, Hungary, Ireland, Italy, Spain and Switzerland). At least eight countries (Austria, Denmark, France, Romania, Spain, Sweden, Switzerland and Türkiye) completed recent thematic assessment reports with varying foci (Table 2.1). In terms of the number of published studies, sectoral or issue-specific assessments predominate and have become more frequent. Overall, the available evidence demonstrates further progress in updating, expanding and deepening the CRA-related knowledge base. However, it also shows a mixed picture which calls for more integrated assessments (e.g. EEA, 2018). Moreover, countries are progressing at different paces and have varying levels of ambition. This may result in a widening gap between those countries that can build on an extensive, solid and regularly-updated knowledge base on the one hand — and others still lacking a first national CRA on the other.

More systemic adaptation will require persistent knowledge gaps to be addressed. Earlier EEA reports (2018, 2020a) identified the need to more consistently address non-climatic factors and their interdependencies with climatic drivers, cross-border and international climate risks, cross-sectoral interactions, and complex, compound and cascading climate-induced risks. The need for more holistic and integrated CRAs — which take into account the complex interactions of multiple climate hazards, exposures and vulnerabilities — is also addressed by the EU adaptation strategy (EC, 2021b). This need is also stressed throughout the Working Group II contribution to the sixth assessment report of the Intergovernmental Panel on Climate Change (IPCC, 2022; Bednar-Friedl et al., 2022).

The same applies social justice issues related to the effects of climate change and adaptation measures. The 2021 country reporting provides only limited evidence that corresponding knowledge gaps have already been tackled in a more systematic way by national assessment efforts. Notable exceptions are the few countries that have analysed the 'interrelationship of risk between different areas' in their latest multi-sectoral assessments (e.g. Spain) or have published dedicated reports about the social implications of climate change and climate policies on vulnerable social groups (e.g. Austria). Transboundary and international climate change impacts appear to be part of the ongoing or future research agenda in some countries (e.g. Finland). Overall, knowledge needs that were previously identified tend to persist. This means that earlier recommendations on the future direction of CRA studies are still valid and deserve more attention. These recommendations could lead to more systemic adaptation, as called for by the EU adaptation strategy (EC, 2021b), and can contribute to avoiding unintended maladaptive outcomes.

2.4 National governance of climate risk assessments

Revising national adaptation policies is increasingly important for updating the knowledge base on impacts, vulnerabilities and risks. Supporting national adaptation policymaking remains the main reason for conducting CRAs. As countries progress through the adaptation policy cycle, the main driver has shifted from the initial development of national adaptation policy frameworks to supporting revisions of the NAS, the national adaptation plan (NAP), sectoral adaptation plans (SAPs) or regional adaptation plans (RAPs).

Correspondingly, MRE of national adaptation policies plays an increasingly important role in updating the CRA-related knowledge base. On the one hand, new climate risk information is often gathered throughout MRE processes. On the other, evaluating adaptation strategies can expose additional knowledge needs. In response, this can trigger new efforts to generate knowledge and incorporate it in adaptation strategy or plan revisions (e.g. Finland). Moreover, in parallel with the increasing maturity of adaptation policies in some countries, the review and reassessment of climate risks tends to become a recurring or even continual task. This task's position in the adaptation policy cycle can change and support most other steps of iterative adaptation processes, including at sub-national levels.

The periodic updating of national assessments requires evidence-based policy development and revision to be effective and institutionalised. However, this is not yet often practised. The EEA (2018) recommends regularly updating national CRAs, e.g. every five years, to allow relevant developments to be incorporated in the knowledge base and policy document revisions. Similarly, the EU adaptation strategy (EC, 2021b) states that improvements in adaptation strategies and plans must be based on the latest science. Several Member States have adopted a regular, mostly five-year cycle for updating their national CRAs. This happens either in the form of legal requirements or through political commitments stated in their NAS and NAP policy documents.

For example, updating the cross-sectoral vulnerability analysis in Germany currently follows an institutionalised six-year cycle. In Sweden, systematic assessments have to be renewed by national authorities and county administrative boards every five years, and in France, ONERC (the national climate change observatory) submits a synthesis report of climate change risks in specific areas to the Prime Minister and the Parliament annually. Some Member States have also anchored the development of climate models, climate scenarios and CRAs as dedicated research measures in their NAP (e.g. Belgium and Ireland).

While explained in detail as step 2 ([14]) of the Adaptation Support Tool (AST), the CRA is the most 'volatile' element of the adaptation policy cycle and the AST. Different country practices highlight that the CRA step can take place between different AST steps.

Expanding the knowledge base predominantly follows incremental, gradual and cumulative patterns that are strongly country-dependent. Across Member States, the systematic updating of comprehensive national assessments at regular intervals is the exception rather than the rule. Overall, information drawn from the country reports in 2021 suggests that the prevailing mode of enhancing the knowledge base on climate risks is incremental and cumulative rather than periodic, systematic and comprehensive. Although the science-policy nexus is strongly country-dependent (EEA, 2018), in general, countries tend to expand their evidence base by drawing on diverse information sources and employing various modes of knowledge production. These include CRA information gathered through monitoring and evaluation, thematic research programmes, research-driven projects, specific (sectoral) studies commissioned by governmental bodies, independent IPCC-style assessments by the domestic research community, and synthesis work done by scientific advisory bodies, NAS-associated working groups or government-affiliated support units (e.g. environment agencies). These institutions are often tasked with incorporating new knowledge from various sources into cyclical revisions of the NAS or NAP.

Expanding the knowledge base thus results from dynamic interactions between science and policy. Specifically, policy demands drive the need for new information, and new knowledge generation stimulates and informs policy advancement. Information provided by countries in their 2021 reports thus confirms earlier findings that enhancing the knowledge base for decision-making in adaptation is largely a self-reinforcing and gradual process that can unfold in diverse ways in different countries (EC, 2018b; EEA, 2018).

National assessments that are centrally-coordinated and initiated by governments predominate. However, sector-driven, project-based and bottom-up scientific assessment initiatives also occur. In many Member States, national CRAs have a centrally-coordinated set-up: most often, the government authority (e.g. national ministry or agency) that is politically responsible for national adaptation policymaking initiates and coordinates the assessment. In several Member States, the leading body is a specifically-tasked governmental institution. Examples include the national environment agency (e.g. Ireland and Slovenia), the hydrometeorological institute (e.g. Czechia) or meteorological institute (e.g. Bulgaria), as well as national committees, commissions, and working groups or scientific advisory bodies (see below) mandated by the government (e.g. Norway and Spain). Coordination responsibilities often appear to be shared between ministries or (inter)ministerial working groups at the political level and national expert institutions at the scientific-technical level. In addition, other ministries or high-level public administration bodies sometimes commission specific, sector-related studies to fill knowledge gaps for sectoral decision-making. For instance, the ministerial department in charge of natural hazards prevention has initiated and funded an independent, comprehensive assessment report on climate-driven extreme hazard events (Austria). Examples of project-based national assessments include the Klimada project (Poland, IOŚ-PIB, 2022) and an EU-funded LIFE+ project in Cyprus (LIFE UrbanProof, 2016).

A few Member States benefit from bottom-up assessment initiatives organised by the domestic research community in line with the IPCC model. For example, the Austrian Panel on Climate Change has not only elaborated on a comprehensive scientific state-of-the-art climate change assessment report, but is also issuing a series of special reports on specific thematic issues (e.g. tourism, health and demography, land use and structures for climate-friendly living).

There are different ways to embed CRA studies into overall adaptation governance frameworks. Adaptation governance systems in European countries are, in general, highly diverse and country-specific (EEA, 2014, 2020a). In consequence, the ways in which CRAs align with the overall governance structure and coordination mechanisms for adaptation also tend to vary considerably. Information provided by some Member States provides insights into the respective institutional arrangements and their roles in CRAs. In some Member States, high-level coordination or advisory bodies have a role in steering and/or supporting the uptake of assessment results in policymaking (e.g. Spain). In others, there are sectoral working groups responsible for including sectoral CRA studies in monitoring reports (e.g. Portugal).

Some Member States tend to outsource and decentralise the responsibility for CRAs to sectoral national authorities (e.g. Romania). Inter- or transnational cooperation bodies, such as the International Commission for the Protection of the

([14]) This step is placed in between step 1, 'preparing the ground for adaptation', and step 3, 'identifying adaptation options'. In practice, this also takes place elsewhere in the adaptation policy cycle, e.g. related to the evaluation of a policy and the preparation of a revised strategy or plan.

Rhine or the International Commission for the Protection of the Moselle and the Saar, have a role in analysing water- and flood-related vulnerabilities in border-crossing river basins (e.g. Luxembourg).

Scientific advisory bodies are sometimes involved in providing national assessments and/or integrating new knowledge into policy development. Dedicated advisory bodies are a more recent policy innovation in the climate governance systems of many European countries (Evans and Duwe, 2021). In several Member States, their establishment and mandates are anchored in national climate laws (e.g. Finland). The formal status, responsibilities, roles and composition of such bodies tend to vary greatly; only in some Member States, scientific advisory bodies, expert panels or climate councils have a mandate that explicitly covers adaptation (EEA, 2021c).

Although the information provided by Member States offers little detail, some of these institutions appear to have a role regarding national CRAs. Examples include the National Climate Panel (Finland), which also has some resources to carry out synthesis work; the Swedish Expert Council on Adaptation, completing a detailed assessment report for the government every five years; and the National Adaptation Division (Hungary), which provides the responsible ministry with adaptation-related analyses and is responsible for developing and operating the national adaptation geo-information system.

National CRAs heavily rely on domestic research capacities, strategic alignment of national research programmes with adaptation policymaking needs and stakeholder engagement. Assessments are mostly carried out by universities, research institutes, government agencies (e.g. environment agencies, meteorological institutes and hydrological institutes) and, in a few cases, private consultants. Most Member States heavily rely on their domestic research capacities, and many draw on research carried out by a large number and broad range of scientific institutions (e.g. Estonia lists 14 scientific institutes). Usually, national CRAs involve a large variety of external stakeholders, including public administrations at different levels, external researchers and non-governmental stakeholders.

Expert elicitations and feedback from stakeholders are regularly used to examine the plausibility of assessment results or to prioritise climate risks for more detailed analysis (e.g. Cyprus). Several countries report that national climate research programmes have been strategically aligned with adaptation policymaking needs (e.g. Austria) or that dedicated programmes for building knowledge around adaptation planning have been installed (e.g. the Environmental Protection Agency research programme in Ireland, and the Delta Programme and Knowledge for Climate Programme in the Netherlands). Some countries have used, or intend

to use, EU-funded projects for developing their knowledge base (e.g. Cyprus and Türkiye). According to the EEA (2018), international, European and transnational assessments are also considered important sources of information for developing national adaptation policies.

Legal requirements to carry out CRAs, which sometimes allocate responsibilities for their preparation to sectoral or sub-national authorities, are in place in several Member States. A number of Member States have enacted legal requirements, and sometimes anchored them in national climate law, that stipulate the preparation and/or updating of CRAs. Member States where preparation of climate impact, vulnerability or risk analysis is mandatory for regional authorities and/or national authorities in charge of sector policies include France, Ireland and Sweden. Sweden explicitly mentions that central-level support, e.g. in the form of guidelines, data or advice, is available for the work.

Improving links between CRAs and risk assessments from related policy fields, in particular national risk assessments (NRAs), has substantial potential for synergies and clearly favours increasing coherence and complementarity between policy areas (EEA, 2020a). However, country reports from 2021 contain scarce information about new efforts to establish closer coordination with national risk assessments for disaster risk prevention, and seizing the synergies between both is still limited. This suggests that earlier recommendations (EEA, 2018, 2020a) for strengthening the close coupling of joint assessment efforts are still valid (UNDRR, 2022). According to the information reported in 2021, more Member States have integrated climate change impacts into national disaster risk management frameworks and sectoral planning (e.g. NRA, national civil protection plan, flood risk management plan and river basin management plan), which is the first step to earlier picking up recommendations.

2.5 Foreseen reviews and updates of climate risk assessments

Making continuous progress on CRAs is crucial to provide up-to-date information for the development of adaptation policies and measures. The EEA (2018) report on this topic draws several important conclusions. Constructing CRA (or climate change impact and vulnerability assessments, as they are called in that report) processes that are flexible, use different forms of data and address the needs of Member States was noted as crucial. Engaging stakeholders in CRAs is seen as a beneficial way of broadening the knowledge base that underpins assessments. Both cross-sectoral and cross-border interactions should be considered in a more systematic way.

Most Member States report taking steps to develop or update CRAs in the near future ([15]). New or updated multi-sectoral or thematic CRAs are under development in most countries. Several Member States reported that no recent CRA-related activities have been carried out or are currently planned (Bulgaria, Croatia, Estonia, Latvia, Lithuania and Luxembourg). Malta is planning to finalise an ongoing comprehensive assessment in 2023, while Türkiye refers to assessments under an Instrument for Pre-Accession Assistance II-funded project. Some Member States provided only superficial data on the steps taken to update and review CRAs.

Some Member States discussed updating their CRAs in relation to planned policy revisions or other ongoing activities. In some countries, steps for updating CRAs are tied to the forthcoming creation or revision of NASs and NAPs (Austria, Cyprus, Denmark, Germany, Hungary, Italy, Netherlands, Portugal, Slovenia, Spain and Türkiye). However, only two countries (Austria and Finland) reported that the CRAs will be reviewed and updated in conjunction with NRAs. A new governance model that aims to integrate climate change adaptation and disaster risk reduction/management to provide a cost-efficient way of conducting national CRAs at regular intervals has been introduced (e.g. Finland). Overall, as already highlighted previously by the EEA (2020a), there is still room to better integrate CRAs and NRAs.

Regarding the thematic scope and breadth of forthcoming CRAs, most Member States report that they intend to focus on sector-based assessments of climate change impacts. Only two countries (Finland and Spain) mention to consider cross-sectoral dimensions for future assessments, and one country (Finland) mentions cross-border interactions as well as non-climatic vulnerability factors related to general societal development scenarios. Three countries report plans for further specific and innovative assessment efforts (Greece and Spain). A comprehensive economic estimation of the damage from and costs of climate change, created by combining a bottom-up approach in nine sectors with top-down economic modelling, will be delivered in Greece. Portugal is engaged in a similar exercise. Spain intends to conduct new types of analysis on worst-case scenarios and environmental and social tipping points as part of the new NAP.

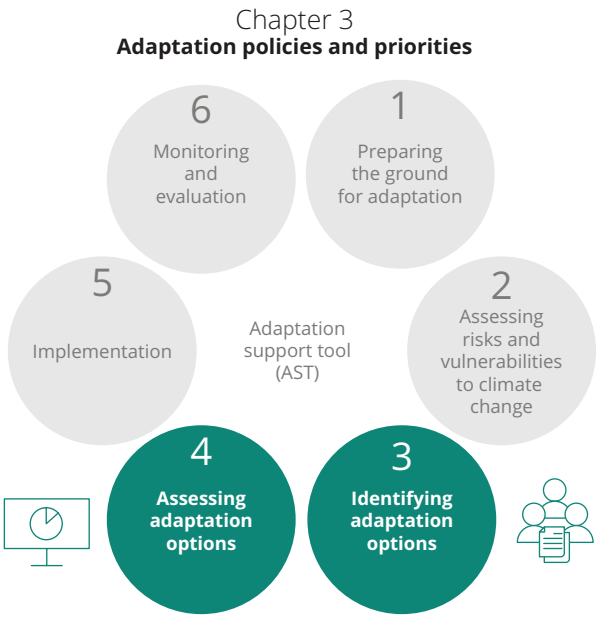
Stakeholder engagement was not widely emphasised when discussing the steps taken for CRAs. Only two countries (Finland and Spain) specifically mentioned the role of different stakeholders in the assessment process. However, clear accounts of how this engagement will be organised were lacking even in these cases.

([15]) In this section, only reported information that deals with CRAs that are currently under construction, planned or ongoing is considered. Reported information on older CRAs, sometimes conducted over a decade ago, is not considered here.

3
Adaptation policies and priorities

- Various policy instruments addressing climate change adaptation have been adopted. They reflect each country's specific national circumstances in terms of governance structure and institutional frameworks.
- Most countries still rely on rather soft policies without legally-binding commitments and on voluntary, informal and non-hierarchical cooperation. More and more Member States are using national climate laws to have more stringent legal instruments available to enforce their adaptation objectives and strategies.
- In the country reports, the prevailing strategic approach is based on avoiding and reducing climate risk. In tandem, these Member States favour 'no-regret' and 'soft' measures to address knowledge gaps, the lack of climate awareness and the lack of management capacity.
- The social justice dimension of adaptation is not yet integrated in all countries. However, this increasingly important aspect aims to address the uneven distribution of climate risks among various vulnerable groups.

Figure 3.1 Content of Chapter 3



All Member States have made further progress along the adaptation policy cycle with their policies for climate change adaptation. However, legislative instruments vary from country to country. The majority of national adaptation strategies (NASs) and plans (NAPs) are rather soft policies without legally-binding commitments: they rely on voluntary, informal and non-hierarchical cooperation. However, following the adoption of the European Climate Law (EU, 2021b) — which sets out how the goals of the EU adaptation strategy (EC, 2021b) should be monitored, reported and evaluated — Member States are making increasing use of national climate laws. This provides a more stringent legal instrument for enforcing the objectives of strategies and plans, for aspects of mainstreaming as well as of multi-level governance. Such regulatory frameworks for national adaptation policies often stipulate the authorities responsible for adaptation policymaking at different stages of the policy cycle, as well as the coordination responsibilities, reporting obligations, and high-level coordination bodies and/or scientific advisory bodies.

In terms of general orientation, national policies share an incremental approach to adaptation. Member States focus on reducing climate risks by giving preference to 'no-regret' and 'soft' informative measures. The priorities in terms of measures are quite homogeneous and distributed across a few sectors; namely, biodiversity, health, water management, agriculture and food, transport, and civil protection and emergency management. Differences in physical, human and environmental geographical conditions of a country do, in general, not correspond with differences in preference for certain types of adaptation measures. An increasing amount of attention is given to the social justice dimension of adaptation and to the social and cultural values at risk.

3.1 A diverse landscape of adaptation policies

All countries have adaptation policies in place, but the instruments used are very diverse. Figure 3.2 gives an overview of the NASs, NAPs, sectoral adaptation plans (SAPs) and regional adaptation plans (RAPs) used in EEA member countries.

According to Figure 3.2, in 2021, all EEA Member countries had a dedicated national adaptation policy in place. It almost always started with an NAS and is — in 24 out of 32 countries — complemented by an NAP and/or RAP and/or SAP.

Over 10 EU Member States have updated their NAS. The function of this document (and whether the climate risk assessment (CRA) is part of the NAS or not) determines when it needs to be updated. If its function is mainly coordination, structures can remain stable for a long period. But even documents with a mid-century outlook should be revised 'regularly' to bring them in line with the latest scientific findings and knowledge (see Section 2.4).

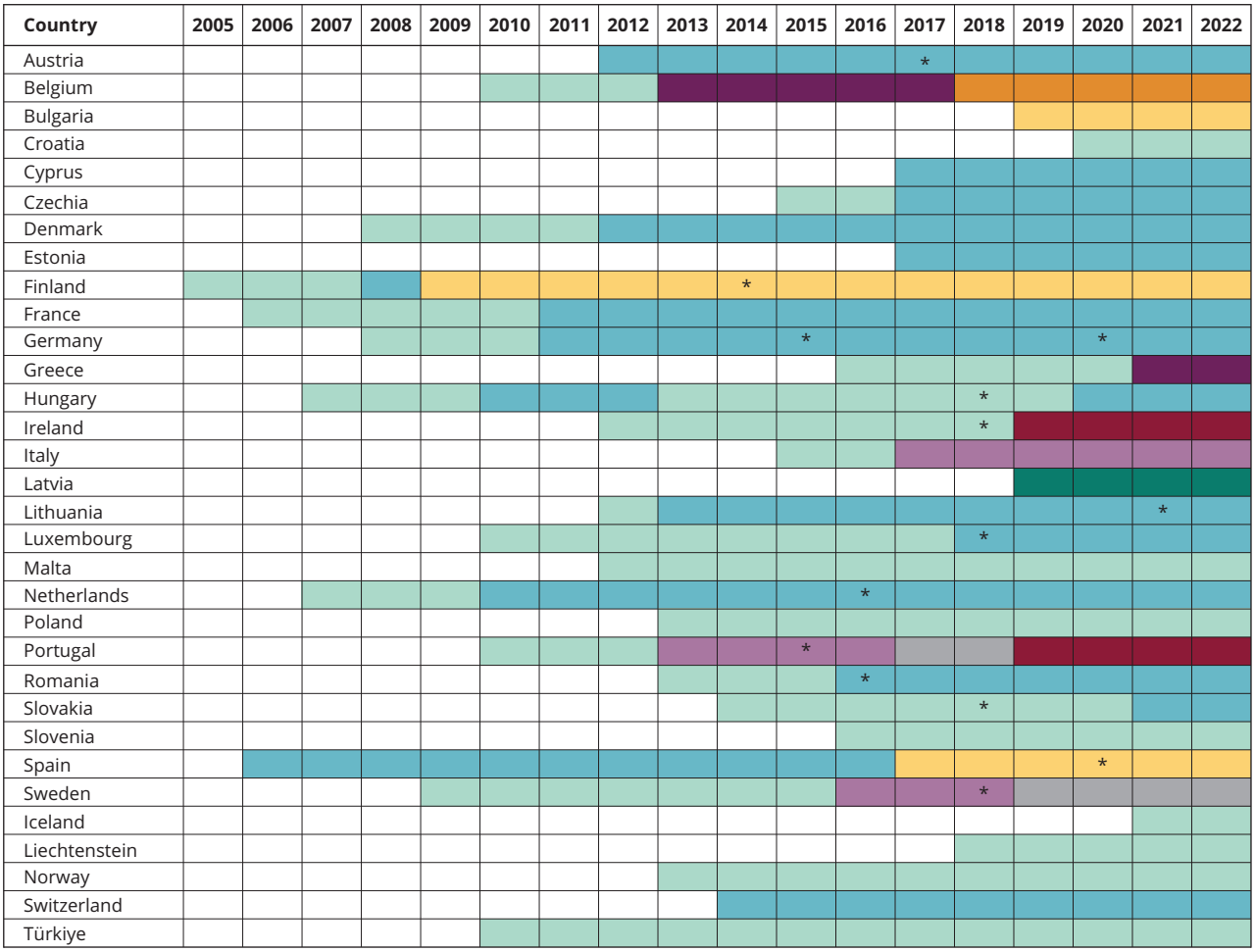
More and more countries have run through the whole adaptation policy cycle (see Figure 3.1), including a monitoring, reporting and evaluation (MRE) aspects for NAPs. Notwithstanding this, the variety of approaches to MRE is considerable. For example, it can be done with or without indicators/criteria; based on a pre-defined monitoring plan or decided at the beginning of the evaluation; follow the process or the progress; and be carried out as a quantitative or qualitative assessment.

For SAPs, the MRE process is reported almost nowhere. It remains unclear if this is because of a lack of reporting or a lack of proper MRE processes for existing SAPs. Mainstreaming complicates the reporting on an SAP compared with an NAP, where the competent authority on adaptation is in the driving seat. Therefore, only information about the revision of NASs is relatively reliable and information on the revision of NAPs, SAPs or RAPs is currently not available.

At the sub-national level, all Member States have progressed with adaptation policymaking, mostly benefiting from voluntary and bottom-up initiatives and multi-level governance arrangements and networks (EEA, 2020b). Several Member States reported that sub-national authorities have developed their own regional adaptation strategies and plans; these are often triggered by policy inputs at the national level and use the NAS and/or NAP as policy guidelines, an orientation framework, or perhaps methodological recommendations. Many of these sub-national authorities have already progressed through the entire adaptation policy cycle.

([16]) Transformative adaptation is a type of adaptation that changes the fundamental attributes of a social-ecological system in anticipation of climate change and its impacts (Möller et al., 2022).

Figure 3.2 Overview of adaptation policy instruments in EEA member countries, 2005-2022



Note: Based on reporting under the Monitoring Mechanism Regulation Art. 15 in 2015, 2016 (voluntary) and 2019, the 2018 country scoreboards prepared for the evaluation of the 2013 EU adaptation strategy and reporting under the Regulation on the Governance of the Energy Union and Climate Action Art. 19 in 2021. Figure updated until 31 May 2022.

Sources: Eionet (2019), EC (2018a), EEA (2020a, 2022b).

3.2 An incremental and no-regret approach

The overall strategic approach towards adaptation taken by all Member States is restrained. Based on the information reported, Member States prefer a risk avoidance and reduction approach with no-regret and/or soft, informative measures. No-regret adaptation is cost-effective under current climate conditions and under a range of future climate scenarios; moreover, it does not involve hard trade-offs with other policy objectives. The preference for no-regret measures particularly focuses on soft measures. These include information-gathering and dissemination to address knowledge gaps, or capacity-building and empowerment to raise awareness and increase managerial capacity to cope with climate change (ETC/CCA, 2021).

Member States focus less on aspects related to the new possibilities or challenges that could arise when implementing adaptation or transformative pathways (e.g. technological innovation, new markets and new jobs). The current focus seems to be on 'incremental' adaptation and thus has not yet become 'transformative'. Notwithstanding this, the Working Group II of the Intergovernmental Panel on Climate Change (IPCC, 2022) states with very high confidence that adaptation can generate multiple additional benefits in multiple sectors or domains. These benefits include improving agricultural productivity and food security, innovation, health and well-being and/or conserving biodiversity as well as reducing risks and damage. For instance, adaptive actions that rely on nature-based solutions might provide co-benefits such as carbon sequestration, tourism opportunities, and biodiversity conservation and restoration.

At the policy level, the EU adaptation strategy (EC, 2021b) also acknowledges the importance of the new possibilities that might open up as a result of adaptation actions. It acknowledges that the transformative ([16]) aspects of adaptation have the potential to be taken up by national planning instruments. Moreover, the European Investment Bank will actively pursue investment opportunities in the development and deployment of climate-resilient technologies, products and services.

3.3 Adaptation priorities

Despite common traits, the information reported by Member States on 'adaptation priorities' differs considerably. This is because the concept of 'priority' is interpreted in different ways. Fifteen countries reported a list of sectors and themes (Austria, Belgium, Croatia, Cyprus, Czechia, Denmark, Estonia, Germany, Hungary, Ireland, Lithuania, Luxembourg, Malta, Romania and Spain). Thirteen countries (Bulgaria, Finland, France, Greece, Italy, Latvia, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Sweden and Türkiye) reported general objectives as 'adaptation priorities', such as avoiding the adverse effects of climate change and increasing the climate resilience of natural and social systems.

Sectoral priorities are distributed across a few sectors. Among the fifteen countries that reported priority sectors, the information has not been reported in accordance with a common classification system. However, they can fit into the classification used for key affected sectors (Section 2.2, and as defined in EC (2020)). Figure 3.3 shows that the 'biodiversity' sector was a priority for all 15 countries. The other sectors frequently reported as priority are 'health', 'water management', 'agriculture and food', 'transport' and 'civil protection and emergency management'. There are small differences when the sectoral priorities reported by countries in this chapter are compared with the key affected sectors reported in Chapter 2 (see also Section 2.2). In general, the priority sectors listed outnumber key affected sectors reported, while, in some cases, one or more reported key affected sectors are not reported as priority sectors (Eionet, 2019).

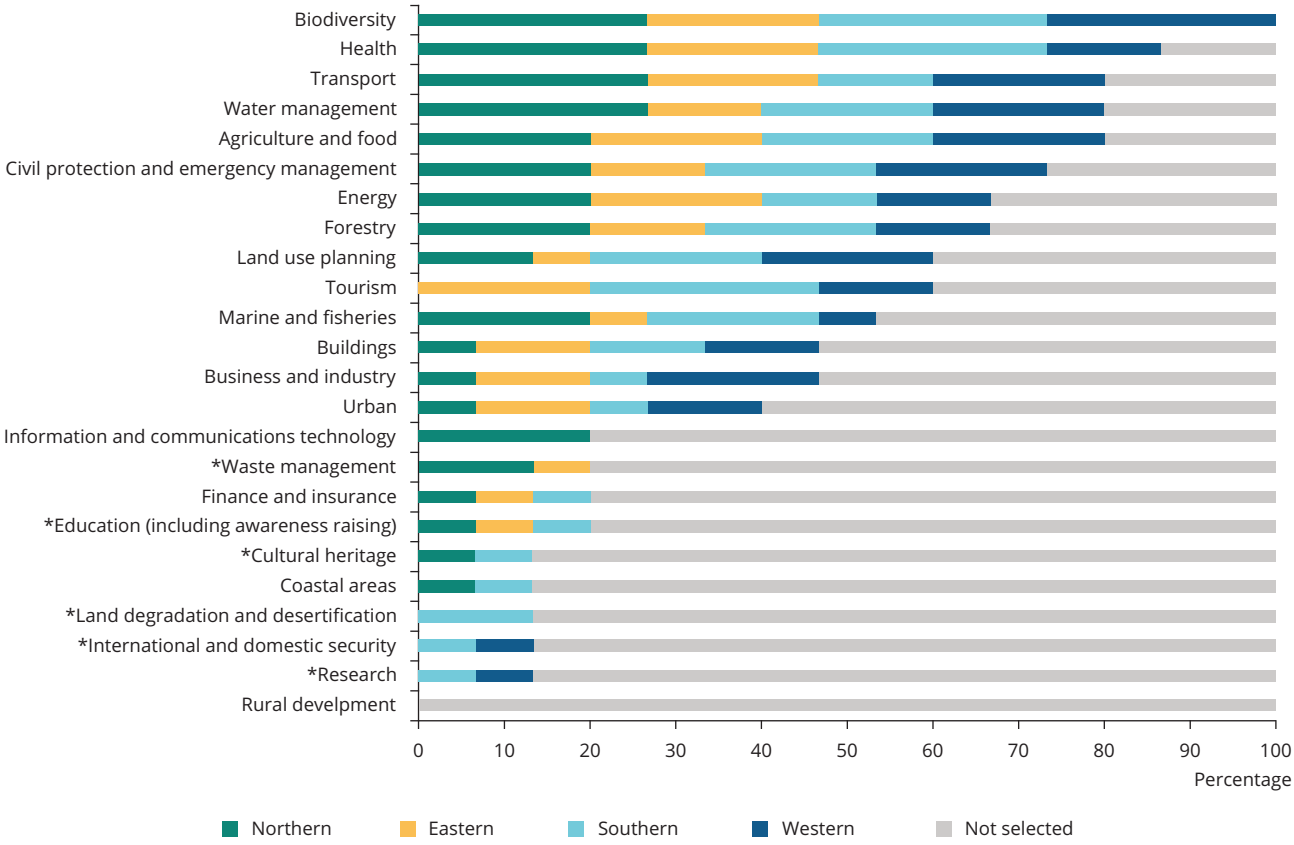
It is interesting to note that only a few Member States indicated politically- and economically-relevant areas such as 'international and domestic security' (Belgium and Spain). Among southern European countries, Cyprus and Spain listed 'land degradation' and 'desertification' as priority 'sectors'.

From the priority sectors reported, it was not possible to analyse the underpinning methodology used to establish prioritisation in most cases. Cyprus, Czechia, Denmark and Malta made explicit reference to the process of identifying priority sectors. Germany and Spain refer to sectors as 'clusters' and 'areas of work', respectively: they represent a way of classifying and clustering adaptation actions previously identified, without expressing any particular sectoral priority. Among the 13 countries that set out a number of general objectives as priority, Sweden and the Netherlands defined them based on the specific climate risks assessed.

Economic considerations have not been reported as criteria for setting priorities. It remains unclear to what extent potential losses or damage from climate change or the costs of adaptation have been considered in the prioritisation process.

([16]) Transformative adaptation is a type of adaptation that changes the fundamental attributes of a social-ecological system in anticipation of climate change and its impacts (Möller et al., 2022).

Figure 3.3 Reported priority sectors per geographical area



Notes: Priority sectors (%) as reported by 15 EU Member States, where possible made consistent with the classification of key affected sectors in the regulation (EU, 2020, Annex I, Footnote 4).

Sectors labelled with an asterisk (*) are only in this classification and not in the list of key affected sectors.

The geographical classification of countries is consistent with the UN geo-scheme for Europe (UN ESA, n.d.), and with the similar nomenclature frequently used in EEA and Commission climate-related assessments. Northern = Denmark, Estonia, Finland, Ireland, Latvia, Lithuania and Sweden; eastern = Bulgaria, Czechia, Hungary, Poland, Romania and Slovakia; southern = Croatia, Cyprus, Greece, Italy, Malta, Portugal, Slovenia and Spain; and western = Austria, Belgium, France, Germany, Luxembourg and the Netherlands.

3.3.1 Attention to the social justice and cultural dimension of adaptation

Some Member States reported the importance of the social justice dimension in their adaptation strategies and plans, such as Austria, France, Malta, Romania and Spain. For example, Austria acknowledges the risk that climate change will increase social inequalities; therefore, reducing such inequalities is explicitly included in the country's policy objectives. It also mentions the threat of climate change to democracy. Malta refers to the importance of migration in its adaptation policy. Spain focuses on intergenerational justice and the gender perspective of its national adaptation policies.

Cultural heritage is another emerging area in tackling the social dimension of climate change adaptation. Ireland and Spain indicated 'cultural heritage' as a sectoral priority in their adaptation strategies and plans, while Latvia includes the 'preservation of natural, cultural and historical values' among its five strategic objectives. Denmark and Romania also mentioned cultural heritage as one of the values exposed to climate risk.

3.3.2 Few geographical differences

Despite the importance of locally-specific geographical conditions and contexts, the countries' priorities do not differ much in geographical terms. The most frequently-reported priority sectors are equally selected by western, eastern, northern and southern European countries (Figure 3.3). The differences expressed were limited, although all Member states reported information showing the importance of geographical context in climate change. Moreover, all Member States reported the significant involvement of local-level governments, which normally have competences in land use planning. This is connected to the principle of subsidiarity that underpins all European policies, as well as the fact that the impacts of climate change depend on specific geographical and socio-economic conditions and contexts. Therefore, adaptation can be approached by adhering to these conditions and engaging stakeholders at the local level and in local contexts. Nevertheless, the priorities reported do not differ much from country to country.

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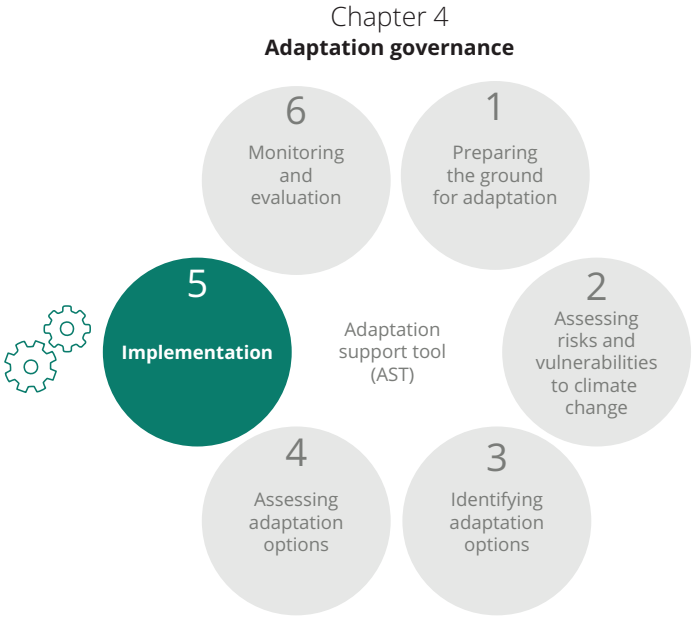
4
Adaptation governance

- Institutionalised coordination mechanisms and national coordination or advisory bodies have been further developed and strengthened in many countries in recent years. The diversity of institutional arrangements and processes for steering adaptation policies across different levels and sectors has increased, depending strongly on countries' overall governance set-up.
- Multi-level governance arrangements at the sub-national level have increased in several countries. Effective multi-level governance embodies a variety of multi-level networks and a set of collaborative mechanisms across sub-national governments. Those networks and collaborations have an essential role in supporting local governments in the development and implementation of their local adaptation strategies and action plans.
- Legal requirements to enforce horizontal policy integration and binding vertical governance frameworks that stipulate adaptation planning by regional and/or local authorities are in place in only a minority of countries. Soft, collaboration-based forms of vertical steering and a supportive governance framework for sub-national levels are more common than top-down regulatory approaches.
- EU funding instruments, macro-regional strategies, international conventions and transboundary cooperation bodies are strong enablers of transnational adaptation efforts. They have directly supported national adaptation policy processes in a number of Member States, which can be seen in the large number and diversity of forms and modes of transnational cooperation.
- Vulnerable groups were involved in the development of national and regional adaptation policies and have been considered in prioritising measures in several Member States.
- The private sector has been involved in some development and implementation of national adaptation policies. It has also been engaged in adaptation actions such as capacity-building, generating and providing information, and developing public-private collaborations at the sub-national level.

Figure 4.1 **Content of Chapter 4**



Adaptation to climate change is a cross-sectoral, multi-level and multi-issue policy field that concerns all sectors. It requires action at multiple levels, from the international and European levels to national governments and local actors. Adaptation governance relates to the ways that actors at various government levels and from various sectors interact, communicate, cooperate and coordinate their plans, decisions and actions. Establishing a governance framework for adaptation essentially entails organising communication, horizontal and vertical cooperation, and coordination between sectors and levels (see Box 4.1). This is achieved by putting in place appropriate structures, rules, mechanisms, arrangements and formats.

Climate adaptation governance involves multiple stakeholders pursuing synergies and collective efforts to address challenges and implement solutions across national and sub-national levels.

Box 4.1 Working definitions of horizontal and vertical coordination used in this report

Horizontal coordination mechanisms refer to the institutions and processes that support the integration of adaptation into sectoral policies. It requires those responsible for different policy areas within an administrative level (e.g. national) to exchange information and adjust their activities to ensure that adaptation efforts result in coherent action (EEA, 2014, 2020a).

Vertical coordination mechanisms refer to the institutions and processes that support the integration of adaptation through multiple administrative levels within a country (e.g. national, provincial, regional and local/city levels). This requires that information on and approaches to adaptation are transferred and exchanged effectively within each policy area — from the national to the sub-national levels and vice versa (EEA, 2014, 2020a).

4.1 Institutional arrangements, synergies and collaborations

A central governmental body officially in charge of adaptation policymaking is in place in all countries. National authorities responsible for adaptation policymaking and coordination are mostly located within ministries of environment or climate. In some countries, dedicated governmental climate policy units have been established at the national level. Vital technical coordination and support roles are often fulfilled by national (environment) agencies or by newly-installed technical adaptation units (e.g. 'adaptation centres').

Multi-level governance arrangements depend on the constitutional architecture of the political-administrative system in place and the socio-cultural traditions of each country. Both vertical and horizontal coordination mechanisms are essential for the development and implementation of climate change adaptation strategies and plans. This is in line with the subsidiarity principle, which is at the centre of the EU treaties. However, it also applies specifically to climate change adaptation — requiring action tailored to local conditions, specific risks and particularly affected sectors. Most Member States have already established structures, mechanisms, arrangements and formats for composing their national governance frameworks to implement climate adaptation at both the strategic (political) and the technical (operational) level. National climate laws — broadly used to include all policies that are passed or promulgated by both legislative and executive governmental powers (LSE, 2022) — have become crucial for institutionalising adaptation policies and establishing frameworks for implementing national adaptation policies in recent years, at both national and sub-national levels.

4.1.1 Institutional arrangements and governance at the national level

Climate laws play an increasing role in institutionalising national adaptation policies and embedding national adaptation strategies (NASs) and national adaptation plans (NAPs) in binding regulatory frameworks. Following the increasing adoption of climate laws in recent years, national adaptation policies (NASs, NAPs and sectoral adaptation plans) increasingly have a binding legal basis. Climate laws, or other pieces of legislation at national level, often stipulate the authorities that are politically responsible for national adaptation policies, coordinating bodies and their mandates, the allocation of responsibilities for policy development, implementation, monitoring and evaluation, reporting obligations, or the time frames for policy revision cycles (e.g. Finland, Greece, Ireland, Luxembourg and Malta). Inter-ministerial coordination bodies and scientific advisory bodies are increasingly anchored in climate laws or other national acts. Some Member States (e.g. France, Germany, Latvia and Portugal) state that they are developing climate laws, or intending to do so, respectively. Anchoring national adaptation policies in country-wide legislation can be seen as an expression of political commitment, increases the political relevance of adaptation, strengthens the legitimacy of adaptation actors and can be in favour of coherent and coordinated implementation.

Adaptation strategies and plans remain soft, non-binding policies in most countries. In all countries, existing NASs and NAPs are adopted by political resolutions of the parliament or the government, e.g. by the Council or Cabinet of Ministers. This demonstrates high-level political commitment.

However, in the majority of countries, regulatory provisions for national adaptation policies are still absent; moreover, NASs and NAPs are mostly soft policies without legally binding commitments. Thus, their implementation relies strongly on voluntary and non-hierarchical collaboration with corresponding soft, informal governance mechanisms (e.g. communication, information exchange, persuasion, consultation, dialogue, capacity-building, networking and voluntary agreements). The 2021 country reports rarely explicitly mention mandatory reporting obligations by sectoral implementation bodies and by sub-national administrative levels. An exception is Sweden, where the ordinance on adaptation sets out the mandatory and annual reporting obligations for both sectoral agencies and for county administrative boards.

All Member States have a central governmental body that is officially in charge of adaptation policymaking and mandated with political and coordination responsibilities. The national authorities acting as adaptation policy owners are most regularly the ministries of environment or climate, with a few exceptions (e.g. Finland and Croatia). Establishing a clear lead role and institutionalised central responsibilities for coordination at the national level is a prerequisite and key success factor for effective adaptation policymaking. Going considerably beyond establishing governmental climate policy units, some countries have set up dedicated climate ministries (e.g. Austria), which is a strong sign of political commitment. The same national authorities are usually tasked with the overall coordination of planning, implementing and monitoring national adaptation policies; they often hold the role of chair of interministerial steering groups or NAS working groups. Vital technical coordination and/or support functions at national levels are sometimes fulfilled by government-affiliated agencies, such as the national environment agencies or dedicated specialised institutions (e.g. Hungary).

A range of framework conditions should be fulfilled to allow coordination units to become fully effective. These include back-up by high-level political commitment, clear definition of roles and responsibilities, and sufficient capacities in terms of staff, budget, time and expertise.

Most Member States have institutionalised cross-sector or interministerial coordination bodies concerned with developing, steering and monitoring national adaptation policies. The mandates of these institutions often include both mitigation and adaptation policies, and this is where political deliberations and consultations on national climate change policies take place. They are usually composed of representatives of different ministries. However, sub-national governments, regional networks, representatives of local authority associations, non-governmental organisations (NGOs), universities and the private sector are also often represented in these committees, councils or working groups (e.g. Austria, Belgium, Denmark, Estonia, Finland, Germany, Greece, Ireland, Portugal, Slovakia, Slovenia, Spain and Sweden).

Coordination tasks are sometimes divided between the political or strategic level on the one hand, and the operational or technical level on the other. For example, in Spain, strategic coordination is done by the Spanish Climate Change Office, whereas operational coordination is carried out by the Working Group on Impacts and Adaptation. In France, the Specialised Commission of the French National Council for Ecological Transition is responsible for strategic coordination, while technical coordination is the task of ONERC (the national climate change observatory). A similar configuration is in place in Slovakia, where the Commission for the Coordination of Climate Change Policy coordinates at the strategic level and the Working Group for Adaptation does so at the operational level. A number of Member States have installed thematic and/or sectoral working groups to steer the planning and revision of national adaptation policies (e.g. Czechia and Portugal). The politically-responsible ministry cooperates with these working groups and/or often (co-)chairs them.

Institutionalised national bodies for coordinating and consulting on adaptation policymaking are an important and widely-used governance instrument that can fulfil crucial roles in horizontal policy integration and in steering adaptation. These roles are fulfilled across multiple levels, especially if such bodies are provided with a robust political mandate and sufficient resources.

Dedicated formal advisory bodies for adaptation policymaking have emerged, but they are still much rarer than similar bodies for mitigation policies. Advisory bodies have increasingly been established in EEA member countries, sometimes by means of national climate laws (EEA, 2021c). Their level of formalisation, focus and role differ strongly between countries, and their mandates relate more regularly to mitigation and/or broader environmental and sustainability policies than explicitly to adaptation. However, there are some examples of countries with formal advisory bodies for national adaptation policymaking (e.g. France, Greece, Ireland, Portugal and Sweden).

Some Member States employ dedicated horizontal governance mechanisms at the national level — ranging from regulatory mainstreaming to integrating adaptation into sector policy instruments to intersectoral coordination bodies. A few Member States have legal requirements directed at the statutory mainstreaming of adaptation into sector policies (e.g Ireland and Sweden). Some Member states have established national horizontal coordination bodies with a specific focus on intersectoral policy coherence (e.g. Croatia and Portugal).

Regulatory multi-level governance frameworks with mandatory requirements for adaptation planning by sub-national authorities exist in a few Member states, but soft, vertical coordination mechanisms combined with a supportive governance framework predominate. The national level has a central role in supporting, steering and enforcing adaptation processes at lower ranking levels. Member States are building on different governance models and employing a varied and diverse portfolio of formal and informal governance modes to promote and coordinate adaptation across levels. They use mechanisms such as a clear strategic framework, legal requirements, funding and financing mechanisms, and an enabling governance framework with non-monetary support measures.

A regulatory framework for multi-level governance of adaptation, e.g. in the form of legal obligations for authorities at lower ranking levels to set up adaptation plans, is currently present in only a minority of EU Member States (e.g. Croatia, Denmark, Greece, France and Sweden).

The adaptation planning requirements for regional and/or local authorities can also originate from sectoral policies and programmes. Mandatory requirements for adaptation planning and reporting at regional and local levels have significant potential to achieve more coherent and effective multi-level adaptation governance. This can enhance both vertical and horizontal coordination and empower sub-national actors. However, while such top-down coercion does indeed produce more local adaptation policy documents, there is still not sufficient empirical evidence to prove that top-down legal requirements result in more measures implemented on the ground (EEA, 2020b).

Soft, collaboration-based forms of vertical steering and a supportive governance framework for sub-national levels are more common than top-down regulatory approaches. Depending strongly on the country-specific context, non-coercive national support for regional and local adaptation can comprise policy inputs, capacity building (knowledge generation and provision, advisory services and training), cross-level dialogue, support for participation in city networks (such as the Covenant of Mayors (CoM)), as well as funding and financing (e.g. Austria, Ireland and Poland).

Both centralised and decentralised governance models can be successful in promoting sub-national adaptation. While top-down regulations alone are likely to be insufficient for enforcing adaptation across different levels, national support and an enabling framework provided by the country will be necessary. However, the type and extent of national-level support appears to differ among countries. Germany, for instance, seeks to combine strong central adaptation governance with an active and enabling role for the state. The country is currently working towards a national adaptation law that may include specific provisions for strategic climate risk governance by local authorities. At the same time, an updated federal funding programme for local adaptation (providing funding for local adaptation concepts, local adaptation managers and implementation projects) and a newly established advisory centre for municipal adaptation aim to increase local adaptation capacities.

Stakeholder engagement and collaboration formats are widely used in governance processes. Common modes of coordinating implementation and monitoring or revising NASs/NAPs include meetings and consultations with (sectoral) implementing bodies, other ministries, subordinated or affiliated state institutions and agencies, and sub-national authorities (regions and municipalities). The academic and research community is regularly involved in these processes; fewer countries (e.g. Cyprus) also mention the involvement of the private sector, NGOs and organised interest groups. Ad hoc advisory groups are also employed, e.g. for the first evaluation report in Spain; in other cases, individual working groups collaborate on specific issues (e.g. Austria). In addition, comprehensive institutional, methodological and procedural frameworks were reported (e.g. Germany).

4.1.2 Synergies, networks and arrangements for sub-national adaptation

Sub-national approaches to climate adaptation at the regional level are key factors in achieving national adaptation goals. They are crucial in scaling up local climate actions, filling the gap left by national adaptation policies, and enabling structural changes that would not be possible at the national and local levels. Moreover, regional adaptation strategies (RASs) and plans (RAPs) can strongly contribute to the vertical coordination of adaptation policies across all administrative levels (national-regional-local). They can also promote compliance with the NAS or NAP and actively engage communities of local authorities in the development and implementation of the RAS and RAP (e.g. Greece and Ireland).

Some Member States have established top-down regulatory frameworks and obligations for adaptation policymaking at the sub-national level, increasing the numbers of adaptation strategies and plans developed at regional and local levels. Examples of those requirements were reported by Croatia (adaptation measures in counties and large cities in strategic documents), Denmark and Ireland (local adaptation action plans), Greece (RAPs), and Sweden (RAPs).

In all countries, adaptation policymaking at sub-national levels has progressed in recent years and benefits from voluntary and bottom-up initiatives (Figure 4.2). Several countries reported that sub-national authorities have developed their own RASs and RAPs, often triggered by policy inputs at the national level and using the NAS or NAP as policy guidelines. Many of these regions have already progressed through the entire adaptation policy cycle (e.g. Austria, Belgium, Germany, Greece, Hungary and Italy). In other countries, regions are

developing integrated climate strategies (e.g. Denmark, where four of five regions have incorporated adaptation into their regional climate strategies, and the fifth region is developing its strategy). In other cases, adaptation policymaking has been integrated into sectoral programmes, strategies and regulations, such as regional sustainable development plans, flood risk management plans, land use and building codes (e.g. France and Italy).

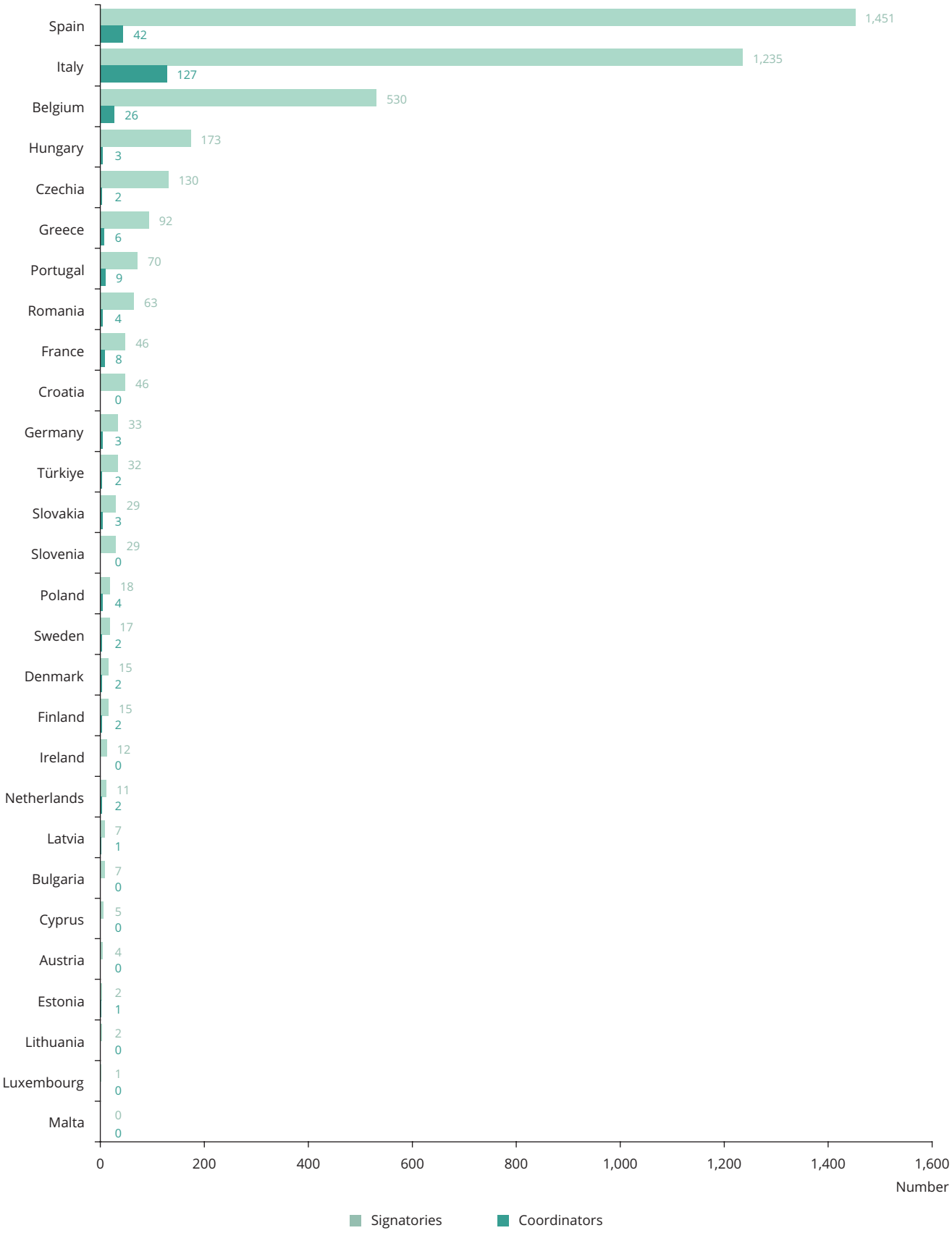
Figure 4.2 **Number of countries indicating voluntary and bottom-up initiatives for climate change adaptation at the sub-national level**

Note: Based on reporting by the 27 EU Member States and Türkiye as of 31 May 2022, and additional information retrieved from the Covenant of Mayors Europe initiative.

Sources: EEA (2022b) and Covenant of Mayors (2022).

An increasing number of cities and municipalities are developing their local adaptation strategies and plans as signatories of the CoM initiative (e.g. Czechia, Italy, Latvia, Romania, Slovakia, Slovenia and Spain). They usually receive tailored support from covenant territorial coordinators (e.g. regional governments) and covenant supporters (e.g. regional development agencies) through capacity building, technical assistance and networking activities (Figure 4.3). The data show that for each CoM signatory, on average 6.1 adaptation actions are planned in their strategies and actions plans. Of these, 1.5 are completed actions, 3.0 are ongoing actions and 1.6 are not yet started (Figure 4.4).

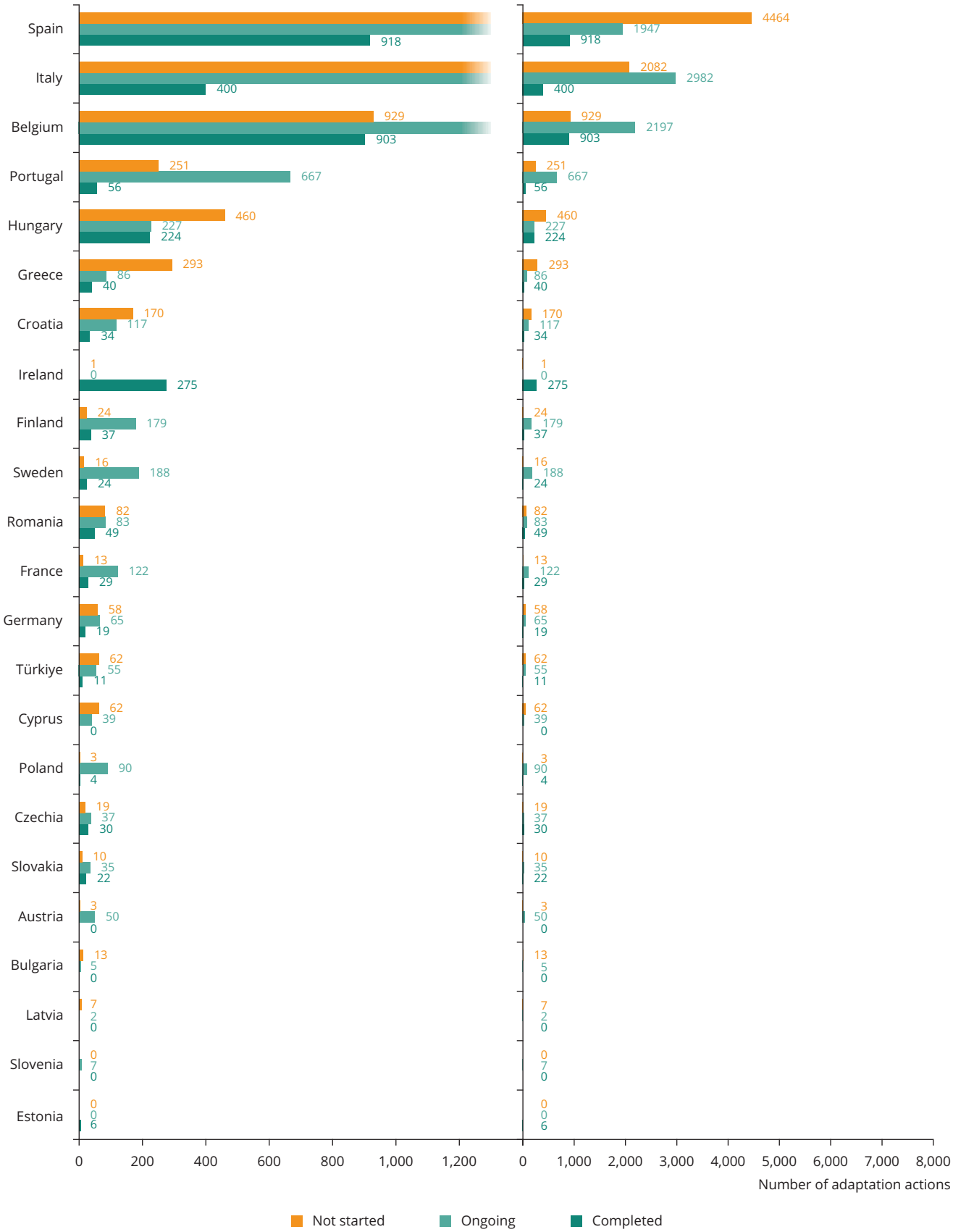
Figure 4.3 **Number of Covenant of Mayors Europe signatories and coordinators with an adaptation commitment**



Note: Based on data submitted in MyCovenant (updated March 2022).

Source: JRC (2022).

Figure 4.4 **Number of adaptation actions identified by Covenant of Mayors Europe signatories per country**



Notes: Based on data submitted in MyCovenant (updated March 2022).
There are no actions submitted for Denmark, Lithuania, Luxembourg, Malta and the Netherlands.

Source: JRC (2022).

Sub-national governments usually have a central coordination body that is officially in charge of regional adaptation policymaking. Establishing institutionalised coordination at the sub-national level is crucial for effective adaptation policymaking in all steps of the adaptation policy cycle. Regional coordinators can fulfil vital roles as agents of vertical coordination for both higher and lower ranking levels, and of horizontal coordination at their own level. Central technical coordination and/or support functions at sub-national level are sometimes fulfilled by interdepartmental and interagency bodies, which facilitate cooperation between the different levels of government (e.g. Germany). Member States with federal state systems have developed more differentiated vertical coordination models, such as semi-formal bodies such as the Conference of State Environmental Ministers and the Conference of Climate Coordinators of the States (e.g. Austria and Germany).

Developing regional adaptation policies and plans can also lead to more visible and credible political commitment by all levels of governments. In those Member States with existing RASs or RAPs, they are adopted by political resolutions made by the sub-national governments or sub-national bodies representing the national government. These bodies encourage local governments to increase the political relevance of adaptation among their various policy and daily priorities. Moreover, sub-national governments can be drivers of ongoing law-making processes at the national level by taking the role of forerunner (e.g. Germany).

Multi-level networks composed of many public and private organisations can boost the development and marketing of innovative climate solutions. Uniting individual networks has created a strong, common framework for many professional activities in research and development, project implementation and competence development to develop and market innovative solutions (e.g. Denmark). In some Member States, established networks of governments and authorities for sub-national adaptation also include higher education institutions, research centres, NGOs, local action groups and private companies (e.g. Portugal and Spain).

4.1.3 Cooperation on a transnational scale

International and transnational cooperation on climate adaptation is needed to adequately address transboundary climate risks, manage shared border-crossing resources (e.g. river basins and biodiversity) and coordinate adaptation policies and actions across borders. This type of cooperation enables collaborating parties to learn from shared strengths and weaknesses, share knowledge, strategically bundle resources, and capitalise on results that are often widely applicable and transferable. The EU adaptation strategy (EC, 2021b) repeatedly addresses the importance of considering transboundary climate risks and cooperating at international and European levels. This includes embracing macro-regional strategies, Interreg programmes and the EU Mission on Adaptation.

Member States reported a large number and diversity of forms and modes of transnational cooperation, suggesting that this element of the EU adaptation strategy is already well-developed. Altogether, Member States reported many and varied activities, structures, processes and topics related to transnational cooperation on adaptation issues. These range from commitment to international policy frameworks to participation in EU-funded programmes, and from cooperation in transnational regions to multi- or bilateral collaborations.

Coordination structures for implementing the obligations of international policy frameworks are in place in many Member States. These structures have strengthened the links between adaptation, sustainable development and disaster risk reduction. In addition to the Paris Agreement, all Member States are committed to the objectives of the major international conventions and multilateral policy frameworks addressing climate adaptation prominently at the global level. In particular, they are committed to the UN Sendai Framework for Disaster Risk Reduction 2015-2030 (UNDRR, 2015), and the UN 2030 agenda for sustainable development (UN, 2015) and its Sustainable Development Goals (UN, 2022). Member states have established coordination mechanisms and institutional structures, e.g. in the form of interministerial working groups, national focal points or national platforms for disaster risk reduction. These are intended to pursue synergies with national adaptation policy processes, e.g. through reciprocal representation of the coordination bodies from policy communities. Several Member States (e.g. Austria and Germany) explicitly report that this has galvanised policy coherence and strengthened links between climate change adaptation, sustainable development, disaster preparedness and humanitarian assistance in both national and international contexts.

Many Member States mention participation in and active contributions to international and European bodies and networks dedicated to climate research, knowledge sharing, policy deliberation, and exchange of experiences and good practices. This suggests that it is quite common to embed domestic policymaking on adaptation into strategic processes dealing with this topic at European and international levels.

Transnational cooperation is not a priority stated in many NASs or NAPs, but that does not prevent countries from engaging in many transnational activities. According to earlier analyses (EEA, 2014; EC, 2018b), transnational or cross-border cooperation is addressed in NAS and NAP documents or otherwise integrated in national adaptation policy processes in up to half of the Member States. With a few exceptions, the 2021 reporting rarely addresses explicit formal links between national policymaking and the transnational dimension (e.g. Austria, Greece and the Netherlands). The often numerous and diverse activities reported by countries confirm that the added value and benefits of engaging in transboundary adaptation efforts are firmly recognised.

EU funding instruments are strong enablers of transnational adaptation efforts and have supported national adaptation policy processes. Information from the 2021 reporting confirms that Member states continue to make regular and extensive use of the existing portfolio of EU funding schemes to generate region-specific knowledge bases, develop transferable tools and guidance, exchange experiences and good practices, and pave the way for transboundary action on adaptation challenges. Projects funded under the Interreg and LIFE programmes are most frequently mentioned. Interreg projects tend to focus on building adaptive capacities through knowledge sharing and have contributed to enhancing the knowledge base on national adaptation policymaking; in a few cases, they have also supported transboundary strategy development. Some Member States have successfully capitalised on LIFE projects to support their national policy processes and to establish durable cooperation frameworks with neighbouring countries (e.g. Cyprus, Portugal and Spain).

Apart from funding schemes in European transnational cooperation regions, most Member states report the benefits of participating in EU-funded research projects under programmes such as Horizon 2020, JPI Climate, JPI Water, ERA-NET, ERA-NET+, ERA-NET Cofund and Copernicus.

EU macro-regional strategies and international conventions are important drivers of adaptation at the transnational scale. The four EU macro-regional strategies ([17]) play an increasingly important role in fostering initiatives, projects, policy options and actions on adaptation and disaster risk reduction at the transnational scale. Countries in some European transnational regions cooperate on adaptation in the form of joint transboundary adaptation strategies or plans. Joint planning and implementation are most advanced in the field of water, flood risk and drought management in transboundary river basins. In some European regions, transnational adaptation strategies or plans have been set up based on multilateral political resolutions. This often happens in the context of macro-regional strategies, international conventions, EU-funded transnational cooperation projects or other transnational cooperation structures. This underpins the findings of the ETC/CCA (2018a) report that the factors it suggests benefit the effectiveness of transboundary adaptation policies.

Moreover, in certain European cross-border regions, international conventions (e.g. Alpine Convention, Carpathian Convention and Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention)) or multilateral treaties (e.g. Trilateral Wadden Sea Cooperation) exist and have integrated adaptation into their agendas. These have often become drivers of transnational cooperation on adaptation.

A broad spectrum of specific forms of transnational cooperation on adaptation issues is in place across European countries. Examples of this diversity include:

- working groups on climate change and transboundary impacts in the framework of the Benelux cooperation (Belgium, the Netherlands and Luxembourg);
- an exchange network of national adaptation policymakers in the Alpine countries (Austria, France, Germany, Italy, Liechtenstein, Slovenia and Switzerland);
- knowledge sharing centres such as the Pyrenean Climate Change Observatory (Andorra, France and Spain) and the World Meteorological Organization Drought Management Centre for Southeastern Europe (hosted by Slovenia);
- intergovernmental bodies such as the Nordic Council of Ministers (e.g. Denmark, Finland, Iceland, Norway and Sweden), the Barents Euro-Arctic Council, the Arctic monitoring and assessment programme of the Arctic Council;
- thematic (research) networks relevant to adaptation, e.g. in the Western Balkan countries.

Some Member States report financial support for national adaptation policy development received from the European Economic Area Financial Mechanism (e.g. Estonia and Portugal) and from donor countries (e.g. Czechia and Latvia via the Norwegian Fund). Moreover, bi- or trilateral cooperation initiatives in the research and innovation field can be relevant for adaptation issues. These include science, technology and innovation cooperation agreements; memoranda of understanding with non-European countries (e.g. Cyprus); or trilateral technological partnership schemes in the Eastern Mediterranean Region (e.g. Greece-Cyprus-Israel and Greece-Cyprus-Egypt).

4.2 Stakeholder engagement and participatory processes

Stakeholder engagement is the process of involving those who are affected by climate risk and thus have an interest in adaptation throughout the policy cycle (EEA, 2014). One of the first steps in the adaptation policy cycle (Climate-ADAPT, 2022a) (see Figure 4.1) is to identify affected stakeholders and include them in the adaptation process (step 1.2) ([18]). Next, the adaptation options should be assessed and prioritised in cooperation with stakeholders, with the aim of securing their approval of and support for the options selected (step 4.1) ([19]). There is also a role for stakeholders in implementing

([17]) So far, the EU has adopted four macro-regional strategies: the EU strategy for the Baltic Sea region (adopted in 2009), the EU strategy for the Danube region (2010), the EU strategy for the Adriatic and Ionian region (2014) and the EU strategy for the Alpine region (2015).
([18]) https://climate-adapt.eea.europa.eu/en/knowledge/tools/adaptation-support-tool/step-1-2
([19]) https://climate-adapt.eea.europa.eu/en/knowledge/tools/adaptation-support-tool/step-4-1

adaptation. Stakeholders should be involved in developing an action plan (step 5.1) ([20]) and in implementing it across sectors and governance levels (step 5.2) ([21]). In the final step, stakeholders should have a role in monitoring and evaluating the adaptation progress made (step 6) ([22]).

The objective and importance of engaging stakeholders in the processes of climate adaptation policy development, implementation, monitoring and evaluation are well understood (EEA, 2020a). Stakeholder involvement in adaptation policy processes is routinely used throughout Europe, having progressed in recent years, to build up resilience and increase adaptive capacity (EEA, 2014, 2020a). In practice, stakeholder engagement at national and sub-national levels regularly includes multiple elements. Some are participatory processes used for multiple purposes; for example, to develop adaptation policy, implement measures, and monitor and evaluate progress. These processes are also used to establish plans or activities, and develop projects (including EU-funded research or climate action projects) and information platforms to disseminate knowledge. Involving representatives from sub-national levels in policy development can contribute to agenda-setting and stimulate policy development at sub-national levels. Vice versa, adaptation policymaking at national levels benefits from the integration of local needs and local knowledge. In terms of implementing adaptation actions at the sub-national level, stakeholder engagement is more common in larger cities than in smaller cities, and in western European cities than in cities in southern Europe or central and eastern Europe (EEA, 2020b).

All Member States reported that the central level of government initiates the process of developing adaptation policies, involving sub-national authorities and stakeholders from different sectors. With stakeholder involvement now well-embedded in the adaptation process, there is an increasing emphasis on the types of stakeholder groups to be included. Specifically, these are stakeholders particularly vulnerable to climate change impacts and the private sector.

4.2.1 Involving vulnerable stakeholder groups in pursuit of just resilience

Vulnerability and exposure to climate impacts differ across regions and socio-economic groups. In many cases, climate impacts are worsening already existing inequalities and vulnerabilities. A just and fair approach to adaptation and resilience-building takes vulnerable groups into consideration to ensure that the benefits of climate adaptation are widely and equitably shared. The goal is to strengthen the resilience of those targeted by an adaptation measure without increasing the vulnerability of others (EEA, 2022c).

Adaptation initiatives have been put in place to engage with stakeholders particularly vulnerable to heat ([23]); for example, in developing heatwave action plans and preparing specific health care measures (e.g. Sweden). Research projects also focus on better understanding the conditions and needs of vulnerable groups. For example, a focus area is migrants' risk awareness and personal resilience, and how they perceive and adapt to natural hazards and climate change while living in rural areas (e.g. Austria). Another area of concern is adaptation to climate change for the vulnerable reindeer herding community (e.g. Finland and Sweden).

Efforts made to provide adaptation information to vulnerable groups, such as providing vital information and warning in good time to vulnerable populations, are improving risk management in emergencies related to climate change (e.g. Estonia and Germany). In Greece, the National Adaptation Knowledge Hub pools together adaptation-relevant data, information, good practices and approaches for stakeholders, including those particularly vulnerable to climate change impacts.

The concept of just resilience is introduced in the EU strategy on adaptation to climate change (EC, 2021b) as a step forward in the pursuit of more systemic adaptation. Along these same lines, the European Climate Law (EU, 2021b) puts a specific focus on addressing the impacts of climate change on the most vulnerable populations. The coverage of justice and inequality in the Intergovernmental Panel on Climate Change sixth assessment report (IPCC, 2022) signals the centrality of these topics in climate change adaptation at the international level.

Despite the increasing interest in social justice in adaptation, information on how vulnerable stakeholder groups are involved in or addressed by adaptation policy at national and sub-national levels in Europe is still limited. Local-level assessments of climate impacts and adaptation measure planning often take social inequality aspects into consideration. However, the participation of vulnerable groups in adaptation is very limited, and little consideration is given to the implications of adaptive actions for vulnerable groups in monitoring adaptation outcomes (EEA, 2022c). The need to give more consideration to vulnerable groups has been clearly expressed at the policy level. In 2021, Member States were asked for the first time to report on measures

([20]) https://climate-adapt.eea.europa.eu/en/knowledge/tools/adaptation-support-tool/step-5-1
([21]) https://climate-adapt.eea.europa.eu/en/knowledge/tools/adaptation-support-tool/step-5-2
([22]) https://climate-adapt.eea.europa.eu/en/knowledge/tools/adaptation-support-tool/step-6-0
([23]) Stakeholders particularly vulnerable to heat include the elderly, children, pregnant women, outdoor workers, people with pre-existing health conditions and marginalised or under-resourced people (WHO Europe, 2021).

in policy and practice at national and sub-national levels to engage vulnerable groups in adaptation under the Regulation on the Governance of the Energy Union and Climate Action. While cases of procedural justice have been reported where vulnerable groups had a role in developing climate adaptation policy, this is not yet the norm. Likewise, cases exemplifying distributive justice, in which vulnerable groups are the intended beneficiaries of adaptation measures, have been reported in a limited number of countries. Only Sweden has explicitly noted that justice in adaptation is an evolving field and work is being carried out to identify areas of action.

The participatory involvement and engagement of stakeholders is an implicit part of developing national adaptation policy; however, vulnerable populations are not yet regularly included in or addressed by the process. In several cases, vulnerable stakeholders are included in the process (e.g. France and Latvia). Groups such as young and elderly people, and indigenous Sami people in Finland, have been consulted on climate change planning, taking into account their language rights. In other cases, vulnerable groups are considered when prioritising adaptation actions (e.g. the Netherlands and Sweden). In Latvia, most adaptation measures, including one of the strategic goals, address vulnerable stakeholders.

At the sub-national level, there are examples of vulnerable groups included in the development of regional adaptation policy, addressed by adaptation strategies and engaged in municipal activities. Vulnerable populations are involved in the development of regional climate policy in France and in Greece, where the practice has become mandatory. Vulnerable groups are addressed in a regional adaptation strategy aimed at improving thermal comfort in the settlements and facilities where they live (e.g. Czechia). Municipalities regularly engage with stakeholders particularly vulnerable to climate change impacts: they have wide-ranging responsibilities from civil protection in natural disasters to elderly care (e.g. Slovenia).

4.2.2 Private sector role in national adaptation policy and engagement in adaptation actions

The private sector is essential to inclusively engaging stakeholders in adaptation planning, sufficiently reflecting on existing and future risks and vulnerabilities, and effectively enhancing ownership for the eventual implementation of adaptation measures (UNEP, 2021). The main motivation for governments to involve private sector organisations in the adaptation process is that they can implement adaptation measures. In many cases, they are already working on adaptation efforts and can be a source of finance for adaptation (Crawford et al., 2020). At the local level, private companies are the stakeholders most frequently involved in adaptation planning, and the fourth most engaged type of stakeholder in the implementation of adaptation action plans (EEA, 2020b).

The private sector has participated in the development and implementation of national adaptation policy in several EU Member States. However, its involvement in monitoring and evaluation is limited. The private sector has been involved in developing national adaptation strategies or plans in Austria, Finland, Lithuania and Romania. It also has a role in implementing national adaptation plans in Austria, Lithuania and Slovakia, and adaptation measures in Austria, the Netherlands and Spain. However, Latvia and Lithuania explicitly note that there are no legal requirements for the private sector to implement measures to adapt to climate change. The private sector is involved in monitoring France's second NAP and evaluating Spain's first NAP.

Some private sector adaptation measures are outlined in national adaptation policy. Measures range from raising the awareness and building the capacity of professional groups working in climate-vulnerable sectors in Greece to cooperating with the private sector in terms of risk sharing within the market in Czechia. Ireland is conducting an analysis of the implications from an enterprise perspective of climate change and adaptation for the private sector. Meanwhile, France recently published the results of a study to identify the economic sectors and their capacities that must be mobilised to face the impacts of climate change and propose adaptation solutions. The private sector in Spain is given a role in internalising adaptation and providing financial resources to third parties.

Information to support private sector adaptation is available in many different forms, such as reports, guidance, catalogues of technologies and methods, resource centres and programmes (e.g. Belgium, Denmark, France, Germany, Ireland, Poland, Portugal, Spain and Sweden). Private actors are going a step further in generating information in Latvia, where they are involved in developing risk assessments; and in France, where they are undertaking vulnerability analysis and adaptation forecasting exercises. They are also involved in studies by sector to identify and strengthen priority actions in collaboration with stakeholders and specialised sector institutes, higher education and research institutions and regional observatories. The German Institute for Standardization is developing standards for managing the impacts of climate change and sharing German expertise in international standard-setting bodies (see, for example, ISO 14090:2019-06 ([24]) or ISO 14091:2021 (ISO, 2019, 2021)).

([24]) An international standard setting out principles, requirements and guidelines to help organisations adapt to climate change, developed with substantial support from Germany and published as a European and national standard in early 2020 as DIN EN ISO 14090:2020-02 (Beuth Verlag GmbH, 2020).

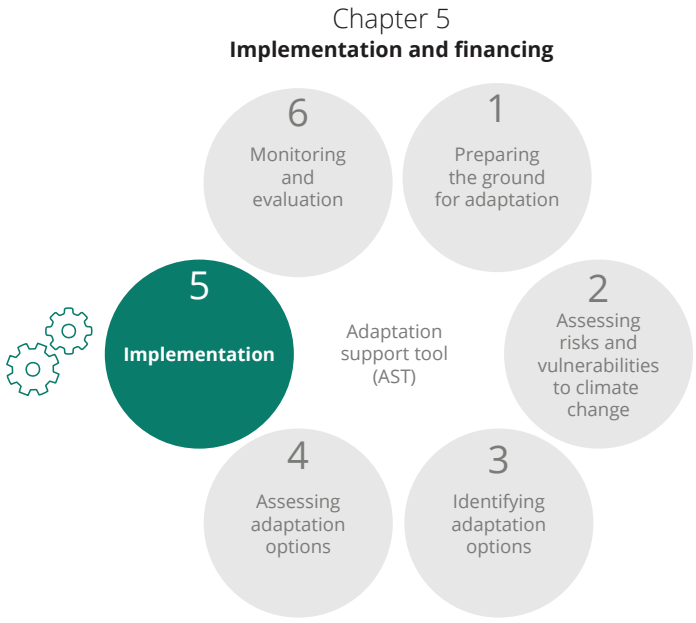
By rewarding innovation in the private sector, governments are highlighting what is working well in climate change adaptation. There are awards for highly innovative adaptation projects implemented by businesses, research institutes and associations in Germany. In Poland, there is a competition for the best investment solutions in the field of green and blue infrastructure to disseminate modern, effective and efficient solutions in cities. These solutions are meant to improve citizens' quality of life and improve cities' resilience to the effects of climate change.

Public-private collaboration on adaptation is ongoing. Networks, associations and programmes at the national level (e.g. Denmark, the Netherlands and Spain), at the sectoral level (e.g. Portugal) and at the municipal level (e.g. Slovenia) support public and private agents in working together to address climate change. A LIFE project (e.g. northern Hungary) is developing a public-private partnership in which cities and local companies work together to reduce climate risks and increase their adaptability to climate change. Spain has an insurance system based on a public-private partnership.

5 Implementation and financing

- Member States reported increasing mainstreaming of climate change adaptation in the wide range of sectors most directly affected by climate change impacts. These include water resources, agriculture, forestry, biodiversity, environment, transport, urban planning and buildings.
- Mainstreaming climate change adaptation into sectoral policies, programmes, and legal and regulatory frameworks is increasing. This mainly addresses water and urban policies, disaster risk reduction and management policies, the common agricultural policy, sustainable development, environmental impact assessments and, in part, strategic environmental assessments.
- Several Member States reported that many of their adaptation measures are about increasing adaptive capacity. These are activities that support awareness-raising, capacity-building, training, inclusion of climate change in educational programmes, strategic project implementation, and adaptation at regional and local levels.
- Ten Member States report that an overview of their progress in increasing adaptive capacity is currently not available on the national level. Several of these Member States report ongoing activities to prepare a methodology to assess adaptive capacity. A common methodology to track the financing of the implementation of adaptation strategies and plans is currently not available.
- Many Member States report challenges related to the immaturity of the monitoring, reporting and evaluation systems for tracking implementation (and especially financing). Some Member States report quantitative adaptation finance information, mainly from EU and other (research) funds, but also from public budget annual expenditure.
- Only a few Member States report having dedicated national adaptation funds to finance the implementation of national or sectoral adaptation plans. Only a minority of national adaptation strategies and plans have budgets earmarked for financing the implementation of adaptation actions.

Figure 5.1 Content of Chapter 5



Implementation in the context of the adaptation policy cycle (see Figure 5.1) is defined as putting 'a public adaptation policy into effect', meaning converting adaptation options or measures into action. The Intergovernmental Panel on Climate Change (IPCC, 2022) in its sixth assessment report identified the important role of monitoring and evaluation in informing implementation of adaptation. The use of monitoring and evaluation is currently limited but has increased since the fifth assessment report (IPCC, 2014) at local and national levels. Monitoring and evaluation facilitate learning about successful, effective and efficient adaptation options and measures, and showcases when and where additional adaptation measures may be needed. Systems for monitoring and evaluation are most effective when supported by sufficient capacity and resources and embedded in enabling governance systems.

When Member States undertake the implementation of adaptation policies and later the evaluation stages, the need for both horizontal and vertical coordination increases together with the need for stronger synergies between national and sub-national coordination bodies and networks. With increasing, institutionalised, cross-sector or interministerial coordination bodies and mechanisms in place in most Member States, more and more sub-national governments and representatives of local stakeholders, authority associations or networks are actively involved throughout the whole adaptation policy cycle.

The plurality of climate risks that cut across all kinds of policy areas as well as human activity requires a cross-cutting and multi-sectoral approach. Thus, the chapter mainstreaming looks at various kinds of implementation such as mainstreaming, how progress has been made in increasing adaptive capacity; and issues related to financing adaptation.

5.1 Adaptation mainstreaming

Mainstreaming climate change adaptation (CCA) into key national and sectoral planning processes and policymaking is a typical approach to implementing national adaptation policies.

As stated in the EEA report on monitoring, reporting and evaluation (MRE) (EEA, 2020a), the term 'mainstreaming' refers to integrating CCA into related government policies in several sectors. Mainstreaming can also involve setting up institutional or organisational structures, or designing and implementing programmes, plans and projects so that they 'automatically' take adaptation into account (Climate Policy Info Hub, 2020). Mainstreaming CCA into other policy areas is seen as a major tool in adaptation policy. By definition, it aims to ensure coherence within vertical and horizontal adaptation policy development and its implementation.

Adaptation has been mainstreamed into a broad range of sectors at the national level. These sectors include agriculture and forestry, maritime spatial planning, integrated coastal management, energy, disaster risk prevention and management, research, inland water, transport, biodiversity, migration and mobility, health and the environment.

Adaptation has been mainstreamed into sectoral policies to comply with EU legislation, particularly in water, urban and disaster risk reduction (DRR) policies and the common agricultural policy (EEA, 2020a).

5.1.1 Mainstreaming adaptation into sectoral policies, plans and programmes

There is increasing, multi-level mainstreaming of CCA into a broad range of sectors most directly affected by climate change impacts. Policy instruments for sectoral integration of adaptation mostly exist in sectoral policy fields with EU mainstreaming requirements (e.g. EU directives transposed into Member State legislation), especially the water sector. Based on the information provided in the EEA (2020a) MRE report, most national adaptation strategies (NASs) and plans (NAPs) follow a sectoral approach, and most Member States cover water management, forestry, agriculture, biodiversity and health (EC, 2018b; EEA, 2018). Most Member States reported advances in mainstreaming CCA into sectors not explored to date such as environment, transport, urban planning and buildings.

Mainstreaming CCA into national sectoral policies, programmes, legal and regulatory frameworks is also increasing. This mainly addresses water policy, sustainable development strategy, urban policy, DRR policy, the common agricultural policy and environmental impact assessments (EIA). Some Member States explicitly reported that adaptation is mainstreamed in river basin management plans (e.g. Poland) or flood risk management plans (e.g. Ireland). Another example of mainstreaming adaptation into national sectoral plans is national drought management plans (e.g. Poland, Portugal, Romania and Spain).

Adaptation activities still need to be better integrated into specific national sectoral policies (such as the EU maritime and fisheries policies) and links to climate mitigation policies have to be strengthened. Other sectors such as infrastructure, construction, tourism or economy are addressed in fewer number of countries. In France, one of the goals of the second NAP is creating and strengthening synergies between adaptation and mitigation strategies and measures. This is because the adaptation targets are directly linked to climate change mitigation targets, leading to win-win strategies and measures for more coherent, timely and effective climate action. Portugal reported integrating adaptation into its tourism strategy for 2027 and sustainable tourism plan for 2023, resulting in recommendations and regulations for adaptation requirements and standards for tourist facilities. The integration of adaptation into education policies and programmes improved the environmental education system

at all levels and increased public involvement at national and sub-national levels in Latvia.

Strengthening CCA integration into sectoral policies is one of the main goals for some NASs or NAPs, which helps increase their sustainability and impact. France, for example, reported that it is a specific goal in both the first and second NAP. In France, integration is progressing well in several sectors, such as land use and urban planning, biodiversity, forestry, agriculture, and coastal and mountainous environments. In Ireland, there are two key actions of the NAS. First, Ireland is integrating climate adaptation within all relevant national policy and legislation; second, the country is ensuring that climate proofing considerations are integrated into arrangements and reforms arising from the new national planning framework.

Some Member States have established new cross-sectoral programmes at national and sub-national levels, linking the most relevant risks with the NAP/NAS key sectors. For example, the Blue Deal programme was launched in Belgium with the ambition to increase efforts to combat drought and water scarcity. In the Netherlands, the Delta plan for agricultural water management provides cooperation between the regional water authorities and the agricultural sector. The Delta plan addresses water issues (water management, flood protection and clean drinking water provision), enhancing climate security and supporting an economically strong and sustainable agriculture.

Developing methodologies and supporting mechanisms for regional and local authorities would lead to more coherent mainstreaming. Finland, for example has developed a pilot plan for regional drought management, based on an assessment of drought impacts on water resources and water sufficiency.

5.1.2 Mainstreaming adaptation into disaster risk management frameworks

It is well understood that most of the increase in disasters due to natural hazards has been caused by extreme meteorological and hydrological events, largely because of climate change. Thus, there is a clear overlap between CCA and disaster risk management (DRM), and this also applies in mainstreaming. CCA and DRR have been mainstreamed into relevant policies and strategies at the EU level, including those for protection of the environment and critical infrastructure, as well as the financial instruments of the EU cohesion policy and Structural Investment Funds (EEA, 2017a). The country scoreboards from 2018 showed that in most of the Member States, the integration of climate change impacts and adaptation and cooperation between the two communities is not yet extensive. At that time, only nine Member States had addressed climate change in their national DRM plans and associated strategies (EC, 2018b). According to the information reported in 2021, more Member States have integrated climate change impacts into their national DRM frameworks and sectoral planning (e.g. national civil protection plans, national risk assessments, flood risk management plans and river basin management plans).

Integrating CCA into DRM is focused on the DRM cycle in terms of prevention, protection, preparedness and response, mainly by climate risk assessment (CRA) (e.g. Bulgaria, Cyprus, Finland, Greece, Hungary, Latvia, Lithuania, Portugal, Slovenia, Spain and Sweden). More efforts are needed to achieve better and more appropriate recovery. These efforts include cooperation with insurance companies, stronger vertical and horizontal governance, more comprehensive land use planning and the adequate distribution of economic and human resources.

Some Member States have identified climate-related DRM as a specific cross-cutting issue in their NAS, NAP or sectoral adaptation plan (SAP) (e.g. Austria, Belgium, Finland, Germany, Hungary, Ireland, Italy and Latvia). In other cases, long-term climate risk prevention is already integrated into a regional adaptation strategy or plan (e.g. Greece); this leads to more effective horizontal and vertical coordination for implementing cross-cutting policies on adaptation, humanitarian assistance and disaster preparedness. In addition, to strengthen policy coherence between the different frameworks and enable a more comprehensive climate risk management and adaptation planning approach, some Member States have established a centralised coordination mechanism between the various ministries responsible for CCA and DRM. This enhances efficiency and the coordination between different stakeholders at all administrative levels.

Stronger cooperation between governments and stakeholders at both national and sub-national levels is needed, addressing the cross-sectoral nature of disaster risk and the regional and local scale of climate change impacts and hazards. This would lead to more coherent DRM, strategic emergency planning and climate adaptation, which would enable the implementation of win-win adaptation and DRM policies. CCA can be integrated into national and regional risk assessment as a driver of change for DRM. This would create the framework for DRM at all administrative levels and help sub-national governments identify and prioritise win-win strategies at the regional and local levels. For example, Finland has introduced a new governance model that aims to integrate CCA and DRR to provide a cost-efficient way of conducting national CRAs at regular intervals.

Some Member States have prepared their own methodologies and guidance documents on how to integrate CCA and DRM. These documents address specific aspects of national strategic emergency management structures and frameworks (e.g. Ireland). Further development of a methodology for responding to priority risks, and providing recommendations for both prevention measures and emergency preparedness was reported (e.g. Belgium).

5.1.3 Mainstreaming into environmental assessment procedures

The country scoreboards (EC, 2018b) from 2018 have already identified that 21 Member States included adaptation in their national EIA frameworks.

Climate change impacts and adaptation are considered in all EU Member States within EIA. The requirements of the Environmental Impact Assessment Directive (EU, 2014; EC, 2022a) have been transposed into national legislation. Since there is no legal requirement in the Strategic Environmental Assessment Directive, climate change impacts and adaptation are only partially considered in strategic environmental assessments.

Some Member States have prepared their own guidance documents on how climate impacts and adaptation can be best integrated into project development and/or EIA (EC, 2018b). Alternatively, they use EU guidelines (EC, 2013a, 2015, 2016) on how to best consider climate change impacts and adaptation in environmental assessment procedures (e.g. Austria, Belgium, Ireland and Poland).

Working Group on Adaptation to Climate Change ([25]) has been created by European financing institutions, including the European Investment Bank, the European Bank for Reconstitution and Development and the Commission. In 2016, the working group published guidance to help practitioners assess climate change risks and vulnerabilities and better integrate adaptation measures into project planning, design and implementation (EUFIWACC, 2016). Several other EU guidance documents for planning infrastructure projects to include consideration of climate risk in the planning phase as well as in cost-benefit analysis were published or updated by the Commission (EC, 2013b).

To support project developers, competent authorities and consultants, part of the EU guidance is being translated into national languages (e.g. Slovenia). Guidance at the Member State level has also been issued (e.g. Austria, Finland and Hungary). For example, climate change impacts need to be considered at project screening level (e.g. Denmark and Malta) to decide whether or not an EIA needs to be performed. New technical guidance was published by the European Commission in 2021 (EC, 2021a).

Based on information from 2018, 15 Member States consider CCA in strategic environmental assessments (EC, 2018b). Several Member States have also developed guidance for considering CCA in strategic environmental assessment (e.g. Ireland) or make use of EU guidance (e.g. Romania).

5.2 Increasing adaptive capacity

The country scoreboards (EC, 2018a) from 2018 have already shown that half of the Member States are coordinating capacity-building activities that are associated with and driven by the NAS or NAP. Eleven Member States are also ensuring that capacity-building actions are pursued in a systemic way (EC, 2018b). The EEA (2020a) report on MRE highlighted that one of the elements used to measure the success of adaptation policies is the increased awareness of adaptation as a proxy for increased adaptive capacity.

The 2021 overview of the information reported makes it clear that Member States still face challenges in addressing 'adaptative capacity', especially when it comes to monitoring and evaluating adaptive capacity. Four countries (Denmark, Poland, Spain and Sweden) have addressed adaptive capacity in their reporting and taken different approaches. Adaptive capacity can be supported by data (Denmark) and information (Poland) availability. Data and information tailored to the needs of authorities are freely available to assess the vulnerability and risks of climate impacts and adaptive capacity (e.g. Denmark through the Danish Climate Atlas (DMI, 2022)). Another way to support adaptive capacity is by relying on the experience of developing, applying and revising methods and tools to conduct multiple sectoral impact and risks assessments (e.g. Spain). The third approach stresses the importance of engaging with several national authorities developing adaptation action plans for their areas of responsibility (e.g. Sweden); plans are also in place at the regional level and in many cities.

In 2021, 10 Member States reported that a national overview of progress in developing adaptive capacity is currently not available. Several of these Member States report on ongoing activities to prepare methodology to assess adaptive capacity (e.g. Croatia, Estonia, Greece, Latvia and Lithuania).

Additionally, several Member States reported that many of their NAP measures are about increasing adaptive capacity (e.g. Austria, Belgium, Cyprus, Finland, Hungary, Ireland and Romania). The assessment of the voluntary reporting on key type measures (KTMs) also shows that 'Capacity building, empowering and lifestyle practices' ([26]) has the highest number of KTMs in this category. Member States reported various activities that support awareness-raising, capacity-building, training, inclusion of climate change in educational programmes, strategic project implementation, and adaptation at regional and local levels (ETC/CCA, 2021).

([25]) The working group consists of the Agence Française de Développement, the Council of Europe Development Bank, the European Bank for Reconstruction and Development, the European Commission's Directorate-General for Climate Action, the European Investment Bank, KfW Development Bank, the Nordic Investment Bank and the Dutch Development Bank.
([26]) Namely sub-KTM E2, part of KTM E 'Knowledge and behavioural change' (ETC/CCA, 2021).

Different Member States reported diverse adaptation actions to increase adaptive capacity. Efforts to raise adaptive capacity or 'measure' progress in increasing adaptive capacity can have different means and formats. These can appear via engagement formats or sub-national/municipal activities or strategies and plans (e.g. Austria and Portugal), specific centres (e.g. France) and financial contribution to activities (e.g. Poland). In addition, a broad portfolio of projects, sectoral strategies and plans contribute to increasing adaptive capacity (e.g. Austria, Portugal and Spain). Growing the knowledge base and disseminating this knowledge via stakeholder engagement processes for NAS, NAP or SAP — or via national or sub-national adaptation portals or platforms — help increase adaptive capacity (e.g. Austria, Germany, Spain and Sweden).

There is progress in building the private sector's adaptive capacity. Organisations in the private sector are included in sector-specific projects and initiatives to help them to obtain, improve or retain the skills, knowledge, tools, equipment or other resources needed to do their work competently in the face of climate change (e.g. Denmark, Estonia, Finland, Hungary, Italy, Lithuania, Portugal, Romania and Sweden). Associations have formed to assist the private sector in the adaptation process in Croatia, France, Portugal and Spain. The private sector is involved in or addressed by EU-funded research or climate action projects in Finland, France, Greece, Hungary, Ireland, Portugal, Romania and Spain.

5.3 Financing

Most existing NASs and NAPs do not have dedicated budgets or financing streams for implementation. Thus, they are not able to allocate dedicated financial resources for implementing actions, even though these measures often need to be implemented within the respective budgets of the responsible ministries. The majority of Member States report no dedicated adaptation funds for financing implementation. The exceptions are the climate change fund in Slovenia, the climate adaptation programme for regions in Austria (Klima- und Energiefonds, 2022) and the adaptation fund for municipalities in Sweden. Portugal has an 'environment fund', which includes revenue from the EU Emissions Trading System. These revenues are then used for calls and other climate actions (mitigation and adaptation).

Many NASs and NAPs have a system to track the implementation of single measures or projects or financing actions through indicators or criteria. However, no particular detail is provided on either the methodology or the progress made. The main challenge is that there are no clear-cut criteria to define adaptation and, for example, the share of maintenance and upgrading of infrastructure that can be considered adaptation is methodologically challenging.

According to the EEA (2017b), only nine EU Member States (Denmark, Estonia, France, Germany, Lithuania, Portugal, Romania, Spain and Sweden) have budgets explicitly earmarked for and readily available to strengthen climate adaptation actions (e.g. national climate projections, climate scenarios and climate services, capacity-building and websites).

Moreover, only 14 Member States include budget allocations in their NAS or NAP. Some Member States report financial figures from larger (mainly EU) funds: public budget annual expenditure (France), operative programmes co-funded through the European Structural Investment Fund (e.g. Lithuania, Poland, Portugal and Slovakia), and other complementary funds and programmes (e.g. the Netherlands and Sweden). Other Member States intend to employ EU co-funding, in particular LIFE projects, as instruments to finance the implementation of their NAS and NAP (e.g. Cyprus) or to develop a monitoring and evaluation system.

With mainstreaming CCA into a broad range of sectors, the EU funds ([27]) are also used for adaptation (see also Section 4.2.2). However, the precise amounts allocated remain unclear. The European Commission announced that the EU had met the 20% target for 2014-2020, reporting that it had spent EUR 216 billion on climate action (ECA, 2022). However, the auditors found that the spending reported was not always relevant to climate action, and that the amount reported as having been spent for that purpose had been overstated by at least EUR 72 billion (ECA, 2022). This can also be explained by the fact that there is no common methodology for monitoring, reporting and evaluating the implementation of adaptation strategies and plans.

([27]) See EEA (2022c) for an overview of EU funding for adaptation.

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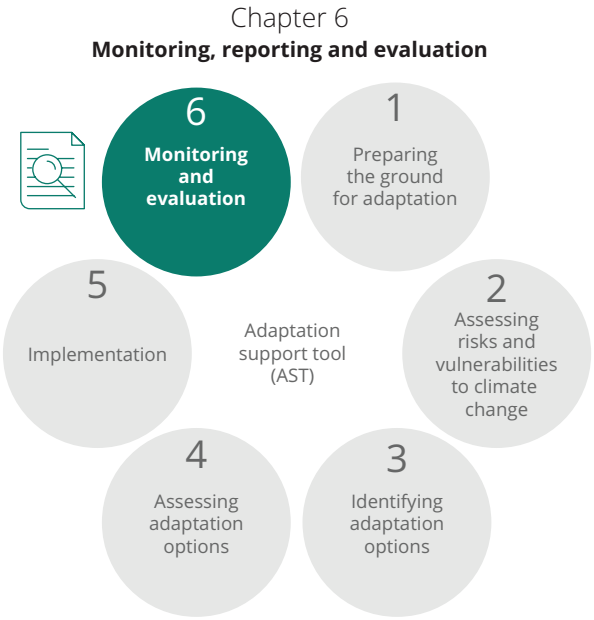
6 Monitoring, reporting and evaluation

- A growing number of EU Member States are conducting monitoring, reporting and evaluation (MRE) activities. However, the level of engagement varies across Member States. Evaluation is still less-used than monitoring and reporting in Member States, but the number of countries engaging in it is growing.
- Member States use MRE mainly for the following three objectives: to gain a better understanding of (adaptation) policy implementation, to identify climate risks and vulnerabilities and to measure the effectiveness of policy in reducing climate change impacts, risks and vulnerabilities.
- Using various methodological approaches and combining qualitative and quantitative data are key for more effective MRE. However, a limited number of Member States report using or planning to use mixed-method, participatory and indicator-based approaches to MRE.
- MRE has the potential to influence decision-making throughout the adaptation policy cycle. However, few Member States are explicitly reporting how MRE is supposed to feed back into policy. More careful consideration of the role of MRE in the adaptation policy cycle would be beneficial.

Figure 6.1 Content of Chapter 6



Monitoring, reporting and evaluation (MRE) plays an essential role in the planning, development and appraisal of climate change adaptation policies and measures. Monitoring aims to map climate risks and adaptation efforts across policy fields or sectors, using criteria or indicators to highlight changes over time. The role of reporting is to communicate monitoring results to a broader audience and make the experience gained and lessons learned available to all kinds of stakeholders. Evaluation classifies and assesses all aspects of climate change adaptation efforts, based on monitoring criteria and indicators, and presents opportunities for taking stock and producing paths for potential future development. Monitoring is mostly performed on a continuous and ongoing basis, while reporting and evaluation are mostly conducted at only specific, usually more strategic, points in time (EEA, 2020a).

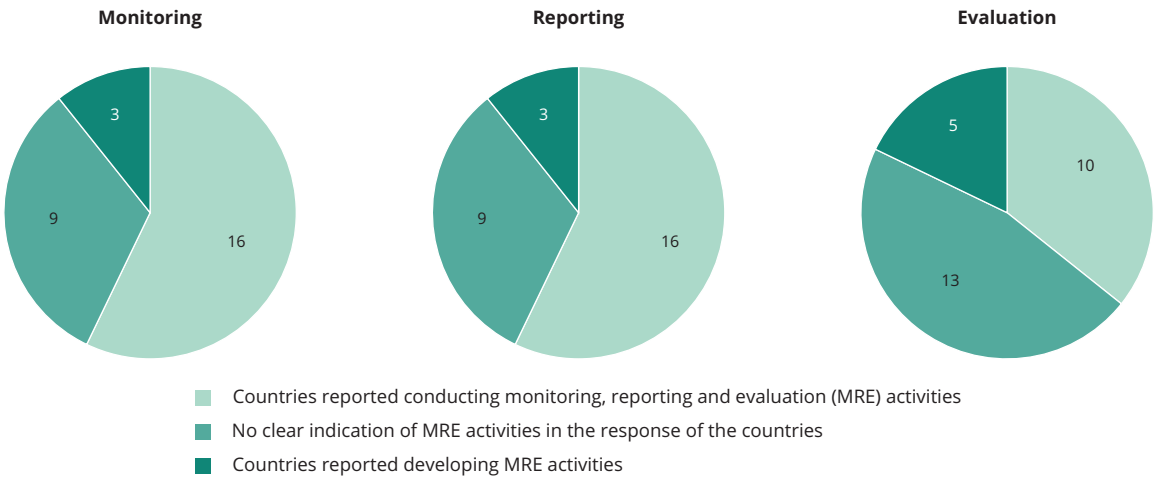
Ideally MRE is performed for each step of the adaptation policy cycle (see Figure 6.1). All steps of the adaptation policy cycle should be evaluated in order to assess, if the methods are the correct ones and more importantly, if the adaptation measures are effective and efficient, as well as if they are successful in terms of achieving the respective targets (ETC/CCA, 2018b; EEA, 2020a). MRE has the strong potential to support adaptation across all levels of governance; however, the scope and objectives of MRE vary across the international, national and local levels (EEA, 2020a).

6.1 Landscape of MRE activities

The 2021 reporting exercise suggests that a growing number of EU Member States are conducting MRE activities. In the EEA (2020a) report on MRE, it was noted that 16 Member States conducted monitoring and reporting; in tandem, 24 Member States reported that they plan to do periodic reviews of their national adaptation strategy (NAS) or national adaptation plan (NAP). Based on the data submitted in the 2021 reporting, there seems to be a positive upwards trend among countries in reported MRE activity. Twenty Member States reported having established an MRE system and engage in at least one form of MRE activity. Three Member States (Bulgaria, Greece and Hungary) report being in the middle of creating MRE systems, although there was some difficulty in interpreting the stage that Member States had reached in terms of developing an MRE system.

The level of engagement in MRE activities varies across countries. Some variation between countries exists as to what extent each element — monitoring, reporting and evaluation — is conducted (Figure 6.2). The EEA (2020a) MRE report indicated that, compared with monitoring and reporting, engagement in evaluation is relatively less common across the Member States. Based on reported data, progress in reported evaluation activities can be identified. Ten Member States reported that they engage in evaluation activities and five countries (Bulgaria, Greece, Hungary, Ireland and Slovenia) reported that they are currently developing the capacity to perform evaluations. Thus, over half of the Member States reported either having conducted or planning to conduct evaluation as part of their MRE activities.

Figure 6.2 Number of countries performing monitoring, reporting and evaluation activities



Note: Based on EU-27 Member State and Türkiye reporting.

Source: EEA (2022b).

Carefully assessing how the Member States reported the MRE activities gives important insight into their different uses of MRE. The reported information clearly indicates that MRE activities are understood fairly broadly and serve multiple purposes throughout the adaptation policy cycle in the Member States. Three main use areas for MRE can be identified from the information reported:

1. **Adaptation policy implementation and development.** Some Member States (Austria, Bulgaria, Croatia, Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovenia, Spain and Sweden) use MRE to better understand how effectively adaptation policies and measures have been implemented and further improve future policy. In this case, the focus of MRE is on policy rather than on climate change impacts.

2. **Identifying climate impacts, risks and vulnerabilities.** MRE is reported by some Member States (Croatia, Cyprus, Czechia, Denmark, Finland, Germany, Hungary, Ireland, Italy, Latvia, Luxembourg, the Netherlands, Slovakia and Spain) as being used to identify the level and extent of and change in impacts, vulnerabilities and risks. Here, the focus is on identifying climate impacts — but treating them separately from the potential effects of adaptation policy and measures.

3. **Reducing impacts, vulnerabilities and risks.** Five Member States (Czechia, Germany, Greece, Slovenia and Sweden) reported using or planning to use MRE to understand how the implemented adaptation policies and measures influence impacts, vulnerabilities and risks. Compared with the previous use areas, this demonstrates an attempt to draw connections between measures and impacts rather than deal with them individually.

All three use areas of MRE serve specific purposes and are important. However, using MRE to measure how impacts, vulnerabilities and risks are reduced seems to be emphasised less than the other uses: only five Member States have discussed MRE in this particular fashion. In addition to different purposes and uses, how MRE is conducted also varies across Member States, which is discussed in the next section.

6.2 Methodological approaches to MRE

MRE is simultaneously needed at different levels of governance, be it international, national and sub-national. However, the aims and objectives, context, available data sources and information, and suitable methodologies do vary partly strongly across the governance levels (EEA, 2020a). As the implementation of adaptation measures arising from adaptation policies and plans are highly context-specific, MRE needs to factor in a variety of issues that define if and how progress is being made towards the goals and objectives of adaptation policy. There are multiple ways to achieve this methodologically, such as by using participatory or mixed methods and indicator-based approaches. Many Member States also report using these approaches for MRE purposes.

6.2.1 Mixed-methods approach

MRE systems come in different shapes and forms and use various methods and types of data. It is generally considered that national-level MRE systems benefit from being flexible and pragmatic, using methods that are appropriate to the national context. The use of mixed-method approaches can play a pivotal role in achieving this. Mixed methods can help combine multiple sources of information and provide a strong basis for assessing adaptation progress and performance (EEA, 2015, 2020a).

Combining qualitative and quantitative methods and data can be especially insightful: it can reveal critical contextual information that can help explain the narrative behind the numbers (EEA, 2015). In previous reports, countries have indeed acknowledged the potential of combining quantitative and qualitative data (e.g. EEA, 2015, 2020a). However, using mixed-methods approaches and combining quantitative and qualitative data is not widely reported by Member States. Only a small number (Austria, Cyprus, Finland, Germany and Greece) specifically describe using or planning to use both quantitative and qualitative methods and data in MRE.

6.2.2 Participatory methods

In addition to combining quantitative and qualitative data, the need to strengthen the role of participatory methods in MRE has been discussed lately. The EEA (2020a) report on MRE states that participatory approaches and co-producing knowledge have become more common in MRE — strengthening adaptive capacity as a result. A significant impact on potential collaboration and cooperation in adaptation monitoring and evaluation of NASs and NAPs is the engagement of stakeholders. It is of utmost importance to involve stakeholders in the earlier phases of the adaptation policy cycle, to ensure ownership and engagement for MRE in a later stage.

However, based on the reported information, stakeholder engagement in MRE is still underdeveloped in the Member States. Only seven (Austria, Germany, Bulgaria, Finland, Ireland, the Netherlands and Spain) reported using or planning to use some form of participatory method in MRE, such as interviews, workshops and Delphi surveys. Given the potential benefits of including more actors in MRE processes, Member States should consider giving more attention to stakeholder engagement.

6.2.3 Indicators as part of the MRE process

MRE can aid in supporting and tracking if defined (climate change-related) objectives are being achieved and if the measures are effective and implemented in a cost-effective and equitable way (ETC/CCA, 2018b). MRE can help raise awareness among various stakeholders in multiple sectors. Here, indicators, or criteria ([28]) play a key role in national MRE systems. There are multiple ways to distinguish between different climate change-related indicators depending on the social, economic and environmental context (Costa et al., 2016; Ebi et al., 2018; Pearce-Higgins et al., 2022). According to ETC/CCA (2018b) and Costa et al. (2016), there are three main categories of indicators for climate change:

1. **climate change indicators** measure the changes in and variability of the climate system (e.g. temperature and precipitation);

2. **climate change impact indicators** provide information on the consequences and impacts of climate change, focusing especially on biophysical systems (e.g. flood hazard and biodiversity loss);

3. **human and socio-economic system indicators** are social, economic, health and ecological vulnerability indicators. They are used to display how socio-economic systems are expected to be affected by climate change and to monitor and understand vulnerability, identify adaptation needs and evaluate adaptation strategies and actions (e.g. loss of livelihoods).

Countries have previously expressed a preference for including indicators, or criteria for climate change adaptation in MRE systems. Climate change and climate change impact indicators are widely adopted in tracking climate change and in supporting the different phases of environmental policymaking. The opportunity to use indicators in various ways across sectors is one of the main reasons why countries are keen to use indicators and even develop new ones (ETC/CCA, 2018b). Moreover, in several countries, indicators, or criteria have been created through an iterative and interactive process involving experts and relevant stakeholders (EEA, 2015; ETC/CCA, 2018b).

Although indicators are key in tracking climate change, climate impacts and the progress in implementing an adaptation strategy or plan, only a limited number of European countries use national indicator sets in adaptation work. Moreover, countries rely on indicators developed for other purposes, such as monitoring of biodiversity, sustainable development or disaster risk reduction, which often have certain time serios and allow for interpretation, but also often due to the lack of resources for developing new indicators for the purposes of adaptation (ETC/CCA, 2018b; EEA, 2020a). This can also be seen in the current national reporting where indicators are mostly used to monitor climate impacts rather than track adaptation progress.

The level of detail of the explanation of data used in MRE varies across the information reported by Member States. Some do not disclose any information; some mention the data type (e.g. indicators) but do not specify them further; and others go into greater detail explaining the characteristics of the data and the rationale for including them in MRE. Few Member States used indicators to track adaptation progress but focus more on climate impact. In addition, the feedback from indicators to policy development is seldom discussed or is dealt with in a superficial way.

Fifteen Member States reported using indicators in MRE (including Member States currently setting up an MRE system). Greece, for example, is currently developing its MRE system. Proposed quantitative and qualitative indicators include 'exposure indicators', 'sensitivity indicators', 'hazard indicators' and 'adaptive capacity indicators', i.e. indicators that show the ability of systems, institutions, humans or other organisms to adapt to a potential change, seize opportunities or face potential impacts. Czechia, for instance, developed 98 indicators as part of its 2019 vulnerability assessment — including those relating to exposure, sensitivity and adaptation capacity. Most Member States did not specify in their reporting the types of indicators used in relation to MRE.

However, developing and selecting indicators or criteria for adaptation can be a complex task. The challenges can be linked to long time frames and uncertainties, establishing measurable targets and objectives, challenges in interpreting the data in the right way and setting baselines for and constraints on data and resources. The process of developing national adaptation indicator sets suitable for adaptation purposes can require significant efforts to engage stakeholders. This is because indicator development is an iterative process and can be time-consuming, as many Member States' earlier experiences have shown (EEA, 2020a). Recent findings also indicate that those monitoring and evaluation processes and frameworks that incorporate issues such as social justice, ecological health and other considerations can strengthen efforts to progress towards adaptation and move away from narrow, static, indicator-based approaches (IPCC, 2022).

([28]) In general, indicators are designed to answer key policy questions and support all phases of environmental policymaking. These cover a range of aspects from designing policy frameworks until setting targets, and from policy monitoring and evaluation, to communicating with policymakers and the public (EEA, 2021a).

6.3 The influence of MRE on adaptation policy development

It is important to consider which MRE activities will have most influence on policy development. Situating MRE in a broader policy context increases the effects of these activities on policy development and decision-making. Based on the reporting, the degree to which MRE was considered to influence policy and how this happens varied across the Member States. Many Member States hinted at the capacity of MRE to influence policy but did not specify the relationship between MRE activities and adaptation policymaking more broadly.

However, four countries (Austria, Germany, Spain and Sweden) explicitly indicated that the outputs from MRE activities will be fed back into their NAS, NAP and SAP.

Learning from experience — both successes and challenges — is an important part of establishing an adaptive policy system that can integrate and act on new information. Although not specifically asked of Member States in the reporting exercise, contemplating and specifying explicitly how MRE activities can contribute to updating NASs and NAPs, and also to broader debates on climate adaptation, would certainly be beneficial.

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7 Conclusions and future directions

7.1 The main lessons learned

Based on the information reported on national adaptation actions under the Regulation on the Governance of the Energy Union and Climate Action (GovReg) in 2021, the following trends towards further increasing resilience and adaptive capacity were identified in the adaptation policy cycle (Figure 7.1), based on the Climate-ADAPT Adaptation Support Tool (Climate-ADAPT, 2022a) (see Figure 1.1).

Figure 7.1 The main lessons learned from reported national adaptation actions

Source: EEA.

Regarding preparing the ground for adaptation, the 2021 information clearly demonstrates that the solid basis needed to enable a successful adaptation policy cycle is in place in each EU Member State and Türkiye.

Countries consider the need to address climate impacts, vulnerabilities and risks when setting the strategic direction for adaptation policies and measures. Many countries have complemented and deepened existing multi-sectoral climate risk assessments (CRAs) with more targeted sectoral and issue-specific assessments. New multi-sectoral assessments were conducted less frequently than sector-based or thematically-focused assessments. Despite substantial progress in conducting multi-sectoral CRAs, they are still not available everywhere. Integrated assessments were reported occasionally. This could result in a widening gap between countries with very different levels of progress.

The knowledge base and landscape on risks has progressed because of advances in national, sectoral and sub-national CRAs in recent years. Gaps related to non-climatic factors, cross-border and international climate risks, cross-sectoral interactions, and complex, compound and cascading risks persist. Addressing these gaps will be necessary to pave the way for more systemic adaptation.

Institutionalising the periodic updating of CRAs supports evidence-based policy development. When planning for future CRAs, there is a need to broaden the scope of the assessments to address cross-sectoral and cross-border interactions and widen the knowledge base that the assessments build on. Actively involving and engaging stakeholders in the process could help with this.

Regarding national adaptation strategies and plans, each EU Member State and Türkiye adopted a policy document establishing a framework for adaptation. Most countries opted for soft, non-binding policies. Climate laws play an increasing role in institutionalising national adaptation policies and embedding national, sectoral or regional strategies and plans in binding regulatory frameworks. As a result of the increasing adoption of climate laws, (national) adaptation policies increasingly have a binding legal basis. The focus of adaptation options in the information reported is on no-regret and low-regret measures. The social aspects of climate risks and adaptation measures have not been reported extensively; therefore, the picture presented in this report has limitations. In light of the increasing importance of just resilience and social justice, even broader stakeholder engagement and inclusion of vulnerable groups will be expected. Member States focus less on aspects related to the new possibilities or challenges that could arise when implementing adaptation or transformative pathways (e.g. technological innovation, new markets and new jobs). Rather, the current focus seems to be on 'incremental' adaptation and has not yet become 'transformative'.

Due to the nature of adaptation as a cross-sectoral, multi-level and multi-issue policy field that concerns all sectors and requires action at multiple levels, adaptation governance is a central element in every step of the adaptation policy cycle. The diversity of institutional arrangements and processes for steering adaptation policies across different levels and sectors has increased at the transnational, national and sub-national levels, as has engagement of the private sector.

Implementing adaptation relates to translating adaptation policies and measures into action. Mainstreaming as a relevant aspect of implementation is taking place to a wide extent, which is a good step forward and helps implementation considerably. This ensures that adaptation is on the agenda and becomes an integral part of several sectors. Financing adaptation is progressing; however, several methodological aspects, such as the tracking of adaptation spending, have not yet been solved. For example, for measures supporting different economic, societal or environmental objectives beyond adaptation, there are no standards that define the share of their costs (and benefits) to be considered climate change adaptation.

Considering the regular manifestations of the negative impacts of climate change, putting adaptation measures into practice needs to happen in a swift, systemic and smart way. The urgency is recognised in the 2021 EU adaptation strategy, calling on EU institutions and Member States to step up adaptation action (EC, 2021b).

More and more countries have now run through the whole adaptation policy cycle, including monitoring, reporting and evaluation (MRE) of adaptation policies. A steady increase in MRE activities in all countries can be seen and many countries are taking on new activities. A clearer understanding of the role and use of MRE remains a partial challenge. For example, the use of indicators or criteria varies greatly between Member States. Relying on indicators or criteria, especially to track social, economic, health and ecological vulnerability, allow us to clearly identify adaptation needs and evaluate how those needs have been addressed. MRE has the potential to influence decision-making throughout the adaptation policy cycle; therefore, more careful consideration of its role in the adaptation policy cycle would be beneficial. The best ways to feed MRE findings back into making or revising policy and into the whole policy cycle remain a challenge in some regards. At the moment, few Member States explicitly report how MRE is supposed to feed back into policy. Contemplating and specifying explicitly how MRE activities can contribute to updating national adaptation strategies and plans or sectoral or regional adaptation plans, and also to broader debates on systemic climate adaptation, would certainly be beneficial.

7.2 Future directions

7.2.1 Potential improvements for the 2023 reporting cycle

Experiences from the first adaptation reporting cycle under the GovReg revealed challenges in six main governance issues, two of which are related to voluntary aspects. Reporting on observed and future hazards, key affected sectors, elements with sub-national components, and spending on climate change adaptation was mandatory; however, different interpretations of these elements (considering the different national circumstances) or lacking the type of requested information occurred frequently. Voluntary reporting elements used for the Climate-ADAPT interactive landing page (Climate-ADAPT, 2022b), and for the summary tables of country profiles and the key type measures, were not always addressed by countries. This contributed to a lack of consistency. For the second adaptation reporting cycle under the GovReg, which is due on 15 March 2023 ([29]), the challenges will be addressed either by technical improvements in the reporting system or by further specifications in the reporting guidelines. Annex 3 of this report contains detailed explanation of and information on the improvements suggested for 2023.

7.2.2 Outlook for European developments

The EU strategy on adaptation to climate change (EC, 2021b) sets out how the EU can adapt to the unavoidable impacts of climate change and become climate resilient by 2050. The strategy is guided by four principles: to make adaptation smarter, swifter and more systemic, and to step up international action on adaptation to climate change. The policy was published only a few weeks before the 2021 reporting concluded, in February 2021. Although Member States could not reflect the four principles of the strategy in their reporting, some preliminary observations can be already made from the 2021 reporting regarding the EU ambition anchored in the EU adaptation strategy.

At the policy level, the strategy acknowledges the importance of new possibilities that might open up in the context of adaptation actions. This is echoed by the scientific community, which acknowledges that 'adaptation can generate multiple additional benefits such as improving agricultural productivity, innovation, health and well-being, food security, livelihood, and biodiversity conservation as well as reduction of risks and damages (very high confidence)' (IPCC, 2022, p. 20). However, the 'transformative' aspect of adaptation promoted by the EU adaptation strategy has not yet been taken up by adaptation policies, so it mostly follows an 'incremental' adaptation approach.

Both the EU adaptation strategy and the majority of Member States indicated the need to prioritise and address the social justice and cultural dimension of adaptation: **just resilience**, in parallel with the just transition initiative, is an emerging area tackling societal transformation.

Financial resources for implementation are nowadays targeted more often towards climate action, with adaptation as a key component. The European Investment Bank will support climate-proofing and will actively pursue investment opportunities in the development and deployment of climate-resilient technologies, products and services. The EU adaptation strategy highlights the need for the private sector to work more closely with the public sector on financing adaptation, aiming to redefine adaptation as an investment rather than a cost. The EU taxonomy for sustainable activities will facilitate faster adaptation and will act as an enabler and an incentive to channel private finance towards increasing climate resilience. The private sector can also have a role in more systemic adaptation by providing risk management and risk sharing instruments to support disaster risk financing. Significant scaling up and incentivising of private adaptation finance is one of the measures required to narrow the adaptation gap (UNEP, 2021).

In the 2021 EU strategy on adaptation to climate change, the European Commission set out to develop an EU-wide climate risk assessment (EUCRA). The first EUCRA, developed jointly by the Commission and the EEA, aims to identify adaptation-related policy priorities for the next Commission term and adaptation-related investment priorities for the next multiannual financial framework of the EU. It will support EU policy development in climate-sensitive sectors and support conducting and updating national and sub-national CRAs. The first EUCRA is scheduled for publication in early 2024, with further EUCRAs planned every 5 years thereafter.

The EUCRA will address changes in Europe's climate and other risk drivers, explore key climate risks for Europe (including the observed and projected changes in the climate) and develop priorities for action. Policy analysis is one of the inputs to the EUCRA. The information provided under the GovReg reporting on national CRAs and the outcome of the assessment presented in Chapter 2 has already been taken on board in the scoping phase of the project.

The recent launch of five Horizon Europe missions (EC, 2022c) broadened the Commission's ability to address policy domains of crucial importance. The EU Mission on adaptation to climate change (EC, 2021c, 2022b) aims to support around 150 regions and communities in Europe to achieve climate resilience by fostering the development of innovative solutions.

([29]) National energy and climate progress reports, including reporting on progress towards adaptation goals in national energy and climate plans regarding the objectives and targets of the Energy Union, are due on 15 March 2023. The technical specifications and reporting guidelines needed for the progress reporting are not discussed in this chapter.

The mission will engage with the widest range of EU regional and local actors, including communities. This is because the subnational level of governance is considered one of the main actors in adaptation to climate change and its role needs to be recognised and enhanced.

The mission offers to help any region better understand and prepare for managing climate risks, based on scientific knowledge. Regional CRAs are expected to be developed to address the needs of the mission's beneficiaries, considering the work undertaken in EUCRA. The second objective of the mission is to develop a vision and design innovation pathways leading to climate resilience, including developing overarching strategic frameworks, and to address questions of finance. The third key objective is building climate resilience by implementing roadmaps and bringing innovative solutions to the sub-national level in the form of demonstration projects.

The European Climate Law (EU, 2021b) calls on the EU institutions and Member States to ensure continuous progress in enhancing adaptive capacity, strengthening resilience and reducing vulnerability. They should ensure that adaptation policies and measures are coherent, mutually supportive, co-beneficial for sectoral policies and mainstreamed well in all policy areas and international action. The law calls on Member States to adopt, implement and regularly revise national adaptation strategies and plans in line with these principles, and it clearly defines both the strategic process and the structure and key building blocks of such documents. By 30 September 2023, and every five years thereafter, the Commission is to review the consistency of EU measures with ensuring progress on adaptation. It is also set to assess the collective progress made by Member States on adaptation and the consistency of relevant national measures with ensuring progress on adaptation. The progress assessment established by the law will illustrate where the EU and its Member States are along the shared journey towards climate resilience.

7.2.3 Outlook for international developments

The adaptation communication, anchored in the Paris Agreement ([30]), is one of the reporting vehicles under the international framework. It is meant to provide and periodically update information on adaptation priorities and implementation, and support needs, plans and actions. It is to be submitted, as appropriate, as a component of or in conjunction with other communications and/or documents — including a national adaptation plan, a national communication, a nationally-determined contribution or a biennial transparency report. A few countries submitted their adaptation communications as stand-alone documents (submission of the EU and its Member States, Austria, Italy, the Netherlands, Norway, Portugal, Spain and Switzerland), while others have submitted it as a component of their seventh national communication and plan to do so again during 2022 ([31]). The Adaptation Communication of the European Union (Slovenia and European Commission, 2021) made a clear reference to the reporting on national adaptation actions under the GovReg. In its annex, Member States' information was presented by linking the submission to the Climate-ADAPT country profiles.

The first global stocktake under the Paris Agreement is to be undertaken between 2021 and 2023 and will facilitate the assessment of collective global progress on three thematic areas, including adaptation. It intends to increase collective ambition and climate action and will be completed before the beginning of the new cycle of nationally determined contributions. Information on adaptation reported under the United Nations Framework Convention on Climate Change transparency framework will feed into the global stocktake. Other sources of information will be considered as well. Country information provided under the GovReg in the first reporting cycle in 2021 and in the next reporting cycle ending on 15 March 2023 — and the outcomes of this EEA assessment report — will support the European Commission in presenting the most accurate information on the state of adaptation in the EU. This will also potentially contribute to the EU input to the stocktake.

Adaptation is already happening across Europe. However, to ensure quality of life and secure the sustainable development of economic and social systems, it needs new momentum. The information from the 2021 reporting clearly demonstrates that all EU Member States and Türkiye have well-established adaptation policy frameworks, which have been in place for many years or decades. Countries are at different stages along the adaptation policy cycle: some of them have already completed the cycle and are building their future adaptation policies on lessons learned, best practice and knowledge gained from putting strategic planning into practice. Learning from experience, successes and challenges is important to establishing a much-needed adaptive policy system that is swift (i.e. flexible, supporting fast implementation and avoiding maladaptation), smart (i.e. integrating and reacting to new information and knowledge) and systemic (i.e. enabling effective mainstreaming in all key sectors and policy domains in a multi-level governance setting). The recent manifestations of climate change — e.g. long-lasting heatwaves, severe droughts, devastating forest fires, melting glaciers, cloudbursts and flash floods — indicate the 'new normal' and inevitability of adaptation. This points to both a pivotal and a challenging period. Implementing adaptation policies and measures, emerging from principles of good adaptation, will be of the utmost importance and even essential for progress.

([30]) UNFCCC (2015, Article 7, paragraphs 10 and 11).
([31]) The eighth national communication (NC8) can be submitted as early as the annual greenhouse gas inventory submission for the inventory year 2020 is provided to the United Nations Framework Convention on Climate Change (i.e. 15 April 2022) but no later than 31 December 2022.

Abbreviations

Abbreviation	Name	Reference
AST	Adaptation Support Tool	https://climate-adapt.eea.europa.eu/en/knowledge/tools/adaptation-support-tool
CoM	EU Covenant of Mayors for Climate and Energy	https://www.covenantofmayors.eu
CCA	Climate change adaptation	
CRA	Climate risk assessment	
DRR	Disaster risk reduction	
DRM	Disaster risk management	
EEA	European Environment Agency	https://www.eea.europa.eu
EIA	Environmental impact assessment	https://ec.europa.eu/environment/eia/eia-legalcontext.htm
Eionet	European Environment Information and Observation Network	https://www.eionet.europa.eu
ETC/CA	European Topic Centre on Climate change adaptation and LULUCF	https://www.eionet.europa.eu/etcs/etc-ca
EUCRA	EU-wide climate risk assessment	
GovReg	Regulation on the Governance of the Energy Union and Climate Action	https://eur-lex.europa.eu/legal-content/EN/TXT/?toc=OJ:L:2018:328:TOC&uri=uriserv:OJ.L_.2018.328.01.0001.01.ENG
IPCC	Intergovernmental Panel on Climate Change	https://www.ipcc.ch
KTM	Key type measure	
MMR	Monitoring Mechanism Regulation	https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013R0525
MRE	Monitoring, reporting and evaluation	
NAP	National adaptation plan	
NAS	National adaptation strategy	
NGO	Non-governmental organisation	
NRA	National risk assessment	
RAP	Regional adaptation plan	
SAP	Sectoral adaptation plan	

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Annex 1 Glossary

Climate risk assessment (CRA) refers to evidence-gathering activities that seek to assess climate change impacts, vulnerability and/or risks. They have evolved over the years and so has their use in adaptation policy development. While the importance of CRAs as information sources for developing adaptation policy is generally recognised, the exact nature of and reason for a CRA can vary greatly from country to country (EEA, 2018, p. 41).

Disaster risk management (DRM) refers to processes for designing, implementing and evaluating strategies, policies and measures to improve the understanding of current and future disaster risks, foster disaster risk reduction and transfer. DRM is also used to promote the continuous improvement of disaster preparedness, prevention and protection, response and recovery practices. The explicit purpose of DRM is to increase human security, well-being, quality of life and sustainable development (Möller et al., 2022).

Disaster risk reduction (DRR) denotes both a policy goal or objective and the strategic and instrumental measures employed for anticipating future disaster risk, reducing existing exposure, hazard or vulnerability, and improving resilience (Möller et al., 2022).

Evaluation of adaptation policies and their implementation benefits from the use of mixed methods, whereby quantitative and qualitative information and evidence from multiple sources, such as indicator data and stakeholder views, are combined. It is a specific and separate effort to focus on getting deeper insights into some elements and to progress from these insights, feeding back into adaptation policy revision (EEA, 2020a).

Horizontal coordination mechanisms refer to institutions and processes that help integrate adaptation into sector policies. It requires those responsible for different policy areas within an administrative level (e.g. national) to exchange information and adjust their activities to ensure that adaptation efforts result in coherent action. This action should respond to the unavoidable impacts of climate change and, where possible, to benefit from climate change (EEA, 2014).

Implementation is defined as putting 'a public adaptation policy into effect' — converting adaptation options into action. Once policymakers decide on, formulate and adopt an adaptation policy, it is implemented i.e. activities identified in the policy document are translated into concrete actions. The Intergovernmental Panel on Climate Change (IPCC, 2014, Chapter 15) identified the important role of monitoring and evaluation in informing implementation: 'implementing adaptation is a dynamic iterative learning process, and monitoring and evaluation help to adjust policy responses and actions to accommodate, for example, the availability of new information such as changes in climate and socio-economic conditions.'

Mainstreaming climate change adaptation concerns into other policies can make efforts to reduce climate change impacts more effective. Its critical aspect is to develop sufficient awareness among decision-makers at all levels to minimise climate change impacts. Therefore, information on potential impacts needs to be available, so that decision-makers are aware of them and a wide range of stakeholders is involved in designing policy instruments (Climate Policy Info Hub, 2020).

Mixed methods are a combination of quantitative and qualitative information and evidence from multiple sources such as indicator data and stakeholder views.

Monitoring aims to map climate change impacts and adaptation efforts across stakeholders, using criteria or indicators to show changes over time. Monitoring is usually undertaken on an ongoing basis, while reporting and evaluation activities are typically conducted at only specific, usually strategic, points in time.

A **national adaptation plan** (NAP) is a national document that articulates how a country's national adaptation strategy is to be implemented (and by whom). In most cases, the NAP outlines a strategic planning process for implementing adaptation. It presents adaptation measures in varying levels of detail, e.g. provides information on the goal of the measures and the next steps needed, assigns responsibilities to those involved and outlines the time frame and deadlines (EEA, 2014).

A **national adaptation strategy** (NAS) is a national document that articulates a country's strategic vision of adaptation to prepare the country for current and expected impacts of climate change. A NAS mostly summarises climate-related risks and vulnerabilities as well as identifying various stakeholders and sectors as areas of action. These strategies facilitate the process of coordinating the adaptation response at the horizontal and vertical levels as well as helping to raise

awareness of adaptation among various stakeholders. A NAS usually provides the framework for adaptation in which other governance approaches emerge. NASs are mainly designed by national governments and informed by the scientific community (based on Grothmann, 2011; Bauer et al., 2012; EEA, 2014, 2018).

The **national risk assessment** (NRA) is based on the EU Civil Protection Mechanism, which obliges all EU Member States and participating countries to regularly assess risks that may create the need to request civil protection assistance from other Member States. To help countries with this task, the European Commission has developed guidelines on risk assessment and mapping. Despite these, the summaries of NRAs provided to the Commission have presented several challenges related to the process and the content of the assessments (Poljanšek et al., 2019).

Reporting aims to showcase the monitoring results to a broader audience, present progress on adaptation, and make the experience gained and lessons learned available to all kinds of stakeholders.

Resilience in this report is defined as the capacity of social and economic systems and ecosystems to cope with a hazardous event, trend or disturbance. These systems must respond or reorganise in ways that maintain their essential function, identity and structure, as well as biodiversity in case of ecosystems. At the same time, resilient systems also maintain the capacity for adaptation, learning and transformation. Resilience is a positive attribute when it maintains such a capacity for adaptation, learning, and/or transformation. (IPCC, 2022, p. 7).

Stakeholder involvement and engagement is used to describe any process that involves stakeholders in some form of collaborative effort directed towards making a decision, which might involve future planning and/or behaviour change. The extent of this collaboration can vary from fairly brief and simple information provision to more extensive and long-term relationships among participants (Gardner et al., 2009).

(Adaptation) tracking refers to assessing progress on adaptation efforts over time and space and between and across populations and sectors.

Transnational is used in this report for issues beyond the national boundaries of neighbouring EEA member countries.

Vertical coordination mechanisms refer to institutions and processes in place to support integration of adaptation through multiple administrative levels within a country (i.e. national, provincial, regional and local/city level). This requires that information on and approaches to adaptation are transferred and exchanged effectively within each policy area from the national to the sub-national levels and vice versa (EEA, 2014).

Annex 2 Information on national adaptation actions

Commission Implementing Regulation (EU) 2020/1208 of 7 August 2020 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) 2018/1999 of the European Parliament and of the Council and repealing Commission Implementing Regulation (EU) No 749/2014 (EU, 2020, pp. 16-19).

Annex I: Information on national adaptation actions pursuant to Article 4

1. National circumstances, impacts, vulnerabilities, risks and adaptive capacity ([1])

   1.1 National circumstances relevant to adaptation actions:

   a. biogeophysical characteristics;

   b. demographics;

   c. economy and infrastructure.

   1.2 Climate monitoring and modelling framework:

   a. main activities on climate monitoring, modelling, projections and scenarios;

   b. main approaches, methodologies and tools, and associated uncertainties and challenges.

   1.3 Assessment of climate impacts, vulnerability and risks, including adaptive capacity:

   a. overview of observed climate hazards among the ones listed in Table A2.1 ([2]) and existing pressures ([3]);

   b. identification of key future climate hazards from the ones listed in Table A2.1 and key affected sectors ([4]).

Table A2.1 Classification of climate-related hazards ([5])

	Temperature-related	Wind-related	Water-related	Solid mass-related
Chronic	Changing temperature (air, freshwater, marine water)	Changing wind patterns	Changing precipitation paterns and types (rain, hail, snow/ice)	Coastal erosion
			Precipitation and/or hydrological variability	Soil degradation (including desertification)
	Temperature variability		Ocean acidification	Soil erosion
	Permafrost thawing		Saline intrusion	Solifluction
			Sea level rise	
			Change in sea ice cover	
			Water scarcity	

([1]) 'Adaptive capacity' as defined in the Fifth Assessment Report of the United Nations Intergovernmental Panel on Climate Change (IPCC AR5): 'The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.'
([2]) The list is not exhaustive.
([3]) Member States shall report existing environmental, economic and social pressures that are likely to be significantly affected by climate change: e.g. loss of biodiversity, poor harvest, energy poverty, unemployment, migration.
([4]) Member States shall select key sectors among the following: Agriculture and food, biodiversity (including ecosystem-based approaches), buildings, coastal areas, civil protection and emergency management, energy, finance and insurance, forestry, health, marine and fisheries, transport, urban, water management, ICT (information and communications technology), land use planning, business, industry, tourism, rural development, other [please specify].
([5]) Where relevant, Member States shall also consider secondary effects of these hazards, such as forest fires, spread of invasive species and tropical diseases, cascading effects, and multiple hazards occurring at the same time.

	Temperature-related	Wind-related	Water-related	Solid mass-related
Acute	Heat wave	Cyclone	Drought	Avalanche
	Cold wave/frost	Storm (including, blizards, dust and sand-storms)	Heavy precipitation (rain, hail, snow/ice)	Landslide
	Wildfire	Tornado	Flood (coastal, fluvial, pluvial, ground water, flash)	Subsidence
			Snow and ice load	
			Glacial lake outburst	

c. For each key affected sector, overview of the following, rated on qualitative scales of high/medium/low/not applicable, with accompanying explanation as appropriate ([6]):

   i. observed impacts of key hazards, including changes in frequency and magnitude;

   ii. likelihood of the occurrence of key hazards and exposure to them under future climate, drawing upon the best available climate modelling science;

   iii. vulnerability, including adaptive capacity;

   iv. risk of potential future impacts.

2. Legal and policy frameworks and institutional arrangements

   2.1 Legal and policy frameworks and regulations, including national adaptation strategies (NASs), national adaptation plans (NAPs) ([7]) and any sectoral adaptation plans.

   2.2 Overview of institutional arrangements and governance at the national level for:

   a. assessing climate vulnerability and risks;

   b. planning, implementing, monitoring, evaluating and revising adaptation policy ([8]);

   c. integrating climate change impacts and resilience into environmental assessment procedures;

   d. collection, ownership and reuse of relevant data (such as climate-related disaster loss data or risk data) and access to it;

   e. integrating climate change impacts and adaptation planning into disaster risk management frameworks and vice versa ([9]).

   2.3 Overview of institutional arrangements and governance at the subnational ([10]) level:

   a. legal requirements and strategic documents;

   b. networks or other collaborations on adaptation across national authorities;

   c. good practice examples of networks or other collaborations on adaptation across local and regional authorities.

3. Adaptation strategies, policies, plans and goals

   3.1 Adaptation priorities

   3.2 Challenges, gaps and barriers to adaptation ([11])

   3.3 Summaries of national strategies, policies, plans and efforts, with a focus on goals and objectives, foreseen actions ([12]), budget and timeline ([13])

   3.4 Overview of the content of sub-national strategies, policies, plans and efforts

([6]) The analysis outlined in points (i) to (iv) shall apply the best available science for vulnerability and risk analysis by the Intergovernmental Panel on Climate Change and the latest Commission guidance on the climate proofing of the Union-funded projects.
([7]) Member States shall report the title, year of adoption and status [superseded/adopted/completed and submitted for adoption/being developed] of each NAS and NAP.
([8]) Aspects to consider include decision making, planning and coordination related to adaptation strategies, policies, plans and goals, addressing cross-cutting issues, adjusting adaptation priorities and activities, implementing adaptation actions, including facilitating action to avert, minimise and address the adverse effect of climate change.
([9]) Including Article 6(1) of Decision No 1313/2013/EU of the European Parliament and of the Council of 17 December 2013 on a Union Civil Protection Mechanism (OJ L 347 I, 20.12.2013, p. 924).
([10]) Throughout the Annex, 'sub-national' refers to local and regional.
([11]) Including those institutional, governance-related and other barriers that restrict the adaptive capacity as identified in the vulnerability assessment.
([12]) Including nature-based solutions and actions leading to mitigation co-benefits and other relevant co-benefits.
([13]) The summaries shall cover also efforts to build resilience and avert, minimise and address the adverse consequences of climate change, and include an explanation how gender perspectives have been taken into account.

3.5 Overview of efforts to integrate climate change adaptation into sectoral policies, plans and programs, including disaster risk management strategies and action plans

3.6 Stakeholder engagement

Overview of measures in adaptation policy at the national level and good practice examples from the subnational levels to engage with:

a. stakeholders particularly vulnerable to climate change impacts;

b. the private sector ([14]).

4. Monitoring and evaluation of adaptation actions and processes

4.1 Monitoring and evaluation methodology ([15]) related to:

a. reducing climate impacts, vulnerabilities, risks, and increasing adaptive capacity;

b. implementation of adaptation actions.

4.2 State of play of the implementation of measures planned under points 3.3 to3.6, including an overview of the subnational level and the disbursement of funding to increase climate resilience.

The reporting on funding shall cover:

a. spending earmarked for climate adaptation including in disaster risk management;

b. to the extent possible, the share of spending used to support climate adaptation ([16]) in each sector ([17]).

4.3 Evaluating progress towards the following ([18]):

a. reducing climate impacts, vulnerabilities and risks;

b. increasing adaptive capacity;

c. cmeeting adaptation priorities;

d. addressing barriers to adaptation.

4.4 Steps taken to review and update the following:

a. vulnerability and risk assessments;

b. national adaptation policies, strategies, plans and measures.

4.5 Overview of good practice with regard to steps taken to review and update subnational adaptation plans, policies, strategies and measures.

5. Cooperation, good practices, synergies, experience and lessons learned in the field of adaptation

5.1 Good practices and lessons learnt, including at sub-national level ([19])

5.2 Synergies of adaptation actions with other international frameworks and/or conventions, in particular the Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction

([14]) Member States shall provide an overview of available information on private sector plans, priorities, actions and programmes, public/private partnerships, and other relevant private adaptation initiatives and/or projects.
([15]) Member States shall report on approaches, systems used, transparency and indicators.
([16]) The additional investment that makes a project (that would have been realised anyway) climate resilient.
([17]) Member States shall report on investment in adaptation actions by the following sectors: Agriculture and food, biodiversity (including ecosystem-based approaches), buildings, coastal areas, civil protection and emergency management, energy, finance and insurance, forestry, health, marine and fisheries, transport, urban, water management, ICT (information and communications technology), land use planning, business, industry, tourism, rural development; other [please specify].
([18]) Based on the monitoring and evaluation methodology as reported under point 4.1.
([19]) Member States may report on the good practices and lessons learnt in the following areas, when relevant: Climate modelling activities and methodologies; assessment of climate impacts, vulnerability and risks to climate change, including adaptive capacity; institutional arrangements and governance at the national level; policy and regulatory changes; coordination mechanisms; adaptation priorities; adaptation barriers; adaptation goals, objectives, undertakings, efforts, strategies, policies and plans; efforts to integrate climate change adaptation into development and sectoral policies, plans and programs; integration of gender perspectives into climate adaptation; integration of indigenous, traditional and local knowledge into climate adaptation; stakeholder engagement; climate risk communication; monitoring and evaluation; strengthening scientific research and knowledge; disaster risk reduction and management, innovative adaptation solutions and innovative financing mechanisms.

5.3 Cooperation with Union Member States, international cooperation, and with regional and international organisations ([20]):

a. cooperation to share information and to strengthen science, institutions and adaptation knowledge;

b. cooperation to enhance adaptation action at the sub-national, national, macro-regional and international level, including the area, scale and types of cooperation.

6. Any other information related to climate change impacts and adaptation

6.1 Key contact details of national coordinator and organisation

6.2 Relevant websites and social media sources used for communication on adaptation action at national and sub-national level, as appropriate

6.3 Key reports and publications at national and sub-national level

6.4 Any other relevant information

([20]) Excluding information on support to developing countries referred to in Part 2 of Annex VIII of Regulation (EU) 2018/1999.

Annex 3 Potential improvements for the 2023 reporting cycle

For the 2023 reporting under the Regulation on the Governance of the Energy Union and Climate Action (GovReg), additional explanations will be provided in the reporting guidelines, including a complete list of definitions for the different **hazards**. For the key future hazards, it should be clear whether the reporting is about the future state or about the changes compared with the observed hazards. While the detailed impacts on the different sectors are expected in the section on the key affected sectors, ideas and suggestions will be provided for the overview of existing pressures (and in particular on environmental, economic and social pressures), as well as on the secondary effects on the selected hazards. On defining 'key' future hazards, the time horizon used and trends in magnitude and/or frequency could improve the quality of the reported information.

Regarding the **key affected sectors**, the reporting for each of these sectors consists of four elements: 1) observed impacts of key hazards, 2) likelihood of the occurrence of key hazards and exposure to them under future climate conditions, 3) vulnerability, and 4) risk of potential future impacts. The first and third item refer to the observed climatic situation, while the second and fourth items refer to the future climatic situation. All of them could benefit from more detailed description in the reporting guidelines to make sure that these differences are understood in the same way across countries. To make any further assessment of the reported information, the items high, medium, low and not appropriate should be defined clearly and in a specific way for each of the four elements under this reporting section when preparing for the next reporting cycle in 2023. The interesting aspects of mixed pictures for different hazards and for different climate projections and/or geographical regions within a country should then be covered outside the ordinal assessment and become optional information that can be provided next to the descriptive assessment.

In the 2021 GovReg reporting, national adaptation strategies (NASs), national adaptation plans (NAPs) and sectoral adaptation plans (SAPs) are included 'when applicable', while the national risk assessment (NRA) reporting was in optional fields and regional adaptation plans (RAPs) were not collected in a structured way (and only collected from the descriptions provided). As a result, the gap between the situation in a country and the reported situation is probably bigger for NRAs and RAPs than for NASs, NAPs and SAPs. Together with 'climate laws' the information on all these **planning instruments** will be collected in a single table, with similar metadata asked for each of them.

The reporting elements addressing **sub-national** level are incorporated under each heading of Annex I of the GovReg Implementing Regulation, and this was reflected in the webform used for reporting. In practice and as a result, information requested and provided at sub-national level was scattered throughout the country reports. Often, the reporting elements focus on many different issues (e.g. 3.6 Overview of measures in adaptation policy at the national level and good practice examples from the sub-national levels to engage with: stakeholders particularly vulnerable to climate change impacts; the private sector). The lack of clarity on the expected content often resulted in a lack of focus in the reported information, where sub-national level-related information was present in a limited way. For the 2023 GovReg reporting, additional explanations will be provided in the reporting manuals and the webform is expected to be restructured to support the provision of information on the sub-national level.

The reporting has also shown that there are different interpretations of **adaptation spending**. No common approach exists across the EU. Although several efforts to develop a common methodology have been made, a clear and harmonised methodology is still lacking. This can be explained by the fact that adaptation is often one of several objectives of a project or policy. This also carries the risk of double-counting in different reporting schemes. The methodological limitation makes it difficult for countries to collect relevant data at the right level. In many cases only information on the share of adaptation in EU funds is reported, but no national or subnational information is provided. A substantial amount of funding related to climate adaptation is not earmarked, since measures and actions on climate change adaptation are mostly undertaken with basic funding as a part of official duties at both national and sub-national level, and some funds are allocated only when needed.

Voluntary reporting elements that are used for the Climate-ADAPT interactive landing page (Climate-ADAPT, 2022b) and the summary tables of country profiles and for the key type measures were not always addressed by countries, contributing to a lack of consistency. For the 2023 GovReg reporting, additional explanations will be provided in the reporting manuals on voluntary reporting elements, with a clear justification for the added value of the reporting of these elements, enabling the creation of interactive products, creating room for mutual learning, cross-fertilisation and inspiration across countries. In other places it can identify areas where adaptation efforts are less developed or provide lessons learned that have the potential to inspire revision of NASs/NAPs (including, for example, more operational and verifiable definitions of adaptation goals, options and measures), thus contributing to the evaluation of adaptation policies and assuring their effectiveness, efficiency and equity in the longer term.

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