EEA Report | No 1/2018

National climate change vulnerability and risk assessments in Europe, 2018

ISSN 1977-8449

European Environment Agency

National climate change vulnerability and risk assessments in Europe, 2018

Cover design: EEA
Cover illustration: © EEA

Luxembourg: Publications Office of the European Union, 2018

ISBN 978-92-9213-940-7
ISSN 1977-8449
doi:10.2800/348489

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Acknowledgements

This report was coordinated by the European Environment Agency (EEA) with contributions from the European Topic Centre on Climate Change Impacts, Vulnerability and Adaptation (ETC/CCA).

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Abbreviations

AR5	IPCC Fifth Assessment Report
CCCA	Climate Change Centre Austria
CCIV	Climate change impact, vulnerability and risk
CCRA	Climate Change Risk Assessment (UK)
CF	Cohesion Fund
COIN	Costs of inaction
DEFRA	Department for Environment, Food and Rural Affairs (UK)
DG	Directorate-General
EAA	Environment Agency Austria
EEA	European Environment Agency
Eionet	European Environmental Information and Observation Network
ERDF	European Regional Development Fund
ESIF	European Structural and Investment Funds
ETC/CCA	European Topic Centre on Climate Change Impacts, Vulnerability and Adaptation
FOEN	Federal Office for the Environment (CH)
IPCC	Intergovernmental Panel on Climate Change
JRC	Joint Research Centre
MRE	Monitoring, reporting and evaluation
NAP	National adaptation plan
NAS	National adaptation strategy
NRA	National risk assessment
NRC	National Reference Centres for Climate Change Impacts, Vulnerability and Adaptation (NRC-CCIVA)
PROVIA	Global Programme of Research on Climate Change Vulnerability, Impacts and Adaptation

SREX	IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation
UKCIP	UK Climate Impacts Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change

Executive summary

Overview

This report provides the first systematic review of national climate change impact, vulnerability and risk (CCIV) assessments across Europe. It is based on information and reflections reported from and authorised by EEA member countries on assessments that are multi-sectoral and cover the whole country. The purpose of the report is to share experiences and knowledge and to highlight approaches and practical solutions that countries have used to produce and present their assessments. The report does not attempt to evaluate or rank existing CCIV assessments; neither does it suggest that there is a one-size-fits-all approach for national CCIV assessments. Rather, it has identified lessons learned and makes suggestions for further developing CCIV assessments in the future. The intention is to provide a source of inspiration and knowledge for countries that will support the planning and implementation of adaptation to climate change in Europe.

The main information source of this report is a survey that was completed by 24 out of 33 EEA member countries. For most countries, the responding organisations were the authorities that lead the development of national adaptation policies, and in many countries additional experts were involved. Additional information was gathered from the country pages of Climate-ADAPT — the European Climate Adaptation Platform — and other public sources of information. Some countries with CCIV assessments are not covered in the main part of this report, because they did not respond to the survey.

To ensure a consistent interpretation of the survey questions and to improve the comparability of the responses across countries, the project team partially pre-filled the survey, conducted consistency checks, and discussed remaining questions with the relevant national experts. Afterwards, the project team carried out both quantitative and qualitative analyses of the survey responses.

A survey-based approach also has its limitations. Most importantly, the survey responses reflect the knowledge and views of only a limited number of experts from each country. Furthermore, there is considerable variability across countries in answering the free-text questions.

CCIV assessments supporting national adaptation policy development

According to information made available through Climate-ADAPT, almost all EEA member countries have adopted a national adaptation strategy (NAS), and over half have adopted a national adaptation plan (NAP). Furthermore, the preparatory work for the survey showed that almost all EEA member countries have conducted **at least one national CCIV assessment**.

Most national CCIV assessments were **initiated** by the lead organisation for the development of national adaptation policy; some were initiated by other public bodies or by scientific institutions. Most national CCIV assessments were **conducted** by universities and research organisations, but a large variety of other public and private institutions were involved.

According to the survey, **national adaptation policy development** has been the major reason for national CCIV assessments. The policy demand can be in the form of direct commissioning, or more generally as an explicit or implicit need for information that becomes evident during the preparation or revision of a national adaptation strategy or national adaptation plan.

Multi-sectoral and sectoral national CCIV assessments have been the most important information sources for the development of national adaptation policies. In addition, virtually all countries have also used stakeholder and expert opinions, as well as information from international and/or European CCIV assessments. Many countries have

conducted national research programmes on CCIV in order to support adaptation policy development.

Assessment approaches

A **variety of approaches and methods** has been used to produce national CCIV assessments. These include reviews of existing literature, summaries of the results of national CCIV research programmes, extensive model-based studies and stakeholder consultations. This diversity reflects the specific national circumstances, such as the purpose of the assessment, the availability of relevant CCIV information and the institutional context.

The **thematic coverage** of national CCIV assessments has been broad**,** with up to 19 different sectors and thematic areas examined in one assessment. The thematic areas covered most frequently were water and agriculture, followed by biodiversity, energy, forestry and human health.

Common challenges during assessments have included gaps in data, the integration of quantitative and qualitative information, and the comparison of diverse climatic risks across sectors.

About two thirds of the reported CCIV assessments have identified, and in some cases evaluated, **concrete adaptation measures.** This has broadened the scope of CCIV assessments and made them relevant in multiple stages of the adaptation policy cycle. These assessments have thus made connections to a policy development that not only focuses on climate impacts and vulnerabilities, but also pays attention to other societal objectives, such as the conservation of biodiversity or disaster risk reduction.

Presentation of assessment results

Almost all reported CCIV assessments presented the main results for the whole country. More than half of the assessments also included information at the **sub-national level**, which facilitates the identification of regional adaptation priorities.

Many assessments have used **monetised metrics** (e.g. expressed in euros) or **other common** metrics (e.g. low, medium and high risk) for displaying assessment results in a comparable form. Only very few assessments have communicated uncertainties in a systematic manner across all sectors.

The results of most CCIV assessments were communicated through several **dissemination channels**, including various types of interactive events. To date social media and webinars have rarely been used.

Lessons learned and suggestions for future developments

National CCIV assessments provide a general overview and can assist in setting thematic and regional priorities, but sub-national and local information is required for developing **targeted adaptation measures**.

Equal attention should be given to the **assessment process**, including an iterative dialogue between stakeholders and assessors, as is given to developing the content. Careful planning can avoid time and resource constraints during the assessment and facilitate uptake of the assessment results by policymakers.

The choice of **assessment approaches and methods** needs to take into account the particular information needs and the purpose of the CCIV assessment. The different needs and purposes will maintain diversity in CCIV assessments.

The survey responses suggest that it is important to use current climate vulnerabilities as a starting point of the analysis, and that **climate change should be considered jointly** with other drivers and policy concerns.

The increasing focus on adaptation actions in CCIV assessments further emphasises the need for **proactive stakeholder engagement** that can provide access to relevant knowledge, ensure buy-in and facilitate mutual learning. The experiences of countries highlight that stakeholder engagement is most effective when stakeholders are included throughout all stages of the assessment.

All respondents in the survey emphasised the need for further CCIV information, and all countries intend to **update their knowledge base** regarding CCIV. Future plans comprise multi-sectoral CCIV assessments as well as targeted sector-specific or thematic assessments. Based on the experiences reported, an updating cycle of approximately 5 years appears appropriate for national CCIV assessments, as it allows

for the incorporation of relevant developments in the knowledge base as well as in policy.

Additional CCIV information needs have been identified for sectors already covered as well as for new thematic areas, such as international (cross-border) impacts. There is growing recognition that a country can be strongly affected by the impacts of climate change occurring abroad, e.g. through cross-border water flows, trade relationships or climate-induced migration.

There is potential for improving the **links to national risk assessments** for security and disaster risk reduction, e.g. by using common assessment approaches, scenarios or metrics.

According to the survey responses, the following areas could be further developed in future CCIV assessments:

1. **Non-climatic factors** that influence the development of exposure and vulnerability should be systematically explored, e.g. using demographic projections and other relevant socio-economic scenarios. Improved consideration of social vulnerability factors would also lead to a better understanding of the social justice implications of climate change, as some population groups are more strongly affected than others.

2. **Cross-sectoral interactions** and **international (cross-border) impacts** are playing an important role in determining overall vulnerability and therefore deserve attention.

3. **Common metrics for impacts and vulnerabilities** can facilitate cross-sector comparisons and the identification of priority areas for action. In the case of international harmonisation, they could also support international adaptation activities and reporting. However, achieving such comparability involves value judgements, and it can mask relevant details. Hence, its applicability depends on the scope, mandate and institutional set-up of a particular CCIV assessment.

4. **Uncertainties** should be systematically assessed and communicated in a way that helps users of the assessments to consider the robustness of the conclusions.

5. CCIV assessments aimed at **supporting long-term adaptation** decisions would benefit from assessing climate impacts over time for different scenarios. Such CCIV assessments would facilitate decision-making approaches that consider different temporal sequences of possible adaptation actions ('adaptation pathways').

6. The findings of CCIV assessments are relevant for many different groups of actors, including central and local administrations, but increasingly also the private sector and civil society. The use of the assessments can be enhanced by **targeting the communication** of key findings specifically to the various audience.

1 Introduction

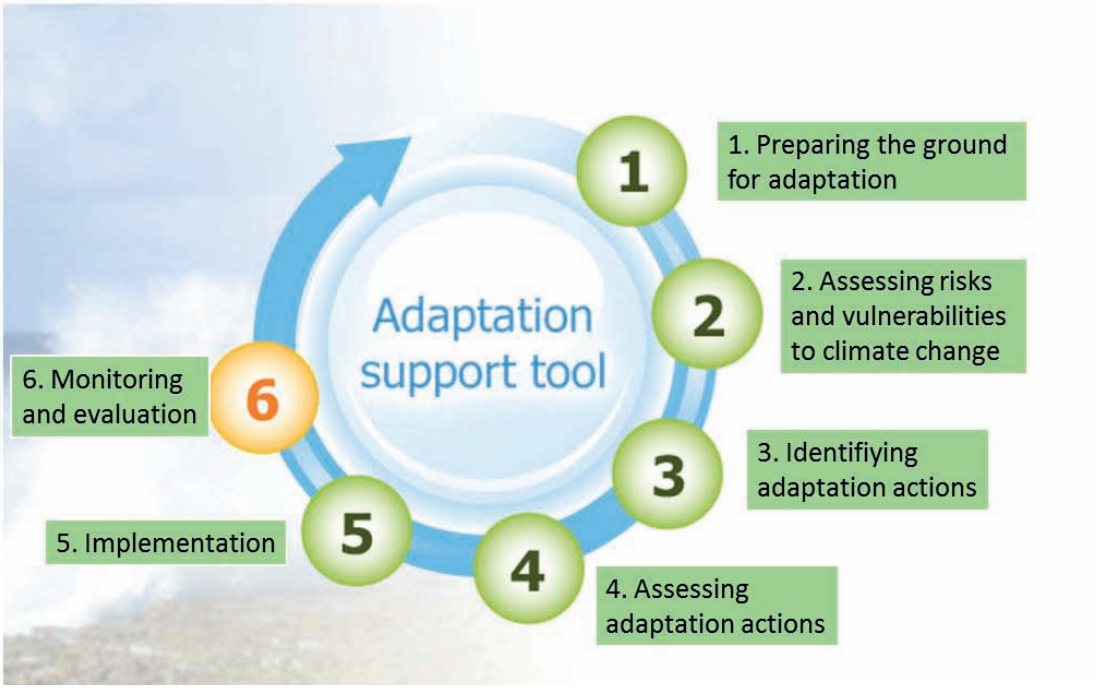
1.1 Purpose and scope

Assessments of current and projected impacts of climate change, and of associated vulnerabilities and risks ('CCIV assessments'; see Box 1.1 for a brief discussion on terminology), are a key element of adaptation policy development. They aim to inform decision-makers in government and/or business, as well as other audiences including the public, about the potential risks and opportunities presented by climate change. They also provide a means to evaluate the impacts associated with different magnitudes and rates of climate change, along with evidence to compare different response strategies and policy options (Moss et al., 2010).

This report provides the first systematic review of national CCIV assessments across Europe that is based on information and reflections reported directly by EEA member countries (see Section 1.3 for further details). Doing so, it complements earlier studies that were done without country participation or that involved only a limited number of countries. The purpose of the report is to highlight approaches and practical solutions that underlie the production and use of CCIV assessments in EEA member countries. This material is a source of inspiration and reflection for further developing sound and salient CCIV assessments that will serve the planning and implementation of adaptation to climate change.

National CCIV assessments are a key element of the national adaptation policy cycle (see Figure 1.1, Step 2). They provide crucial information for the development, implementation and revision of adaptation policies and measures, including national adaptation strategies (NASs) and national adaptation plans (NAPs).

Figure 1.1 The adaptation policy cycle



Source: EEA (adapted from Climate-ADAPT).

Box 1.1 Climate change impact, vulnerability and risk assessments: concepts and definitions

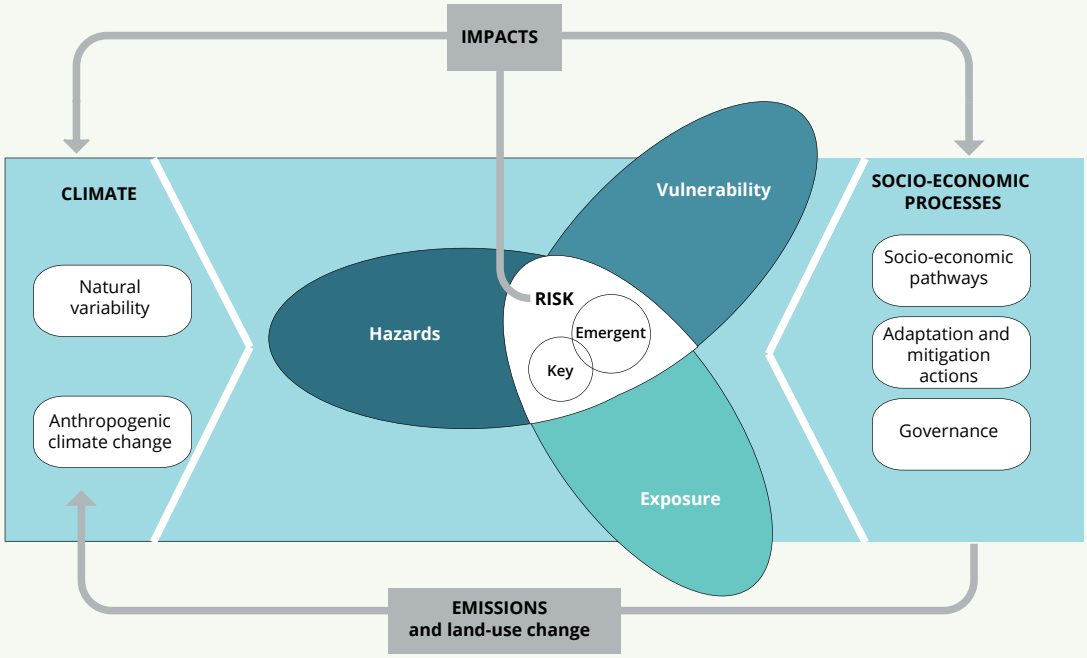
Assessments of climate change impacts, vulnerability and risks ('CCIV assessments') can have different purposes in the policy cycle, and they have developed over time. An early classification distinguished between (1) climate impact assessments that aim to advance science and to raise awareness, (2) first-generation vulnerability assessments that identify and prioritise sectors and regions for more detailed assessments, (3) second-generation vulnerability assessments that identify needs for additional adaptation actions, and (4) adaptation policy assessments that identify and evaluate specific adaptation actions (Füssel and Klein, 2006). Later the term 'climate change risk assessment' also became popular, and it is now sometimes used similarly to 'climate change vulnerability assessment'.

CCIV assessments build on contributions from different academic and expert communities, such as natural sciences, social sciences and natural hazards, which have developed their own terminologies largely independently from each other. As a result, the same term may refer to rather different concepts, and different terms may be used to refer to similar concepts. In particular, the term 'vulnerability' has been used in many different ways (O'Brien et al., 2007).

The conceptualisation of 'vulnerability' in Intergovernmental Panel on Climate Change (IPCC) reports has developed over time. Earlier definitions regarded vulnerability (to climate change) as an integrated measure of the following three dimensions: exposure, sensitivity and adaptive capacity (IPCC, 2007). Vulnerability was, therefore, interpreted as the final outcome of an assessment that integrates bio-geophysical and socio-economic factors. The IPCC partially integrated the different conceptualisations of vulnerability in its Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) (IPCC, 2012), and further developed and adjusted these in its Fifth Assessment Report (AR5) (IPCC, 2014). The AR5 glossary also contains for the first time a definition of 'risk', which 'results from the interaction of vulnerability, exposure and hazard' (see Figure 1.2). In this conceptualisation, hazards represent the actual biophysical events — for example flood events — that are driven by climate change. Hazards can often be described by their magnitude and probability. The exposure describes what is being affected by the hazard. Finally, vulnerability depicts how sensitive the affected system or population is to a particular hazard, given its exposure. The predominant definition of vulnerability and risk in the IPCC AR5 is close to the use of these terms in the disaster risk community, but other vulnerability definitions are also recognised. The interested reader can find a more thorough discussion of definitions and conceptual frameworks for assessing climate change vulnerability and risk in a recent EEA report (EEA, 2017b, Section 1.4).

The discussion in the present report does not require an unambiguous definition of specific terms. However, particular attention was paid to formulating the country survey (see Section 1.3) in such a way as to accommodate different terminologies and conceptual approaches.

Figure 1.2 An integrated framework for the risk of climate-related impacts



Source: IPCC (2014, Figure SPM.1): © 2014 Intergovernmental Panel on Climate Change. Reproduced with permission.

The terms 'climate impacts', 'vulnerability' and 'risk' are used in different ways in the climate change context (see Box 1.1). This report aims to cover the breadth of assessment approaches applied by European countries at different stages in their policy cycles rather than to engage in discussions around terminology. For this reason, the abbreviated term 'CCIV assessment' is used here broadly to refer to any systematic assessment of climate change impacts, vulnerability and/or risks, independent of the approach and terminology applied in the assessment.

CCIV assessments differ widely in their thematic and geographical scope, their assessment approach and method, the terminology applied, the involvement of stakeholders, and the use of the results for the development of adaptation policies and actions. The differences reflect, among other things, the broader policy and institutional context, and the availability of resources and prior knowledge. Five specific purposes have been identified for undertaking a vulnerability assessment (modified after Patt et al., 2009):

1. to frame climate change mitigation and adaptation as urgent tasks (by contrasting the impacts of unmitigated and mitigated climate change);

2. to improve basic scientific understanding of vulnerability and improve the methods and tools used in its evaluation;

3. to inform adaptation planning and implementation processes;

4. to create the knowledge base for monitoring and evaluating adaptation action; and

5. to address social injustice, by exposing the differential burden of vulnerability borne by different population groups.

The primary audience of this report are policymakers in public authorities responsible for adaptation planning, policy advisers and other experts involved in planning, conducting and using CCIV assessments at the national and sub-national level. The report does not attempt to evaluate or rank existing CCIV assessments; neither does it suggest that there is a one-size-fits-all approach for national CCIV assessments, but it can help to improve them. It provides an overview of the different institutional, procedural and analytical approaches applied across Europe, including lessons learned. The findings will also be of interest to experts involved in European and international processes related to CCIV assessment and adaptation planning. In particular, this report contributes to the ongoing evaluation of the EU Adaptation Strategy by the European Commission. Finally, this report intends to contribute to the academic discussion on CCIV assessments and their use in adaptation planning.

1.2 Outline

The remainder of this chapter explains the methodological approach for producing this report (Section 1.3); it explains the links from this report to relevant EU policies (Section 1.4) and to earlier EEA reports (Section 1.5); it briefly reviews earlier activities related to assessing national CCIV assessments in Europe (Section 1.6); and it reports on recent and planned efforts at the international level to guide CCIV assessments (Section 1.7). Chapter 2 presents the current state of national adaptation policy and CCIV assessments in all EEA member countries. Chapter 3 reviews the assessment context, approach and results for multi-sectoral national CCIV assessments from each country that has responded to the EEA survey. Chapter 4 discusses the broader experiences of these CCIV assessments and their role and position in the development of national adaptation policy. The concluding Chapter 5 reflects on lessons learned and on possible future directions for developing, conducting and using CCIV assessments to support adaptation policy development in Europe.

1.3 Methodological approach of this report

This report was developed by a team of experts from the EEA and the European Topic Centre on Climate Change Impacts, Vulnerability and Adaptation (ETC/CCA) ([1]). The project started in early 2017 with a review of the available information on national CCIV assessments in Europe. This review comprised information from the country pages of Climate-ADAPT — the European Climate Adaptation Programme ([2]) — as well as earlier and current activities with a related focus (see Section 1.6 for further information). Based on this review, the project team developed a draft survey for collecting information on national CCIV assessments from EEA member countries through their National Reference Centres for Climate Change Impacts, Vulnerability and Adaptation (NRC-CCIVAs; henceforth NRCs). The draft survey underwent several

([1]) http://cca.eionet.europa.eu
([2]) http://climate-adapt.eea.europa.eu

rounds of internal tests by members of the project team and by EEA colleagues. An external test was conducted by four invited experts from EEA member countries with considerable experience related to national CCIV assessments. The feedback from these tests informed the revisions of the draft survey.

The survey comprised both closed and open questions. Almost all closed questions had an optional free text field that allowed the responder to provide further information. The survey consisted of two parts. Part I comprised 10 questions that aimed to collect general information on the development of national adaptation policy and on underlying information on climate change impacts, vulnerability and risk (CCIV). All countries were asked to fill out Part I. Part II comprised 35 questions that collected more detailed information about one specific multi-sectoral national CCIV assessment. The full survey is reproduced in Annex 1.

Based on information reported earlier to the EEA and published in Climate-ADAPT, the project team attempted to identify all relevant 'multi-sectoral national CCIV assessments' from EEA member countries. This identification was guided by the following criteria, which were applied in a pragmatic way:

1. The assessment is completed, and the results are publicly available. (This requirement was relaxed for one country where the final assessment report was published shortly after the deadline for completion of the EEA survey.)

2. The assessment covers the whole country, with the possible exception of outlying regions. (This requirement was relaxed for one country where separate assessments were conducted for sub-national regions.)

3. The assessment covers climate change impacts, vulnerability or risks in the majority of climate-sensitive sectors, systems or policy domains. If separate assessments were conducted for different policy domains, they should share key characteristics, so that they can be treated largely as a single assessment. (This requirement was relaxed for one country, which focused its first CCIV assessment on several water-sensitive sectors.)

No further restrictions were imposed, such as how the assessment characterised itself (e.g. as a climate change impact, vulnerability or risk assessment), who initiated the assessment (e.g. government authorities or the scientific community), or the language of publication. Hence, the range of qualifying national CCIV assessments was intentionally kept broad, reflecting the diverse assessment contexts in EEA member countries.

Most countries were invited to fill in Part II of the survey for one national CCIV assessment. If two assessments were available for the same country, where the later assessment was clearly building on the earlier one, countries were asked to fill in Part II for the most recent assessment only. If two largely independent assessments were available for the same country, countries were invited to fill in Part II for each assessment separately. In those cases where it was not immediately obvious which assessment(s) should be covered in Part II of the survey (e.g. in the case of coordinated CCIV assessments for various sectors or sub-national regions), this point was agreed with the respective NRC ahead of sending out the survey.

The survey comprised both objective questions (e.g. on the availability of summary illustrations) and more subjective questions (e.g. on lessons learned). In order to assist NRCs and to increase the coherence of the responses across countries, the project team pre-filled parts of the survey before sending it to NRCs. Pre-filling of Part I was based on information previously submitted to the EEA and published in Climate-ADAPT. Pre-filling of Part II was based on the reading of the relevant CCIV assessment by the project team. Pre-filling was restricted to questions of a more objective nature. The invitation letter to NRCs stressed that final responsibility for the information submitted to the EEA lies with the NRC.

The pre-filled survey was sent to the NRCs of all 33 EEA member countries in early June 2017. Further clarifications were provided to NRCs in mid-June at the 11th Eionet Workshop on Climate Change Impacts, Vulnerability and Adaptation. NRCs were initially requested to respond by mid-July. At the request of several NRCs, this deadline was later extended to mid-August, which allowed some additional countries to respond to the survey. By the extended deadline, completed surveys had been submitted by 24 countries. Based on dialogues with the respective NRC, it was concluded that Part II for one country did not cover a multi-sectoral national CCIV assessment as understood in the context of this report. In total 23 countries provided information, of which 21 filled in Part II for one CCIV assessment, whereas two countries filled it in for two independent CCIV assessments.

Once all surveys had been received, the project team conducted a limited check of the responses. This check focused on the completeness of answers, on cases where countries had changed pre-filled information,

and on consistency in the responses to related questions. In those cases where survey responses were incomplete, not clear or potentially inconsistent, the respective NRC was invited to provide further clarification. In this phase, the project team also learned that, despite the pre-tests, some questions or answer options were not as clear to all respondents as expected. These findings were considered in the interpretation of the respective responses.

Following the consistency check and the related corrections, the project team conducted both quantitative and qualitative analyses of the survey responses. A draft report was sent for Eionet review in December 2017. The final report considers all comments received during the Eionet review.

The scope and content of this report reflects both the strengths and the limitations of the primarily survey-based data collection. An obvious strength is that a survey can elicit information that is not necessarily accessible for a desk-based study reviewing official documents, such as on lessons learned. Furthermore, all country-related information presented here has been provided and authorised by the countries themselves. In most cases, the NRCs providing this information are also the authorities that lead the development of national adaptation policies (see Section 2.4 for further information), which implies that they are in a good position to provide answers to questions on the links between CCIV assessments and adaptation policy development. Furthermore, the invitation letter to NRCs encouraged them to involve other institutions and experts in their country, and one survey question explicitly requested this information.

The survey-based approach also has a number of limitations. Most importantly, the completeness and correctness of the information presented here depends on the accuracy of the information provided by the NRCs. Unfortunately, some countries with qualifying CCIV assessments are not covered in this report, because their NRCs did not respond to the survey, even after extending the deadline. The partial pre-filling of the survey and the consistency checks have helped to ensure a consistent interpretation of the survey questions and to improve the comparability of the responses across countries, but this approach cannot detect or eliminate all possible misunderstandings. Furthermore, there is considerable variability across countries in answering the free-text questions, which may be considered particularly relevant for mutual learning. Finally, the survey responses reported here as being provided by 'countries' eventually reflect the partly subjective views of a few experts in each country who are affiliated to its NRC.

1.4 Relevant EU policies

1.4.1 EU Adaptation Strategy

In 2013, the European Commission adopted the communication 'An EU Strategy on adaptation to climate change' (EC, 2013b). This strategy aims to make Europe more climate-resilient by focusing on three objectives:

1. promoting action by Member States;
2. better informed decision-making; and
3. climate-proofing common EU action — promoting adaptation in key vulnerable sectors.

Addressing Objective 1, the EU Adaptation Strategy includes several elements to support Member States in adaptation: providing guidance and funding, promoting knowledge generation and information-sharing, and enhancing the resilience of key vulnerable sectors through mainstreaming — or incorporating adaptation into everyday activities. Key elements are the LIFE Programme (EU, 2014), which is the EU's financial instrument supporting environmental, nature conservation and climate action projects in the EU Member States, and the Covenant of Mayors for Climate and Energy ([3]), an initiative whereby European cities sign up to contribute to a more climate-resilient Europe by developing local adaptation strategies and reviewing the outcomes on a biannual basis (see below for further information).

Key elements for addressing Objective 2 are: Climate-ADAPT; Horizon 2020 ([4]), the EU Framework Programme for Research and Innovation; and the Copernicus services, including the Copernicus climate change service ([5]), which is the EU programme on observations and climate services to support climate change policymaking.

A more comprehensive overview of the EU Adaptation Strategy and related activities is available in a recent EEA report (EEA, 2017b, Section 2.3). The present EEA report contributes to Objectives 1 and 2 of the EU Adaptation Strategy, by supporting Member States in

([3]) https://www.covenantofmayors.eu/en
([4]) http://ec.europa.eu/programmes/horizon2020
([5]) https://climate.copernicus.eu

developing the knowledge base for better informed decision-making.

1.4.2 Evaluation of the EU Adaptation Strategy

The European Commission is currently evaluating the EU Adaptation Strategy. As part of this evaluation, the Commission has prepared country fiches for all EU Member States ([6]). Each country fiche assesses the level of readiness of a country at each of the five steps of the adaptation policymaking process identified in the Guidelines on developing adaptation strategies (EC, 2013a) (see also Figure 1.1). The part of the country fiches addressing *Step 2: Assessing risks and vulnerabilities to climate change* comprises seven domains grouped into three main areas of performance:

1. systems are in place to monitor and assess current and projected climate change, impacts and vulnerability;

2. knowledge gaps on climate change and climate change adaptation are tackled; and

3. knowledge transfer processes are in place to build adaptive capacity across sectors.

In the context of the evaluation of the EU Adaptation Strategy, DG Climate Action (CLIMA) funded a knowledge assessment study that synthesises the frameworks, processes and methods being used to assess vulnerability to climate change in Europe (Downing et al., 2017). This study analysed the current status of EU Member States' risk and vulnerability assessments with a focus on assessments that have been undertaken at the national level characterised by a method applied to multiple sectors. Data on the EU Member States came from the country information pages on Climate-ADAPT. A detailed analysis of seven countries used the individual assessment reports in the national language and follow-up interviews. The study showed that there are still knowledge gaps to be addressed for socio-economic scenarios and projections and the required adaptation measures, the assessment of current social vulnerabilities (e.g. vulnerable populations), monitoring and evaluation frameworks, and the international dimension of climate change impacts. These knowledge gaps are being addressed to a certain extent through the ongoing work by the Joint Research Centre (JRC) and the EEA and through Horizon 2020.

1.4.3 EU funding for national and sub-national CCIV assessments

The EU Adaptation Strategy commits the European Commission to supporting the establishment of vulnerability assessments and adaptation strategies, including those with a cross-border nature. The Commission has been co-financing the development of national or sub-national vulnerability assessments and adaptation projects through the LIFE Programme, European Structural and Investment Funds (ESIF) and other funding. For example, Croatia has used the EU Transition Facility to develop its adaptation strategy and plan, and Greece will develop regional adaptation action plans using the ESIF Thematic Objective 5 funding. LIFE funding for adaptation can cover the development and implementation of vulnerability assessments and adaptation strategies, in particular in urban areas.

A CCIV assessment and an adaptation strategy is a key component of some of the funding streams and initiatives at EU level. For example, the ESIF legal framework requires a 'national or regional risk assessment', which should 'take into account, where appropriate, national climate change adaptation strategies' as a funding pre-condition for European Regional Development Fund (ERDF) and Cohesion Fund (CF) investments under Thematic Objective 5 on climate adaptation and risk prevention and management. Some EU Member States have developed national adaptation strategies and vulnerability assessments to access such funding, e.g. Slovenia and the Czech Republic. A risk and vulnerability assessment is a required baseline for the development of the Sustainable Energy and Climate Action Plan for a city or community signatory to the EU-level Covenant of Mayors for Climate and Energy initiatives.

1.4.4 European research projects

Countries have used the results of EU-funded research and pan-European vulnerability assessments to inform their own national and sub-national CCIV assessments. PESETA (Projection of Economic impacts of climate change in Sectors of the European Union based on bottom-up Analysis) is a JRC-CLIMA 'umbrella' aimed at reducing the knowledge gap on climate change impacts and adaptation, through sectoral and multi-sectoral assessments of the impacts of climate change in Europe. PESETA has already gone through four iterations, and its fifth one (PESETA IV ([7])) is currently

([6]) https://ec.europa.eu/clima/consultations/evaluation-eus-strategy-adaptation-climate-change_en
([7]) The roman numbering does not accurately reflect the number of iterations, because there was a PESETA GAP study in between PESETA II and PESETA III.

reviewing various biophysical impact models with the aim of providing insights regarding the potential of adaptation to reduce adverse impacts of climate change. PESETA benefits largely from the work and results of the Seventh Framework Programme and Horizon 2020 research projects that have developed impact modelling capabilities and high-resolution climate scenarios for Europe.

1.4.5 European Union Civil Protection Mechanism

The European Commission (EC) adopted in 2009 a Communication on a Community approach on the prevention of natural and man-made disasters, setting out an overall disaster prevention framework and proposing measures to minimise the impacts of disasters (EC, 2009). The Communication advocated the development of EU and national policies supporting the disaster management cycle: prevention — preparedness — response — recovery. This was followed by a staff working document *Risk assessment and mapping guidelines for disaster management* in 2010 (EC, 2010).

As one part of the European Union Civil Protection Mechanism (UCPR), the 34 participating States (the 28 EU Member States and the six non-EU countries Iceland, Norway, Serbia, Montenegro, former Yugoslav Republic of Macedonia, and Turkey) are required to submit summaries of national risk assessments (NRAs) by December 2015, and every 3 years thereafter (EU, 2013). Most European NRAs conducted so far are not publicly available. One notable exception is the NRA 2015 for Finland, which explicitly considers the impacts of climate change on relevant hazards (Ministry of the Interior, 2016).

The EC published a staff working document *Overview of natural and man-made disaster risks the European Union may face*, in 2017 which shows that the national contributions received were of varying levels of detail, and reflected varying levels of progress and completeness in the production of NRAs (EC, 2017a). However, climate- and weather-related risks are of critical relevance in most NRAs. The staff working document recommended that NRAs should reinforce their attention on the impacts of climate change on disaster risks, including by considering climate projections, and that they need to consider longer time periods to reflect a changing risk landscape in the light of a changing climate. At the same time, approaches and methods developed for NRAs can be fed back into further development of CCIV assessments. The Commission also made a proposal for amending the decision on the UCPR (EC, 2017b). This proposal stresses that 'prevention plans need to include in addition to short-term prevention actions, also longer-term prevention efforts, looking at the overall adaptation to the increasing impacts of climate change'.

1.5 Related EEA reports

This report complements information in several recent EEA reports. The EEA report *National adaptation policy processes in European countries* reviews the development of national adaptation policies in Europe based on a self-assessment by individual countries (EEA, 2014). The availability and approach of national CCIV assessments is reviewed in the section Knowledge generation and use in that report. Twenty-two out of 30 European countries that responded to the survey in 2014 stated that they had risk or vulnerability assessments available. Most of the assessments focused more on the national level and less on the sub-national level. The sectors that attracted the greatest attention in these assessments were agriculture, water, forestry, human health and biodiversity. One of the findings of the report was that risk and vulnerability assessments are still needed at the local level. Furthermore, European countries reported the need for more information about the estimated costs of climate change impacts and of response measures.

The EEA report *Climate change, impacts and vulnerability in Europe 2016* can be considered a multi-sectoral CCIV assessment at the European level (EEA, 2017b). It also includes a brief overview of other multi-sectoral CCIV assessments at the European level (e.g. conducted by EU-funded research projects) and for various transnational regions in Europe. A review of national-level CCIV assessments was beyond the scope of that report.

The EEA report *Climate change adaptation and disaster risk reduction in Europe* reviews opportunities for enhancing the coherence of the knowledge base, policies and practices between climate change adaptation and disaster risk reduction in Europe (EEA, 2017a). Both policy areas have a common objective, namely the prevention and reduction of the risks of disasters by reducing vulnerability and increasing resilience of societies. However, there are also important differences related to the types of hazard considered, their novelty, the time horizon, and the key actors involved. One of the case studies in this report discusses specifically how NRAs can better consider adaptation-related goals, e.g. by adopting longer time horizons. This case study was based on a draft version of a recent OECD publication on this topic (OECD, 2018).

The ETC/CCA Technical Paper *Social vulnerability to climate change in European cities — State of play in policy*

and practice discusses the social justice dimension in climate change impacts, including approaches to consider social vulnerability in CCIV assessments at the urban level (Breil et al., 2018).

1.6 Earlier activities by EEA member countries

This section provides a brief overview of related activities by selected member countries and the former CIRCLE-2 ERA-NET, including selected findings.

In 2012, the Swiss Federal Office for the Environment (FOEN) and the Federal Environment Agency Germany (UBA) organised a 'Workshop on experiences with climate related risk and vulnerability assessments in Europe'. A follow-up workshop, 'Cross-sectoral vulnerability, risk and economic assessments of climate change impacts' took place under the framework of the CIRCLE-2 ERA-NET in 2014 (Schauser et al., 2014). These two workshops brought together representatives from public authorities and other experts involved in cross-sectoral climate change vulnerability and risk assessments and/or economic impact assessments. The discussions covered methodological approaches to CCIV assessments, implementation aspects, the communication of results, and the role of these assessments in inducing and informing adaptation activities. Recommendations for reducing the science-policy gap addressed, among others, the consideration of non-climatic factors, the assessment of impacts from current climate variability and extremes, the consideration of cross-sectoral impact chains, and the importance of targeted communication and outreach.

The CIRCLE-2 Joint Initiative on Climate Uncertainties ([8]) produced a book exploring the role of uncertainty management and communication in support of adaptation decision-making (Capela Lourenço et al., 2014). One chapter in this book reviewed the consideration of uncertainties in the knowledge base for national adaptation planning in Europe, based on a country survey to which 14 countries responded (Füssel and Hildén, 2014).

In 2013, representatives from five countries (Australia, Canada, the Netherlands, United Kingdom and the United States of America) responsible for delivery of their respective national CCIV assessments came together by invitation of the UK Department for Environment Food and Rural Affairs (DEFRA) and the UK Climate Impacts Programme (UKCIP) to explore experiences, challenges and lessons learnt with respect to the nature, scope and purpose of these assessments, their evolution, and their dissemination and use ([9]). The summary report of this meeting presents various perspectives, lessons learned, and challenges related to the nature, scope and purpose of CCIV assessments, and to their dissemination and use (UKCIP, 2013):

Purpose and drivers

- Supporting an effective NAS and NAP are important drivers for defining the purpose and scope of a CCIV assessment.
- It is important to define clearly the intended audience and purpose of the assessment up front (e.g. raising awareness, informing adaptation policy or informing specific actions).

Scope

- The available resources and capacity for the assessment should be considered in determining its nature, scope and outputs.
- Full sectoral coverage and ensuring comparability between assessments for different sub-national regions and topics can be challenging because of data and knowledge limitations; sector or issue-specific assessments can provide the necessary focus.

Process

- Maintaining a consistent assessment process, including maintaining funding and organisational capacity, is critical for realising the benefits of and continually improving CCIV assessments.
- To have policy relevance, the assessment needs to be structured around existing policy areas and should engage a variety of stakeholders.
- Including a focus on current impacts and vulnerabilities can help in engaging policy- and decision-makers; a stepped assessment process can be effective for sustaining stakeholder engagement.

([8]) http://www.circle-era.eu/np4/P_UNCERT.html
([9]) http://www.ukcip.org.uk/projects/national-climate-change-assessments

Outputs

- The structure and presentation of an assessment should recognise that most policymakers will not read the entire assessment; different outputs targeted at different audiences can support the broad uptake of the assessment results.
- Appropriate information on how the conclusions were reached, including providing access to underlying data, should be provided.
- Scientific assessments of risks by themselves will not bring about transformational policy change.

Evaluation

- Evidence-based criteria for evaluating the 'success' (or otherwise) of an assessment should be established beforehand, in order to facilitate learning; this includes understanding who is using the assessment and for what purpose.
- The process of undertaking a CCIV assessment can be as important as its results or more so; if the main purpose of an assessment is raising awareness and capacity building, engagement in the process is part of its success.
- A 5-year cycle for updating a CCIV assessment is sensible, considering changes in policy, exposure and science.

Subsequent to this DEFRA/UKCIP exercise, the EEA with support from UKCIP organised a session 'Vulnerability and risk assessments' during the 8th Eionet Workshop on Climate Change Impacts, Vulnerability and Adaptation in 2014 ([10]). The main objective of this session was to discuss what and how countries can learn from experiences with CCIV assessments in other countries. A key conclusion of these activities was the recognition of the value of a dialogue between experts and policymakers from different countries and the need to identify opportunities for a continued dialogue. Subsequent European Climate Change Adaptation (ECCA) and Adaptation Futures conferences have provided opportunities for such dialogues at the European and international levels, respectively.

1.7 Past and current efforts at guiding CCIV assessments

Starting with the *IPCC technical guidelines for assessing climate change impacts and adaptations* (Carter et al., 1994), various international organisations and national institutions have developed guidance material for CCIV assessments. Whereas early guidelines tend to focus exclusively on CCIV assessments, later guidelines often address the whole adaptation policy cycle.

At the European level, the European Commission published Guidelines on developing adaptation strategies, which included 'Assessing risks and vulnerabilities to climate change' as a key step (EC, 2013a). These guidelines have informed the development of the *Adaptation Support Tool* in Climate-ADAPT ([11]). They provided many helpful suggestions related to the development of adaptation strategies, including practical examples and links to further information. However, they did not include a detailed discussion of methodological issues related to CCIV assessments.

At the global level, the Global Programme of Research on Climate Change Vulnerability, Impacts and Adaptation (PROVIA) ([12]) published the *PROVIA guidance on assessing vulnerability, impacts and adaptation to climate change* (PROVIA, 2013). This guidance builds on research conducted within the EU-funded project MEDIATION (Methodology for Effective Decision-making on Impacts and Adaptation) ([13]). It presents a decision-tree approach that guides adaptation decision-makers through a wide range of relevant methods and tools, including those identified in the United Nations Framework Convention on Climate Change (UNFCCC) *Compendium on methods and tools to evaluate impacts of, and vulnerability and adaptation to, climate change* (UNFCCC, 2005). The main focus of the PROVIA guidance is on identifying and assessing adaptation options in a specific decision situation. Only limited attention is given to guiding the

([10]) All documents related to the 2014 workshop (including background paper and meeting report) are available on the Eionet Forum: http://forum.eionet.europa.eu/nrc-climate-change-adaptation/library/workshops-meetings/2014-eionet-workshop-climate-change-impacts-vulnerability-and-adaptation

([11]) http://climate-adapt.eea.europa.eu/knowledge/tools/adaptation-support-tool

([12]) Established in 2011, the Global Programme of Research on Climate Change Vulnerability, Impacts and Adaptation (PROVIA) is a global scientific initiative of the United Nations Environment Programme (UNEP), the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the World Meteorological Organization (WMO) that seeks to harmonise, mobilise and communicate the growing knowledge base on vulnerability, impacts and adaptation. The PROVIA homepage is currently inaccessible (status: March 2018), and it is not clear whether PROVIA is still active.

([13]) http://www.mediation-project.eu

development of broad-scale CCIV assessments, such as the multi-sectoral national CCIV assessments that are the focus of this report.

In 2017, the International Organization for Standardization (ISO) started a project to draft an ISO standard *Adaptation to climate change — Vulnerability, impacts and risk assessment* ([14]). The goal of this project is to develop an application-oriented standard for preparing and carrying out CCIV assessments in practice. Germany, which chairs this project together with South Korea, has recently published several relevant documents on this matter. The *Guidelines for climate impact and vulnerability assessments* describe the assessment approach undertaken in the most recent national CCIV assessment for Germany; *The vulnerability sourcebook — concept and guidelines for standardised vulnerability assessments* adapts this approach with the aim of improving its applicability in developing countries; and the R*isk supplement to the vulnerability sourcebook* provides guidance on how to apply *The vulnerability sourcebook*'s approach with the new IPCC AR5 concept of climate risk (Buth et al., 2017; Fritzsche et al., 2014; Zebisch et al., 2017).

([14]) ISO/AWI 14091; see https://www.iso.org/standard/68508.html

2 Overview of national adaptation policies and CCIV assessments in Europe

Key messages

- Almost all countries in Europe have published a national adaptation strategy, and over half have published a national adaptation plan. Almost all countries have conducted at least one national CCIV assessment.
- Multi-sectoral and sectoral national CCIV assessments were the most important information sources for the development of national adaptation policies. In addition, virtually all countries have also used stakeholder and expert opinions as well as information from international and/or European CCIV assessments.
- Most national CCIV assessments were initiated by the lead organisation for the development of national adaptation policy; some were initiated by other public bodies or by scientific institutions. Most national CCIV assessments were conducted by universities and research organisations, but a large variety of other public and private institutions were involved.
- All national CCIV assessments were targeted at national policymakers, but most of them also targeted other stakeholders. Most assessments were specifically designed to support the development or revision of a national adaptation strategy or national adaptation plan.
- All countries intend to update their knowledge base regarding CCIV. Plans for future CCIV assessments comprise multi-sectoral CCIV assessments as well as targeted sectoral or thematic assessments.

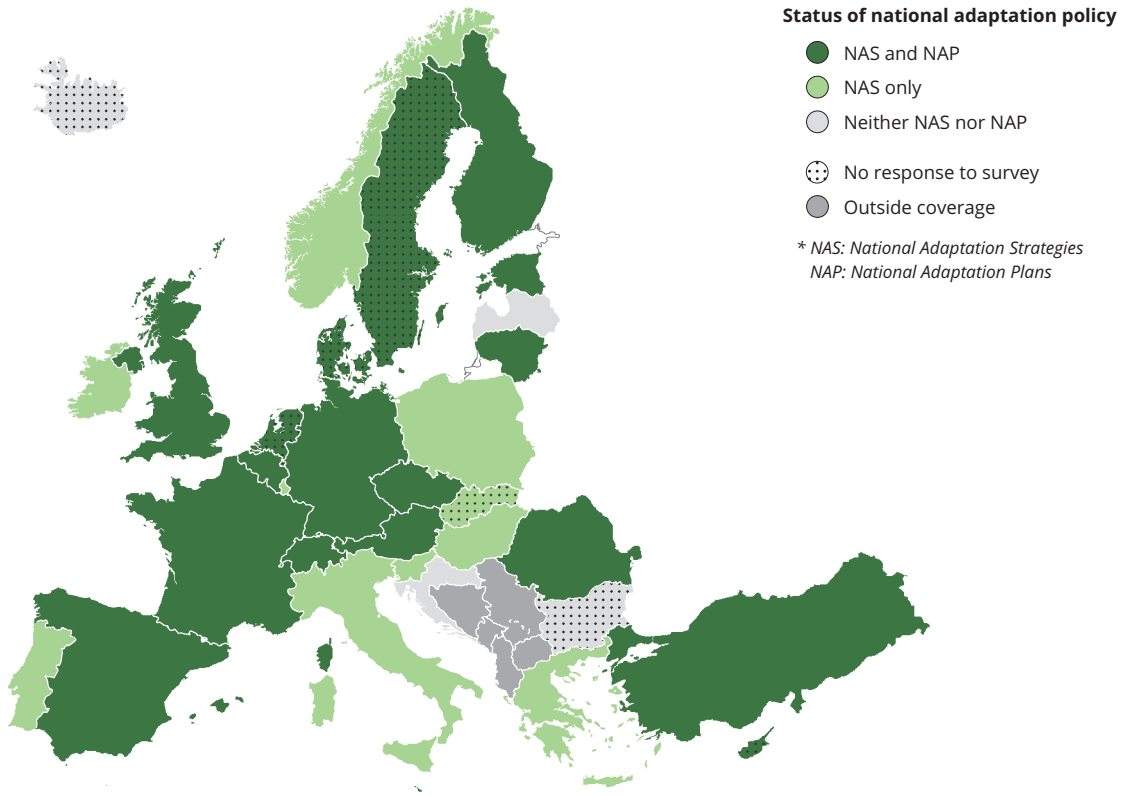
This chapter presents the current status of national adaptation policies and CCIV assessments in all 33 EEA member countries. Twenty-four countries responded to the dedicated survey (see Section 1.3). An Excel workbook with all survey responses and a PDF file comprising the individual surveys are available online ([15]). Basic information on the state of adaptation policy for non-responding countries was added from information reported previously to the EEA and published on Climate-ADAPT ([16]).

2.1 Overview of national adaptation policies

Map 2.1 illustrates the availability of NASs and NAPs in all EEA member countries ([17]). Countries that did not respond to the survey are stippled. A NAS has been adopted by most EEA member countries, except for Bulgaria, Croatia, Iceland, Latvia and Liechtenstein. A NAP has been adopted by 17 countries. Of the 24 countries that responded to the survey, eight stated

([15]) https://www.eea.europa.eu/publications/national-climate-change-vulnerability-2018
([16]) http://climate-adapt.eea.europa.eu/countries-regions/countries
([17]) A NAS addresses overarching issues and positions adaptation on the policy agenda. A NAP, sometimes called a national adaptation action plan or national adaptation programme, aims to implement a NAS by organising activities to achieve its objectives, typically through sectoral adaptation actions. Both NASs and NAPs require formal adoption by the responsible government or legislative authority, depending on the national circumstances. For further information, see here: https://www.eea.europa.eu/airs/2017/environment-and-health/climate-change-adaptation-strategies

Map 2.1 Status of national adaptation policy [Q5, Q6]



that the NAP was integrated with the NAS whereas seven stated that it was separate. [Q5, Q6] ([18])

2.2 Status of national CCIV assessments

Map 2.2 shows the status of national CCIV assessments in all 33 EEA member countries, including the date of the latest assessment (see Table 2.2 for additional information on the assessments covered in this report). Countries that did not respond to the survey are stippled. Almost all countries (30 out of 33) have published a multi-sectoral national CCIV assessment. In one country, such an assessment is under development (Poland), and two countries are without an assessment (Iceland and Liechtenstein). [Q12]

Of the 24 countries responding, all but one have completed and published a national CCIV assessment; in two countries two separate multi-sectoral CCIV assessments have been published. In Austria, one CCIV assessment was an IPCC-type literature review initiated by the scientific community, and the other was an economic assessment initiated by the government. In Germany, one assessment was a national vulnerability assessment initiated by the government; the other was an IPCC-type literature review initiated by the scientific community. In summary, responses for Part II of the survey cover 25 CCIV assessments from 23 countries.

All CCIV assessments reviewed here have national coverage. For Belgium, three regional studies were conducted in addition to the federal assessment. The national assessments were partly accompanied by sectoral or regional case studies. [Q15]

Table 2.1 gives an overview of the years in which the most recent national CCIV assessment for each country was published. The majority of CCIV assessments covered in this report were published in the last 5 years (2013-2017), but two of them are over 10 years old. [Q19]

Table 2.2 gives a full overview of the most recent CCIV assessments in all countries that have responded to the survey. All assessments are available on the Eionet Projects website ([19]). The remainder of this chapter, and indeed of the whole report, focuses on information from those 24 countries and their CCIV assessments. Further information about the CCIV assessments in one country (Austria) is presented in Box 2.1.

([18]) Square brackets at the end of a paragraph [Qx] refer to the survey question 'x' as the source of information. The full survey is available in Annex 1 of this report.
([19]) https://projects.eionet.europa.eu/2018-eea-report-national-cciv-assessments/library/national-documents

Map 2.2 Availability of national CCIV assessments [Q14]

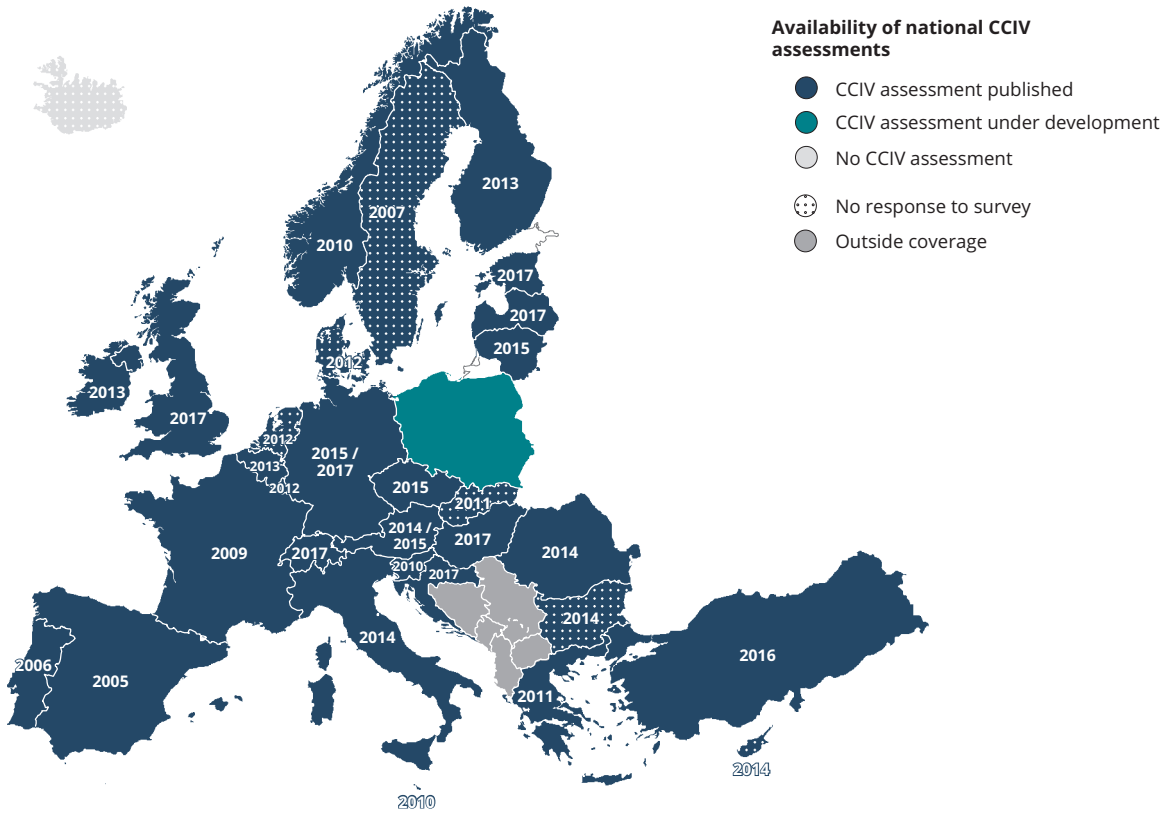


Table 2.1 Dates of most recent CCIV assessments in EEA member countries [Q19]

Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Responding countries	●	●			●	●●	●	●	●●●	●●●	●●● ●	●	●●● ●●● ●
Non-responding countries			●			●	●	●●		●●			

Notes: Dots (●) indicate the year in which a national CCIV assessment was published in the 24 countries responding to this survey as well as in the nine non-responding countries. (For Belgium and Latvia, the date of the latest contributing assessment was used.)

Table 2.2 Multi-sectoral national CCIV assessments considered in this report

Country	Year	Assessment title (in English)
Austria (AT-1)	2014	Austrian Assessment Report 2014 (AAR14)
Austria (AT-2)	2015	Cost of Inaction: Assessing the costs of climate change for Austria (COIN)
Belgium	2011-2013	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 to the regional adaptation plan Federal (2013): Exploring federal contribution to a coherent adaptation policy
Croatia	2017	Report on assessment of climate impacts and vulnerabilities in different sectors
Czech Republic	2015	Comprehensive study on impact, vulnerability and risk sources connected to climate change in the Czech Republic
Estonia	2017	Development plan for climate change adaptation until 2030
Finland	2013	The adverse impacts of climate change and the vulnerability of sectors
France	2009	Climate change: costs of impacts and lines of adaptation
Germany (DE-1)	2015	Germany's vulnerability to climate change
Germany (DE-2)	2017	Climate change in Germany. Trends, impacts, risks and adaptation
Greece	2011	The environmental, economic and social impacts of climate change in Greece
Hungary	2017	Second National Climate Change Strategy 2017-2030, with an outlook until 2050
Ireland	2013	Current and future vulnerabilities to climate change in Ireland
Italy	2014	Report on the state of scientific knowledge on impacts, vulnerabilities and adaptation to climate change in Italy
Latvia	2016-2017	Risk and vulnerability assessment and identification of adaptation measures (Six separate reports for the most vulnerable sectors)
Lithuania	2015	Studies, laying down 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
Norway	2010	Adapting to a changing climate. Norway's vulnerability and the need to adapt to the impacts of climate change
Portugal	2006	Climate change in Portugal. Scenarios, impacts and adaptation measures
Romania	2014	Summary of sector rapid assessments and recommendations for incorporating climate actions in the 2014-2020 sectoral operational programmes
Slovenia	2010	Climate variability in Slovenia and its effects on the aquatic environment
Spain	2005	A preliminary general assessment of the impacts in Spain due to the effects of climate change
Switzerland	2017	Climate related risks and opportunities. A national synthesis for Switzerland
Turkey	2016	Climate change impacts on water resources — Sectoral vulnerability analysis in three river basins
United Kingdom	2017	UK Climate Change Risk Assessment 2017

Note: Some assessment titles were translated into English by the project team. All assessments are available on the Eionet Projects website (see footnote 19). A new national CCIV assessment for Ireland was published in December 2017, but the survey response refers to the 2013 assessment.

2.3 Information sources for adaptation policy development

The survey asked about the importance of eight different information sources for national adaptation policy development. The responses from the 24 responding countries suggest that the distinction between CCIV assessments initiated by public authorities and those initiated by scientists/others was not clear enough in the survey. Hence, these categories were grouped together in this analysis.

Figure 2.1 shows that 19 out of 23 countries that have concluded a **multi-sectoral** national CCIV assessment

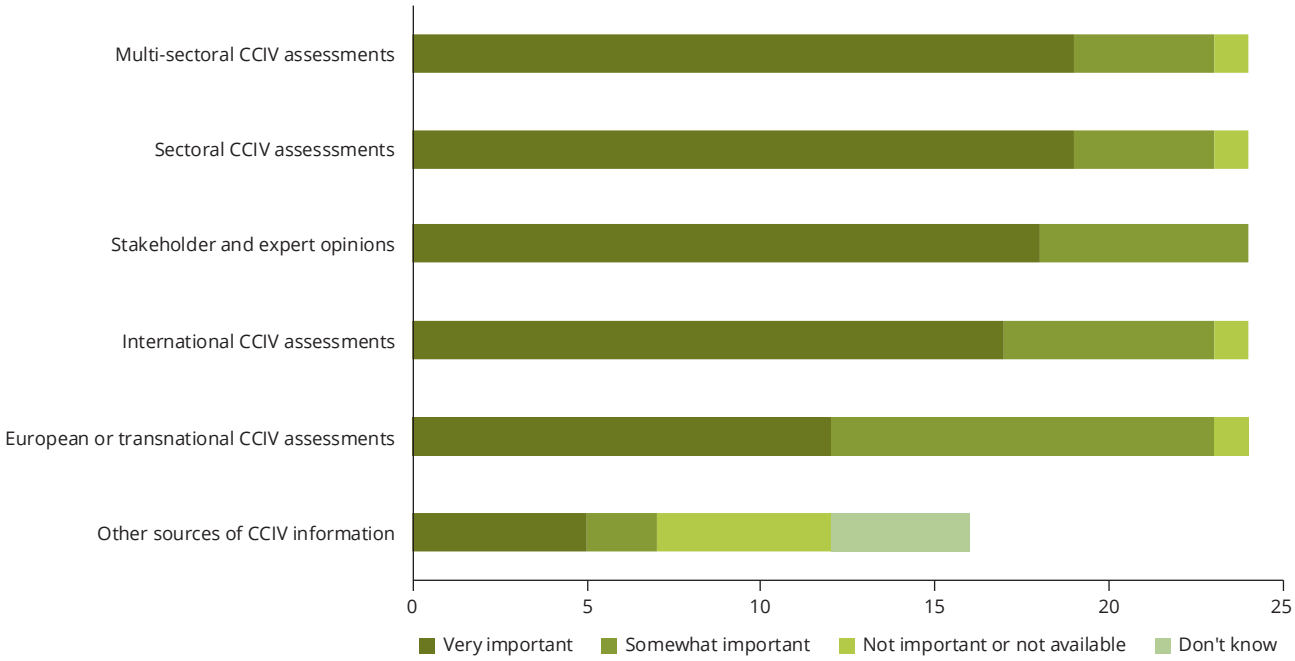
Box 2.1 Austria: The Austrian Assessment Report 2014 (AAR14) and Assessment of the cost of inaction (COIN)

In Austria, two different kinds of multi-sectoral CCIV assessments have been published in recent years. The *Austrian Assessment Report 2014* (AAR14) is an IPCC-type report based on a literature review that was initiated and driven by the scientific community and supported by the Federal Ministry of Sustainability and Tourism ([20]). The study *Costs of Inaction: Assessing the costs of climate change for Austria* (COIN, 2015) is an economic assessment of the costs of climate change that was initiated by the Federal Ministry of Sustainability and Tourism. Both studies were funded by the Austrian Climate and Energy Fund ([21]) (Austrian Climate Research Programme), and both assessments were commissioned to support the development and revision of the Austrian Adaptation Strategy (NAS) and Austrian Action Plan (NAP) published in 2017 ([22]).

The AAR14 was the first joint effort of the whole scientific community in the research field of climate change in Austria, and it was the first joint product of the Climate Change Centre Austria (CCCA). It had broad media coverage, and it is still being used to raise awareness of the issue of climate change in Austria. Like the IPCC reports, it aims to be policy-relevant without being policy-prescriptive. Currently the Austrian Panel on Climate Change (APCC) is working on a Special Report focusing on health, demography and climate change ([23]), which is planned to be published in 2018.

The COIN study was the first economic assessment of all sectors of the NAS/NAP, including cross-sectoral interactions. It conducts a scenario-based analysis of possible climate change impacts in combination with socio-economic developments. The project has for the first time identified the economically relevant impact chains for each field. It has also conducted a quantitative monetary evaluation of those impact chains where quantitative models were already available. The COIN study was later followed up by two dedicated research projects: PACINAS (Public Adaptation — Investigating the Austrian adaptation strategy) ([24]) and PATCHES (Private Adaptation Threats and Chances Enhancing Synergies with the Austrian NAS Implementation) ([25]).

Figure 2.1 How important have different sources of CCIV information been for the development of national adaptation policy? [Q8]



([20]) At that time, the ministry was called the Federal Ministry for Environment.
([21]) www.klimafonds.gv.at
([22]) https://www.bmnt.gv.at/umwelt/klimaschutz/klimapolitik_national/anpassungsstrategie/strategie-kontext.html
([23]) http://sr18.ccca.ac.at
([24]) http://anpassung.ccca.at/pacinas/en
([25]) http://anpassung.ccca.at/patches/en

regarded it as 'very important'; the other four countries (Austria, Czech Republic, Luxembourg and Spain) regarded it as 'somewhat important'. Note that several of those countries concluded the CCIV assessment only **after** the NAS had been adopted. Similarly, 19 countries regarded **sectoral** national CCIV assessments as 'very important', and four as 'somewhat important'. The next most important information sources were stakeholder and expert opinions (18 times 'very important' and six times 'somewhat important') and international CCIV assessments (17 and 6). European and transnational CCIV assessments were considered 'very important' by 12 countries and 'somewhat important' by 11; only one country considered them 'not important'. Seven countries described 'Other sources of CCIV information' as 'very important' or 'somewhat important'. These other sources included, among others, research projects and regional assessments. In summary, a broad range of knowledge sources has been used to support the development of national adaptation policies, with multi-sectoral and sectoral national CCIV assessments being the most important ones. [Q8]

The understanding of climate change and its associated impacts and opportunities is constantly developing. All 24 countries stated that they plan to produce further CCIV information. Twelve countries intend to conduct new or to update multi-sectoral national CCIV assessments, whereas nine countries are planning national CCIV assessments for specific sectors. Other response options were selected by only a few countries. Some countries provided additional information, e.g. on the sectors covered by ongoing or planned assessments, or on planned regional and local assessments. [Q10]

2.4 Institutional context

The survey included three questions related to the institutional set-up of adaptation policy development and CCIV assessment. These questions asked for (1) the lead organisation for adaptation, (2) the organisations initiating and coordinating the national CCIV assessment, and (3) the organisation(s) that actually carried out the study. The complex answers to some of those questions prevent an exact quantitative analysis, but some interesting lessons can nevertheless be drawn.

In most countries, the lead organisations for adaptation at the national level are government ministries. In one country, this responsibility lies with the environment agency (Portugal); two further countries have established dedicated bodies for climate policies (Belgium, France). [Q2]

Three countries stated that the responsibility for implementing adaptation policies lies mostly with devolved regions or regional administrations. However, sub-national authorities also play a strong role in the development and implementation of adaptation policy in several other countries. [Q5, Q6]

About two thirds of the CCIV assessments were initiated by the same national ministry or government authority that is leading national adaptation policy development. Several other assessments were initiated by the whole government or by other public bodies. Finally, two assessments were initiated by scientific organisations (one of the two assessments each from Austria and from Germany). [Q2, Q16]

The organisations carrying out the CCIV assessments were mostly universities, research institutes and government agencies. In a few countries, the government ministries that initiated the CCIV were also directly involved in developing its content (Croatia, France, Latvia, Romania and Turkey). In some other countries, private consultancies conducted some or all of the work. In three countries, the work was coordinated by committees appointed by the government (Norway and the United Kingdom) or by another public institution (Greece). One country mentioned support by the World Bank (Romania). [Q17]

In most of the 24 responding countries, the survey was filled in by the lead organisation for adaptation. In four countries, the survey was filled in by the national environment agency, but the ministry leading adaptation policy was consulted. Nine countries consulted additional organisations, such as other government ministries and national meteorological and hydrological agencies. [Q3, Q4]

The majority of CCIV assessments (14 out of 25) were initiated by the same authority that responded to the survey. In various cases, the authority responding to the survey was also involved in conducting the CCIV assessment (Croatia, France, Latvia, Romania, Slovenia and Switzerland). [Q3, Q16, Q17]

These results suggest that the respondents to the EEA survey were knowledgeable about the political context as well as the methodological aspects of the national CCIV assessments covered in this report. While the responses still reflect their personal opinions to some degree, this is unavoidable in an assessment where critical information on a political process is held by a limited number of persons.

3 Review of national CCIV assessments

Key messages

- The dominating reason for conducting national CCIV assessments is the development or revision of national adaptation strategies and plans. All assessments were targeted at government authorities at the national level; sub-national authorities, non-governmental stakeholders and politicians were further important target groups.
- There is a large variety in the approaches applied and the resources used for national CCIV assessments in Europe. Most countries have developed their own approach or combined different generic approaches when designing their national CCIV assessment.
- The average number of sectors and impact domains included in national CCIV assessments was 12, with some countries covering up to 19 out of 20 pre-defined areas. The thematic areas covered most frequently were water and agriculture, followed by biodiversity, energy, forestry and human health.
- All countries emphasised the need for further CCIV information. Additional information needs relate to sectors already covered as well as to new thematic areas, such as cross-border impacts.
- Most national CCIV assessments involved external stakeholders from government authorities at national and sub-national level, external scientists and non-governmental stakeholders. They were mostly involved through workshops, the review of drafts, advisory committees, and interviews or hearings.
- All CCIV assessments used quantitative climate information from various sources. Almost two thirds incorporated non-climatic scenarios, and just as many considered adaptive capacity on a systematic basis.
- Almost all CCIV assessments presented the main results for the whole country. More than half also included information at the sub-national level, and most of them identified regional adaptation priorities.
- More than half of the CCIV assessments use monetised metrics or another common metric to present their results. Most of them also identified the most affected sectors or priority impacts.
- About two thirds of the CCIV assessments go beyond an analytical assessment by identifying, and possibly evaluating, concrete adaptation measures.
- More than half of the CCIV assessments communicate uncertainties in the main assessment results. However, only a few do this in a systematic manner for all sectors.

Countries have used many different ways to communicate the results of CCIV assessments. Most countries used interactive dissemination channels, such as various types of events, in addition to printed or electronic reports. Social media as well as webinars were used only rarely.

This chapter presents key findings from Part II of the survey, which elicited information on the purpose, scope, approach, results and use of multi-sectoral national CCIV assessments in Europe. An Excel workbook with all survey responses and a PDF file comprising the individual surveys are available online ([26]).

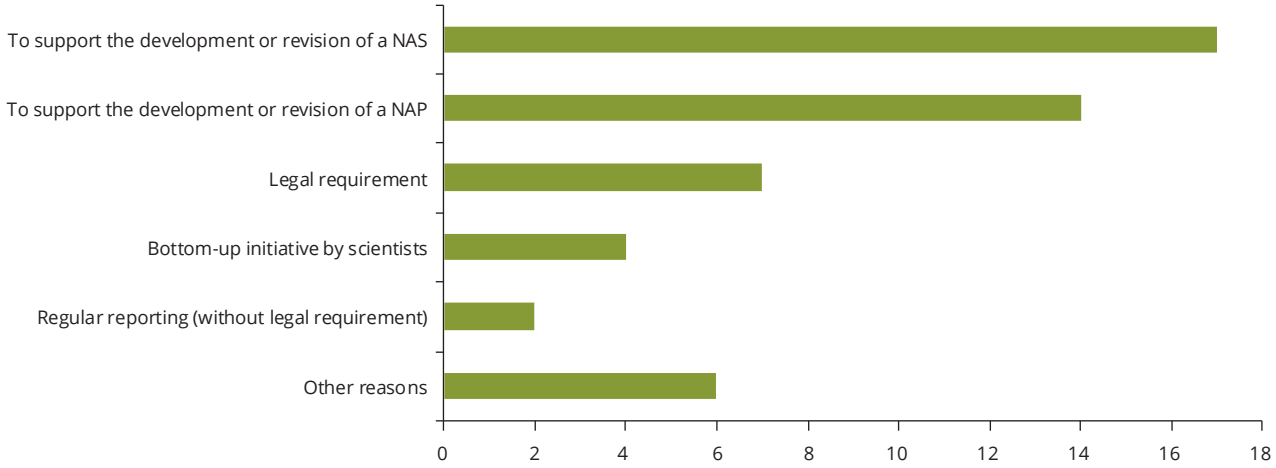
([26]) https://www.eea.europa.eu/publications/national-climate-change-vulnerability-2018

3.1 Assessment purpose

Figure 3.1 shows the main reasons for conducting a national CCIV assessment (multiple answers were possible). The large majority of assessments (20 out of 25) were initiated to support the development or revision of a NAS (17 assessments) and/or a NAP (14 assessments). Eight countries (Croatia, Germany, Hungary, Latvia, Lithuania, Romania, Switzerland and the United Kingdom) mentioned a legal requirement or regular reporting as a reason for the production of a CCIV assessment. Some respondents mentioned other reasons, such as the development of sub-national adaptation plans. [Q19]

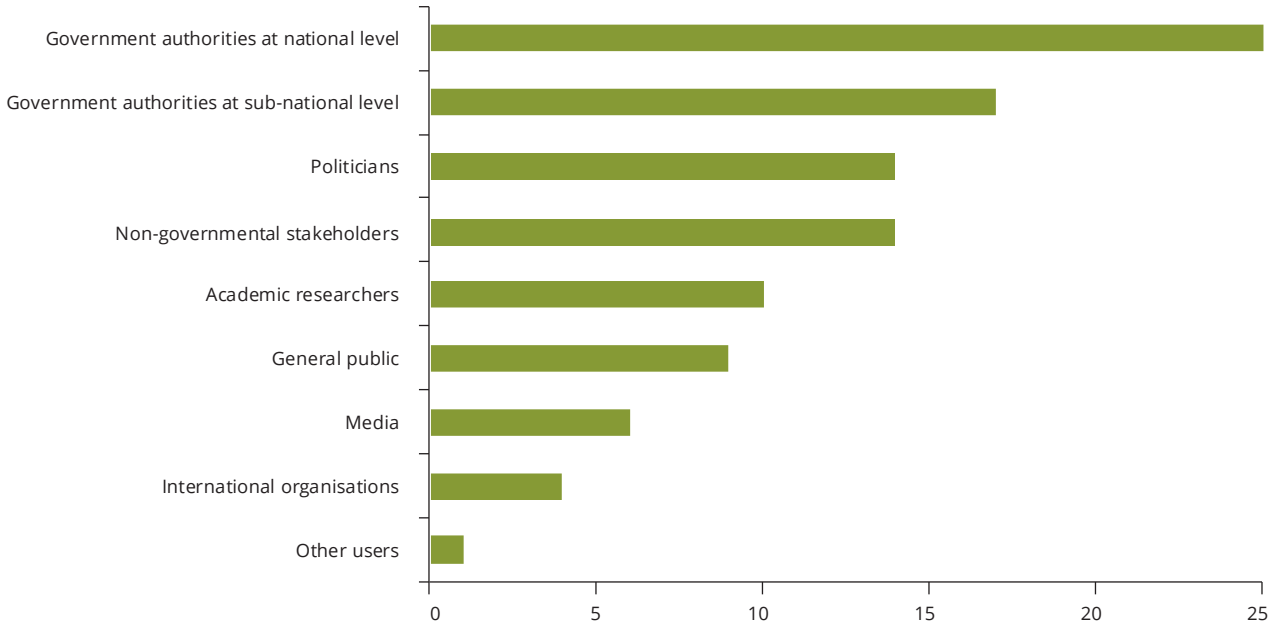
Figure 3.2 shows the survey responses regarding the main target groups of the CCIV assessments (multiple answers were possible). Not surprisingly, all of them were targeted at national government authorities. Other target groups that were mentioned for more than half of the assessments included sub-national government authorities, politicians and non-governmental organisations. Less than half of the CCIV assessments were targeted at academic researchers, the general public, the media and international organisations. [Q20]

Figure 3.1 What were the main reasons for conducting the CCIV assessment? [Q19]



Note: NAS, national adaptation strategy; NAP, national adaptation plan.

Figure 3.2 Who were the main target users of the CCIV assessment? [Q20]



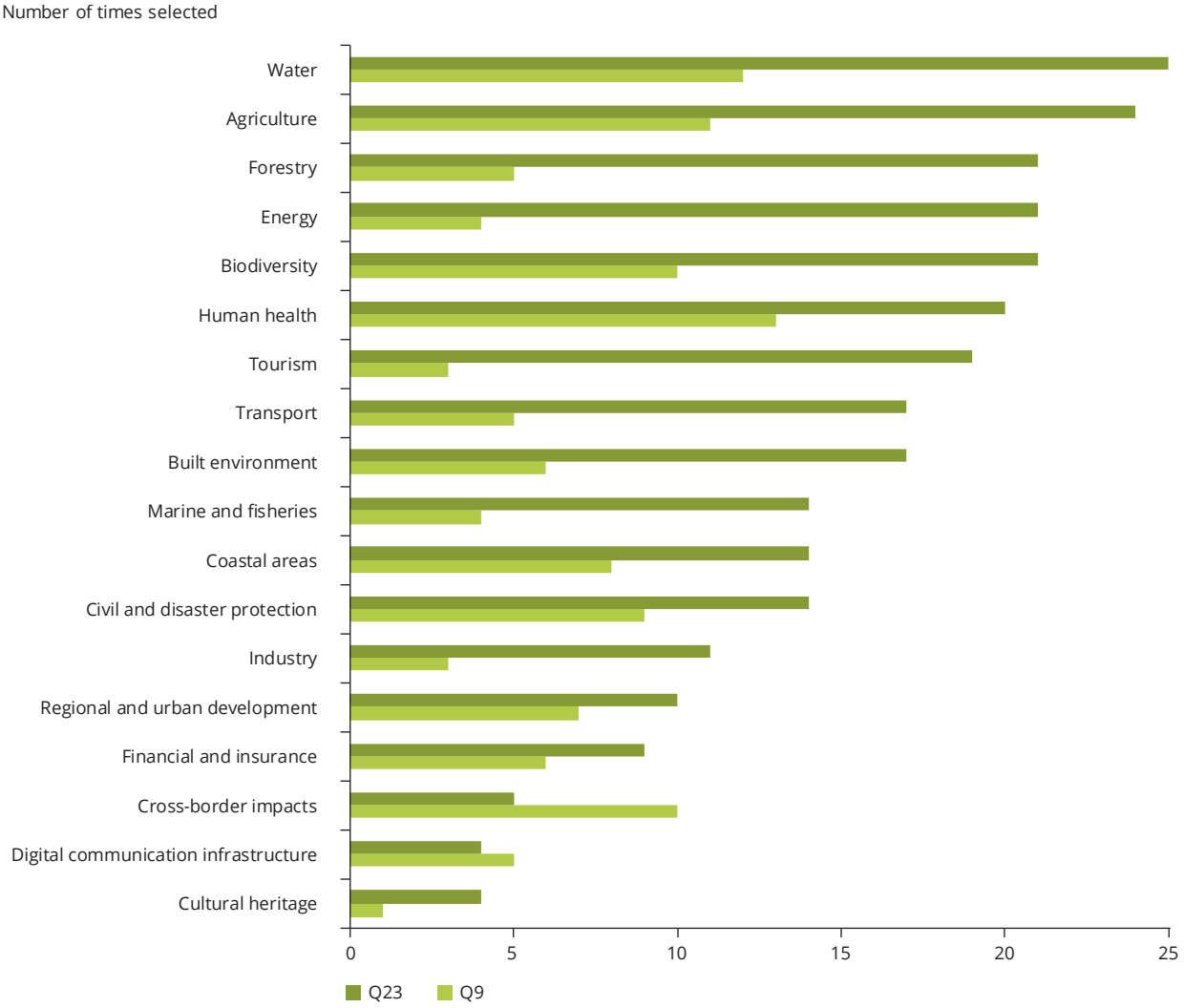
3.2 Assessment scope

Almost all CCIV assessments mentioned in this survey had national coverage, as requested. Belgium published separate CCIV assessments for its three regions, in addition to the federal assessment, which reflects the strong federal element of the Belgian governance system. For pragmatic reasons, these independent assessments were treated here as a single assessment. In a few countries, the national assessment consists of a nationwide assessment as well as separate assessments for sub-national units (e.g. devolved regions in the United Kingdom). Some countries mentioned that some climate risks were assessed in only selected parts of the country, reflecting their specific topographic, environmental or climatic conditions. [Q15]

There is considerable variation in the thematic comprehensiveness of the national CCIV assessments covered in this report. The survey asked about the coverage of 20 thematic areas, including 17 pre-defined domestic sectors, other sectors, cross-sectoral policy domains and cross-border impacts. The median of the number of thematic areas covered was 12 (out of 20). Three out of 25 assessments covered 19 out of 20 thematic areas (Finland, Norway and the United Kingdom), whereas seven assessments incorporated fewer than 10. [Q23]

The dark green bars in Figure 3.3 show the thematic coverage of the 25 national CCIV assessments reviewed here. The best covered sectors and thematic areas were water (all 25), agriculture (24 out of 25), followed by biodiversity, energy and forestry (21 out

Figure 3.3 Coverage of thematic areas in CCIV assessments (dark green bars) and countries stating that more information is required (light green bars) [Q9, Q23]



Note: The light green bars are based on the responses from 24 countries, whereas the dark green bars are based on 25 assessments from 23 countries. The absolute length of the two bars cannot be compared, because the survey invited countries to identify up to five priority areas for further information, which is smaller than the number of thematic areas considered in many multi-sectoral CCIV assessments. However, comparison of their relative length is meaningful.

of 25 each), health (20 out of 25) and tourism (19 out of 25). The survey did not ask specifically whether and how the disaster risk community was involved in the preparation of the national CCIV assessment, but the majority of CCIV assessments (14 out of 25) included civil and disaster protection. About half of the countries (12 out of 25) included 'other sectors' of national interest (e.g. game management and reindeer husbandry in Finland and Norway). Five assessments included cross-border impacts of climate change, i.e. how climate change impacts abroad could affect their country (Finland, one of the German assessments, Norway, Switzerland and the United Kingdom). Examples mentioned included food security, development cooperation, and migration. [Q23]

Countries were also asked to identify up to five thematic areas for which additional CCIV information would significantly improve adaptation policies. The responses are shown as light green bars in Figure 3.3. The most mentioned thematic areas were human health (13 out of 24 countries), water (12 out of 24) and agriculture (11 out of 24), followed by biodiversity and cross-border impacts (both 10 out of 24) and civil and disaster protection (9 out of 24). [Q9]

A comparison between the dark green and light green bars in Figure 3.3 shows that several of the most covered thematic areas are also the ones for which additional information is seen as particularly relevant (e.g. water, agriculture and human health), and that some of the least covered sectors are also the ones where additional information is seen as least important (e.g. cultural heritage, digital and information infrastructure). However, there are several exceptions to this pattern. Cross-border impacts were covered by only five countries in their national CCIV assessments but listed by 10 as requiring more information. Conversely, energy, forestry and tourism were included by the majority of countries in their respective CCIV assessments, but additional information for these three sectors was regarded as important by only a small number of countries. [Q9, Q23]

Table 3.1 shows the time periods covered by the national CCIV assessments. The future time periods (early, mid- and late 21st century) are defined with some flexibility in order to accommodate the specific start and end dates chosen in different assessments. Furthermore, in some cases the temporal coverage varies between sectors. The present as well as each of the future time periods is covered by between 19 and 21 out of 25 assessments. Three assessments cover only one future time period whereas the others cover multiple time periods. No assessment extends beyond 2100. [Q24]

3.3 Resources and funding

The survey included three questions on the use of human and financial resources for the CCIV assessments. These questions were admittedly difficult to answer, because there is no clear-cut way to define which persons and costs to include in the calculation. Therefore, considerable caution is needed when interpreting the survey responses on this topic.

The first question asked for the number of experts 'participating' in the assessment, inviting further explanation. The 22 responses ranged from several tens to several hundred persons. In some cases, these numbers included only those who authored text for the national assessments, whereas, in other cases, they also included reviewers and authors of sub-national assessments contributing to the national assessment. Therefore, the numbers are not directly comparable across countries. However, it should be noted that several CCIV assessments for countries with a population of less than 10 million involved the active participation of hundreds of experts (Austria, Norway, Switzerland). [Q18]

The second question asked for the amount of resources used for the assessment and their funding source, divided into contracted costs, staff time, in-kind contributions, costs for targeted research activities, and other resources. It is admittedly difficult to state the total costs, because it is hard to identify underlying research activities and assess their costs. Furthermore, staff time in government authorities may not have been monitored, and some CCIV assessments are part of a larger activity, such as the development of a NAS or NAP ([27]). The 13 answers on contracted costs ranged from EUR 50 000 to EUR 1.35 million. The funding came mostly from the national budget, including research funds. However, some countries also used international funding, such as the EEA Grants Financial Mechanism and the Tromp Foundation. Responses on staff time used (in the authority initiating or conducting the assessment) ranged from small numbers up to 108 months, which reflects the diverse institutional set-up of these assessments (see Section 2.4). Several countries mentioned dedicated research activities and in-kind contributions from scientific experts contributing to the national CCIV assessment, but

([27]) Furthermore, several countries experienced difficulties providing detailed information on resource use because of technical problems with an earlier version of the questionnaire.

Table 3.1 Which time periods were addressed in the CCIV assessment? [Q24]

Country	Present	Early 21st century	Mid-21st century	Late 21st century
Austria (AT-1)	■	■	■	■
Belgium	■	■	■	■
Czech Republic	■	■	■	■
Estonia	■	■	■	■
France	■	■	■	■
Germany (DE-1)	■	■	■	■
Germany (DE-2)	■	■	■	■
Greece	■	■	■	■
Italy	■	■	■	■
Latvia	■	■	■	■
Lithuania	■	■	■	■
Luxembourg	■	■	■	■
Norway	■	■	■	■
Turkey	■	■	■	■
United Kingdom	■	■	■	■
Ireland	■	■	■	
Croatia	■	■	■	
Finland		■	■	■
Austria (AT-2)	■		■	
Switzerland	■		■	
Slovenia	■			■
Spain	■			■
Romania		■		
Hungary			■	
Portugal				■
Total	**21**	**19**	**21**	**19**

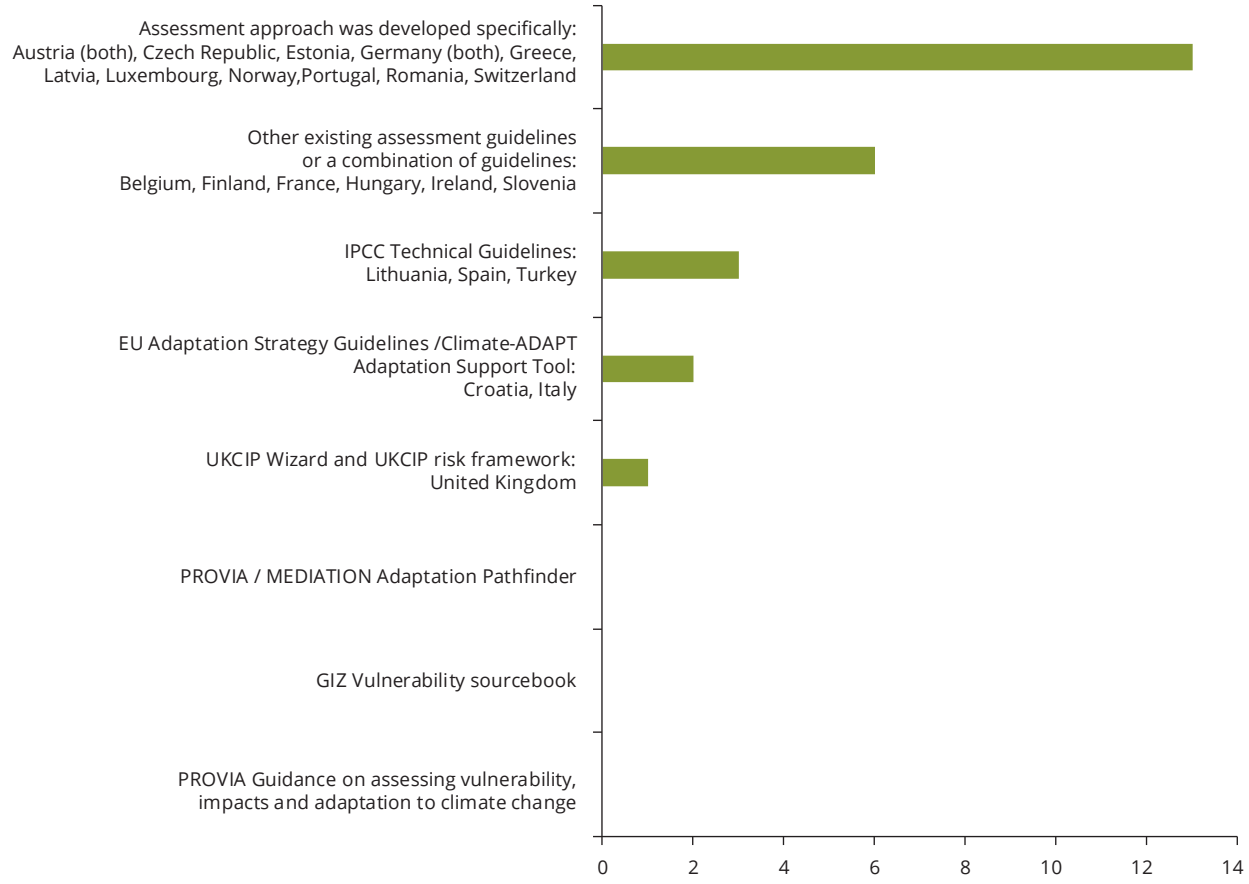
only a few included quantitative estimates of these resources. [Q22]

The third question addressed the duration of the national CCIV assessment. The responses varied between 5 months (prepared by a core group of 10 experts) and 7 years (with 360 experts involved), with a median duration of 2 years. Based on the limited information provided, it was not possible to identify a clear link between the duration of an assessment and its costs. Nevertheless, the survey suggests, as expected, that greater diversity in approaches, more technically demanding approaches, more regional detail and rigorous review processes demand significantly more resources than general assessments based on a literature review and expert opinion. [Q21, Q26]

3.4 Assessment approach and stakeholder involvement

Since the 1990s, various guidelines have been developed for assessing climate change impacts, vulnerability and risks, and for planning adaptation policies and measures. Only a few countries reported that they directly applied existing guidelines for their national CCIV assessments (Figure 3.4). About half of the assessments (13 out of 25) have used a specific approach, and five used a combination of existing guidelines. Seven countries stated that they have used existing guidelines. The distinction between these responses can be somewhat fuzzy, because even specific approaches usually have borrowed features from generic guidelines to develop their own tailor-made approach. The *PROVIA guidance on assessing*

Figure 3.4 Did the assessment follow any specific assessment guidelines or framework? [Q 25]



vulnerability, impacts and adaptation to climate change, the PROVIA/MEDIATION *Adaptation Pathfinder* and the GIZ *Vulnerability sourcebook* have not been applied directly in any of the CCIV assessments reported here. Further information on the specific assessment approaches of countries is available in their survey responses (available online). Information about the approach of one specific country (Germany) is presented in Box 3.1. [Q25]

The survey asked also about the application of five pre-defined assessment methods and allowed for the specification of other methods. The results are shown in Figure 3.6. Almost all CCIV assessments (23 out of 25) include a review of existing literature. Expert workshops and interviews, as well as stakeholder workshops are also widely applied ([28]). A quote from the Swiss survey provides an example of their use: 'The team that conducted the assessment reviewed the literature and assessed the risks and opportunities based on this information and indicators. Interviews with experts helped clarify/estimate certain risks or opportunities and the expert workshops as well as the reviewing of drafts by experts validated plausibility.' About half of the assessments (13 out of 25) included a coordinated modelling exercise, whereas only a few (6 out of 25) applied a composite indicator approach. An example for 'other methods' is the use of case studies. [Q26]

Table 3.2 gives an overview of the involvement of external stakeholders in the assessment. Almost all assessments involved government authorities at the national level and external scientists. A large majority also involved non-governmental stakeholders and government authorities at the sub-national level. International organisations were involved in only a limited number of assessments. The most common types of stakeholder involvement comprised

([28]) The distinction between expert workshops and stakeholder workshops may not have been completely clear.

Box 3.1 Germany: Guidelines for climate impact and vulnerability assessments

The guidelines for climate impact and vulnerability assessment of the Interministerial Working Group on Adaptation to Climate Change of the German Federal Government provide methodological recommendations for the execution of climate impact and vulnerability assessments at regional and national level, and they refer to further material and information. They are intended to support the methodical preparatory work. The aim is to develop comparable research results for sectoral and cross-sectoral climate impact and vulnerability assessments at federal and state (*Land*) level in Germany. The guidelines are intended to close existing gaps in the IPCC vulnerability concepts 2007 and 2014, but use the IPCC 2007 terminology. They also give recommendations as to how to operationalise these concepts. Text boxes in the different sections of the guidelines give examples and sum up key recommendations for carrying out climate impact and vulnerability assessments.

The guidelines cover the creation of the right framework for such an assessment and its execution, separated into three working steps: planning and preparation, step-by-step execution, and communicating and using the results. When creating the framework, the objectives and extent as well as the vulnerability or risk concepts to be used have to be determined. A cornerstone in complex assessments is the differentiation between technical-scientific analysis and normative/value-based evaluation. These two elements should be done in separate steps, preferably by different bodies, and documented transparently. If possible, a network of experts from relevant organisations responsible for using the results later for adaption planning should be involved.

The framework is the foundation for the preparation step, when the experts to be involved are selected and the key terms as well as the scenarios for climate stimuli/hazard, spatial exposure and sensitivity are specified. If possible, an ensemble of climate and socio-economic projections should be used for future assessments. During the execution step, impact chains are developed. Impact chains help to understand, systematise and prioritise which factors influence the impacts of climate change, including climate extremes, on a system. They are used to select the relevant climate change impacts, which are then operationalised by quantitative or qualitative methods. Estimating the confidence of the results for climate impacts is recommended in order to facilitate interpretation. The adaptive capacity of affected systems or action fields also has to be estimated. The results of these technical processes are then evaluated and aggregated to a vulnerability statement (see Figure 3.5). This aggregation must be done carefully to enable interpretation of the results. In the last working step, the results need to be tailored to the different target groups by developing specific communication products. It is recommended that estimates of adaptive capacity and of climate impacts be communicated separately.

Figure 3.5 Parts of a climate change vulnerability assessment

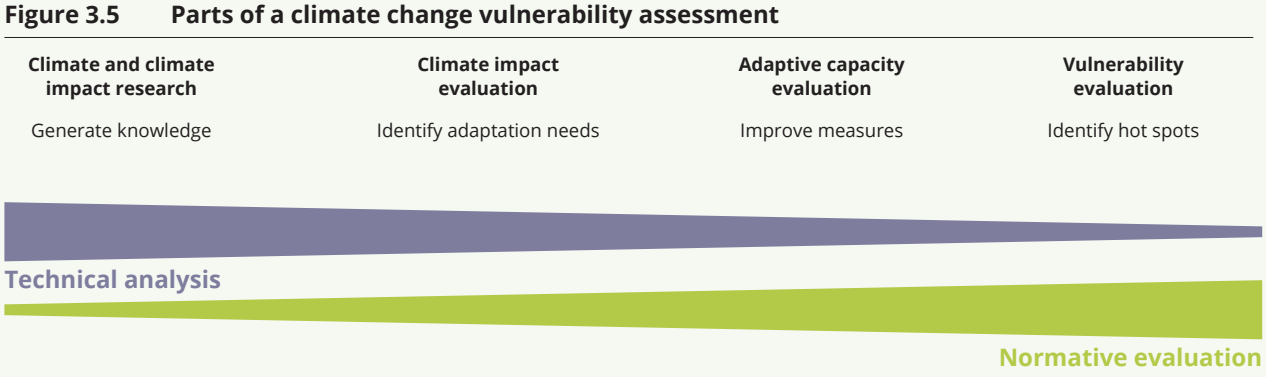


Figure 3.6 Which were the main assessment methods used? [Q26]

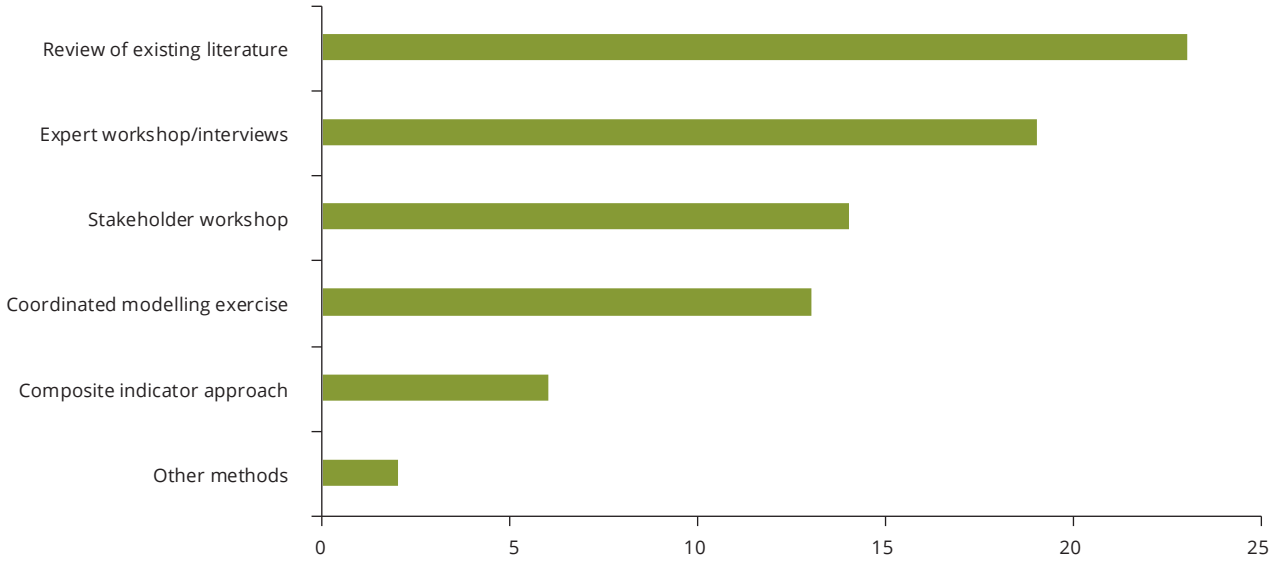


Table 3.2 Were external stakeholders involved in the assessment, and how? [Q27]

	Review of drafts	Online survey	Interviews or hearings	Advisory committee	Workshops	Total number of assessments
Government authorities at national level	15	2	9	12	18	**24**
Government authorities at sub-national level	6	0	6	4	14	**19**
International organisations	3	0	2	3	5	**9**
External scientists	12	1	11	8	16	**23**
Non-governmental stakeholders	8	2	10	1	18	**21**
Total number of assessments	**18**	**3**	**13**	**16**	**20**	

Note: Multiple answers were possible.

workshops, the review of drafts and advisory committees. There is some variation in the type of involvement for different stakeholder groups. For example, sub-national stakeholders were primarily involved through workshops (possibly towards the end of the assessment project) rather than through advisory committees or the review of drafts. Non-governmental organisations were involved in various ways, but they are hardly represented in advisory committees. [Q27]

Innovative aspects were reported for 13 out of 25 assessments. Highlighted aspects included, among others, the assessment process, the generation and provision of a national CCIV knowledge base, and the translation of scientific information into policy recommendations. [Q28]

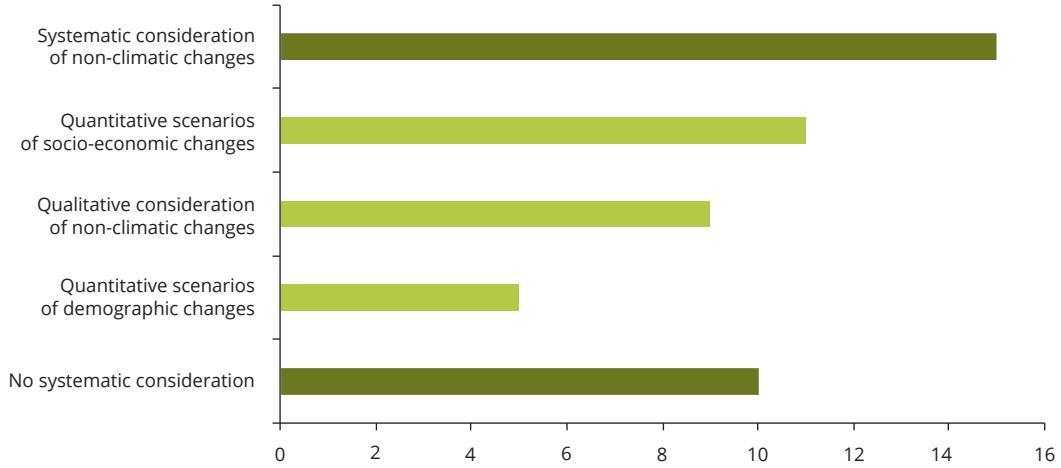
3.5 Scenarios and drivers

Several survey questions addressed the climatic and non-climatic scenarios and drivers of CCIV assessments. All 25 assessments used some kind of quantitative climate information. National projections downscaled from existing global or European projections were used most frequently (11 out of 25), followed by different sources of climate projections (e.g. in the case of a literature review, 5 out of 25), existing

European projections (e.g. PRUDENCE, ENSEMBLES, EURO-CORDEX; 4 out of 25), national projections based on own regional climate models (3 out of 25), and existing projections based on global climate models (e.g. CMIP3 or CMIP5; 2 out of 25). [Q29]

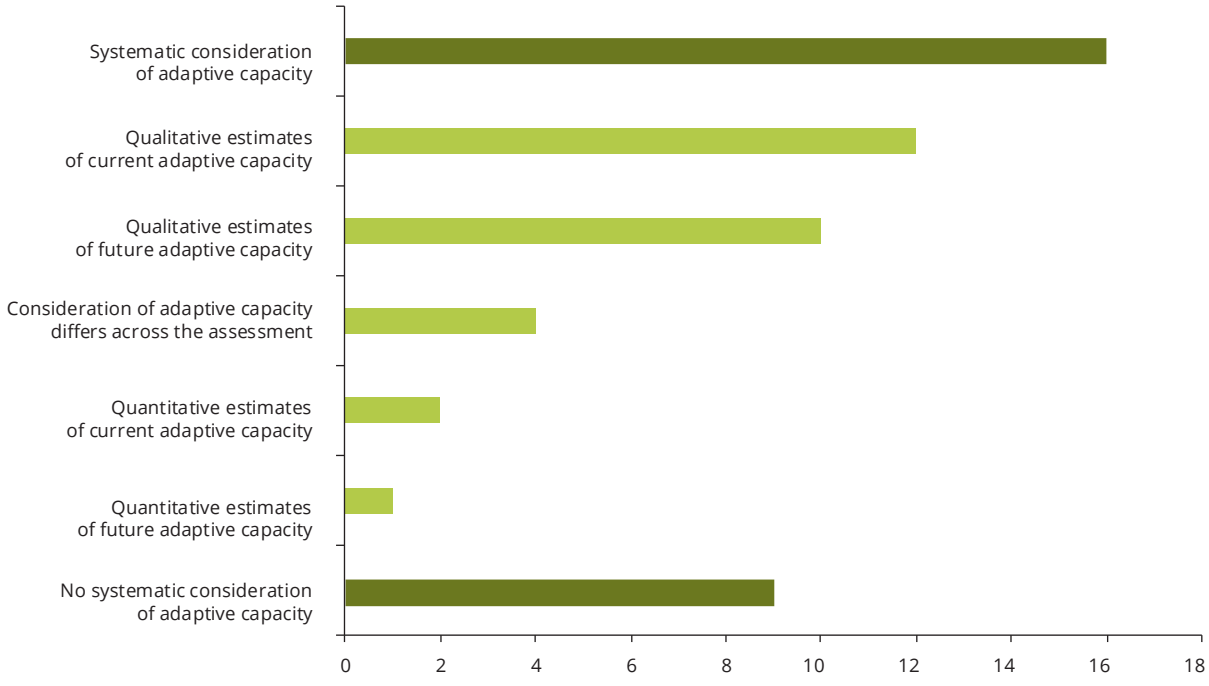
Figure 3.7 shows that a clear majority of the assessments (15 out of 25) incorporated demographic and/or socio-economic scenarios, either quantitatively or qualitatively. On the other hand, more than one third of the assessments did not systematically include such scenarios. Current and future adaptive capacity was also reported to be considered in most assessments (16 out of 25), but usually in a qualitative way (Figure 3.8). In total, a systematic consideration of non-climatic changes or adaptive capacity has been reported for 19 out of 25 assessments. In other words, while the use of quantitative climate information is standard, scenarios for non-climatic factors and estimates of adaptive capacity were not included in all assessments. The differences in the drivers between CCIV assessments are likely to be reflecting the variety

Figure 3.7 Did the assessment consider scenarios for non-climatic changes on a systematic basis? [Q30]



Note: Multiple answers were possible in the event that non-climatic changes were considered (light green bars).

Figure 3.8 Did the assessment consider the adaptive capacity of regions and/or sectors on a systematic basis? [Q31]



Note: Multiple answers were possible in the event that adaptive capacity was considered systematically (light green bars).

in assessment approaches and underlying resources. For example, a systematic consideration of non-climatic scenarios is much easier in a coordinated modelling study than in a literature review. [Q30, Q31]

3.6 Presentation of assessment results

The survey asked for information on how the main CCIV assessment results were summarised, presented and disseminated. In this context, 'main assessment results' refers to a synthesis of the assessment results, such as a dedicated summary chapter, key messages or graphical illustrations.

The results of CCIV assessments can help prioritise the planning, implementation and/or funding of adaptation across regions, sectors and/or for specific impacts. However, the comparison of risk levels across sectors unavoidably involves value judgements, because there is no objective way of comparing, for example, risks to economic actors, human health and biodiversity. Furthermore, the prioritisation of adaptation also needs to consider the estimated costs and benefits of actions, trade-offs and synergies with other societal goals, and the responsibilities shared between various actors (e.g. political, administrative). Therefore, the prioritisation of adaptation requires a combination of scientific assessment and value judgements, e.g. through a structured dialogue between scientific experts, stakeholders and policymakers. Such a dialogue either can be an integral part of the process of developing a CCIV assessment or it can be done separately, i.e. after publication of the assessment results. Several questions in the survey addressed to what degree the CCIV assessment integrated normative aspects in an effort to support the prioritisation of adaptation.

Common metrics are one way to make assessment results comparable across sectors, impacts or regions. Figure 3.9 shows the metrics used to present the level of vulnerability or risk for different sectors or impacts. At least 5 out of 25 assessments have used monetised metrics (i.e. expressed in euros or another currency) to present all or most of their CCIV results ([29]). For example, the Greek CCIV assessment estimated the costs for direct effects on production activities and infrastructure. In the case of Norway and Austria, costs of socio-economic impacts of climate change were presented based on separate studies. The CCIV assessments for Switzerland and France used monetised metrics for most, but not all, sectors and risks. Where such metrics could not be applied, qualitative and descriptive information was used.

At least nine assessments used a non-monetary common metric. In these cases, vulnerabilities or risks are often described as high, medium or low (e.g. in the case of Croatia, Finland, and Germany). Another approach is the use of colour codes, ranging from red to green, which also allows the identification of opportunities from climate change. The United Kingdom uses a slightly different approach by describing the magnitude of the risk and an urgency rating separately. For example, even if the future magnitude of a risk is assessed as medium, the urgency might be high if plans do not exist to manage the relevant drivers of the risks. Eleven assessments use different metrics, depending on the impact and sector. [Q32]

Summary illustrations, such as tables, maps or graphs, are another way to present results for different sectors, impacts or regions in a comparable way, thus supporting the prioritisation of adaptation action. More than half of the CCIV assessments (15 out of 25) present the main results in a summary table or matrix; several assessments also use quantitative and/or qualitative maps (Figure 3.10). Several summary tables or matrices use a colour scheme ranging from green to red to indicate the level of impact, vulnerability or risk (e.g. Belgium, Croatia, Czech Republic and Switzerland). The United Kingdom CCIV assessment provides a summary table and fact sheets for each chapter. In addition, they use qualitative infographics to illustrate selected climate change impacts. Ten CCIV assessments do not use an illustration to present their main results. In the case of Italy, an illustrated synthesis was compiled in a separate document after the CCIV assessment had been completed. There is a clear link between the use of common metrics and of summary illustrations. A summary illustration is included in 11 out of 14 assessments (79 %) that used some form of common metric, but only in 2 out of 11 assessments (18 %) without a common metric. [Q32, Q33]

3.7 Identification of thematic and regional priorities

The survey also asked whether a CCIV assessment allowed for the unambiguous identification of thematic or regional priorities. In this context, the term 'unambiguous' means that all readers of an assessment report would come to the same conclusion as to which sectors or regions are particularly affected under a given scenario and/or what are the largest risks. However, the free-text answers suggest that some respondents interpreted the question more broadly than intended.

([29]) This survey question only allowed for a single response. However, free-text answers (e.g. for Switzerland) indicated that the same CCIV assessment may present results using monetised metrics, common risk levels and other metrics. The term 'at least' is used to indicate the possibility of a small underreporting of monetised and other common metrics.

Hence, the following numbers should be interpreted with some caution.

According to the survey responses, 19 out of 25 CCIV assessments unambiguously identified particularly affected sectors and/or priority impacts/risks (Figure 3.11). Eleven assessments identified both priority impacts and sectors, five assessments only particularly affected sectors, and three only priority impacts/risks. The remaining six assessments did not unambiguously identify particularly affected sectors or priority impacts/risks. For example, several respondents stated that the assessment includes an overview of the main impacts of climate change for each sector, but that it does not compare or prioritise the impacts or sectors. [Q35]

There is a clear link between the use of common metrics and the identification of priority sectors, as 13 out of 14 CCIV assessments using monetised or other common metrics also identified priority impacts and/or sectors. The identification of priority impacts and/or sectors was also claimed for several other CCIV assessments, but it is not clear whether this was indeed done 'unambiguously', as intended by the survey question. [Q32, Q35]

Figure 3.12 shows that almost all CCIV assessments (22 out of 25) present the main results for the whole country. The other three assessments presented results for sub-national regions (Slovenia) or for other levels (Ireland and Luxembourg). Fourteen assessments presented results at the sub-national level (e.g. cantonal and regional level in Switzerland, regional level in Greece). Four assessments each provide results at high spatial resolution and at other levels. [Q34]

The survey also addressed the identification of regional priorities, which is facilitated by the use of common metrics and by the determination and presentation of assessment results at the sub-national level. The assessment of regional priorities for specific risks or impacts can be relatively straightforward, because impacts in different regions are usually expressed in the same metric. In contrast, the identification of regional priorities for a whole sector (comprising various risks or impacts) or even across sectors necessarily involves normative evaluations.

Figure 3.13 shows that less than half of the CCIV assessments (11 out of 25) have identified particularly

Figure 3.9 **Was the level of vulnerability or risk for different sectors or impacts presented in a common metric? [Q32]**

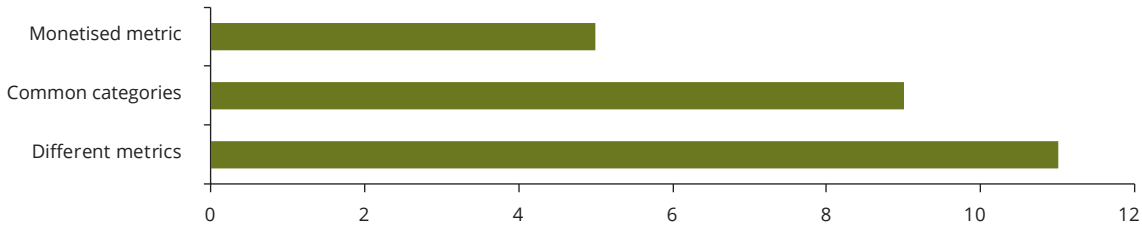
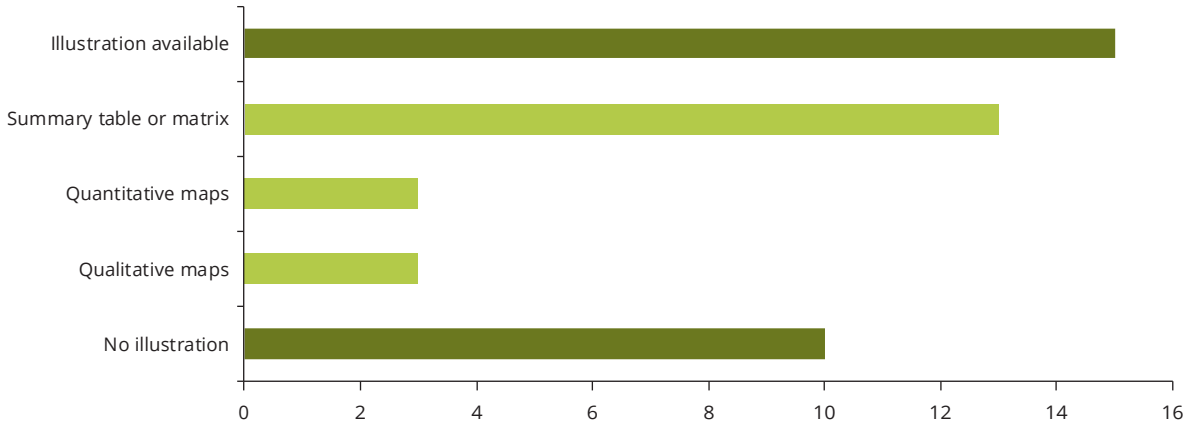
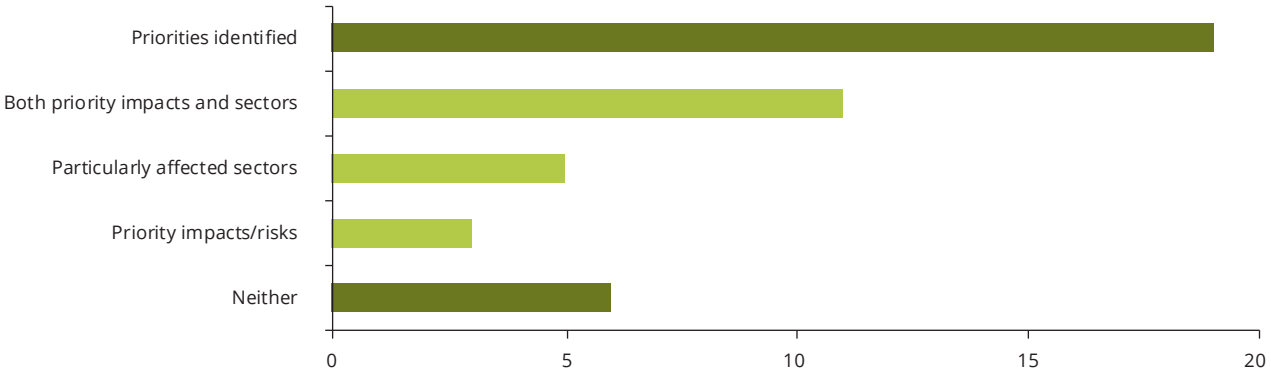


Figure 3.10 **Were the main assessment results across sectors or impacts presented in a summary illustration? [Q33]**



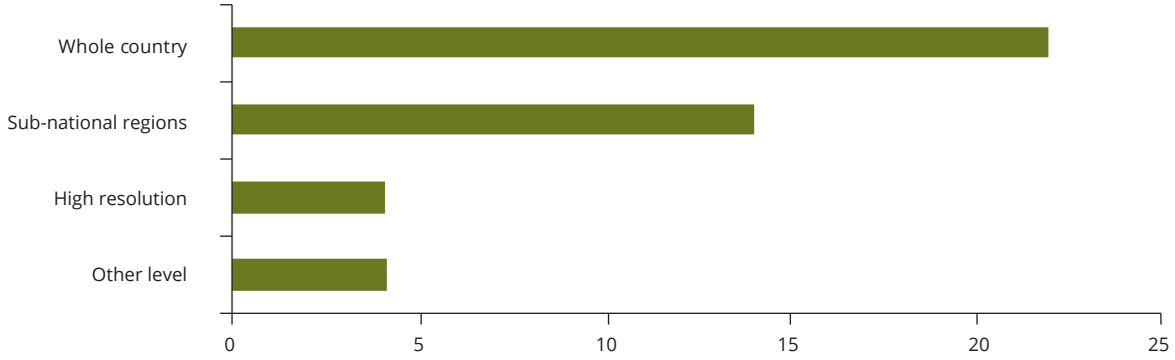
Note: Multiple answers were possible in the event that an illustration was available (presented in light green bars).

Figure 3.11 Did the assessment unambiguously identify particularly affected sectors or priority impacts/risks? [Q35]



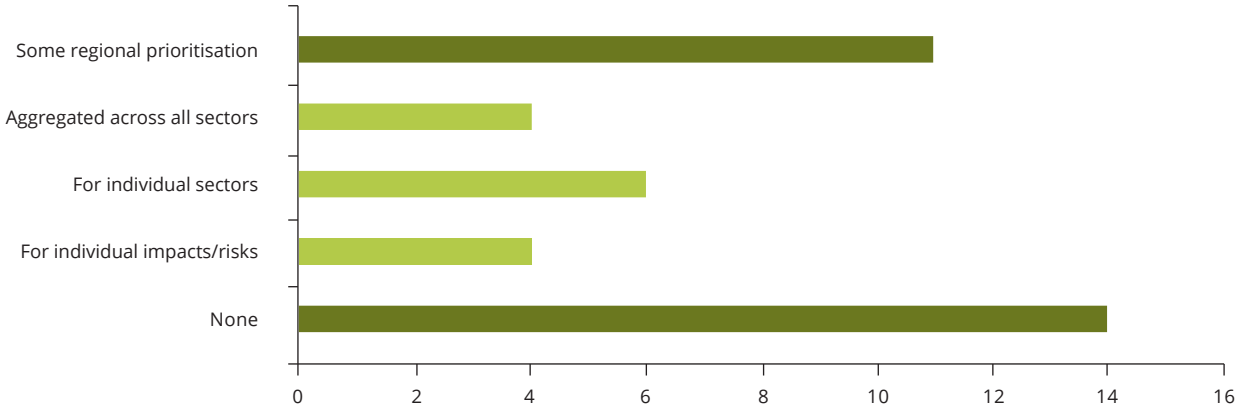
Note: Multiple answers were possible in case of priorities identified (presented in light green bars).

Figure 3.12 At what level of regional aggregation were the main assessment results presented? [Q34]



Note: Multiple answers were possible.

Figure 3.13 Did the assessment unambiguously identify particularly affected regions? [Q36]



Note: Multiple answers were possible in the event of some prioritisation (presented in light green bars).

affected regions in some way. Among those 11 assessments, four identified regional priorities aggregated across all sectors (e.g. Italy highlights mountain areas such as the Alps and the Apennines), six for individual sectors (e.g. Spain included a section on the most vulnerable regions in each sectoral chapter), and three for individual impacts/risks (e.g. in the case of Latvia, for flood-prone territories). These numbers should be interpreted in the context that only 14 assessments presented results on the sub-national level. [Q34, Q36]

3.8 Consideration of adaptation measures

Considering that CCIV assessments are ultimately intended to inform the development of adaptation policies and actions, the survey asked whether the identification and/or evaluation of potential adaptation measures was part of the assessment. According to the responses, about two thirds of the assessments (16 out of 25) go beyond analytical work on impacts, risks and vulnerability by also considering concrete measures for adaptation (Figure 3.14). The survey distinguished further between the identification and the evaluation or prioritisation of adaptation measures, but the free text responses suggest that this question may not have been interpreted in the same way by all respondents. [Q37]

3.9 Communication of uncertainties

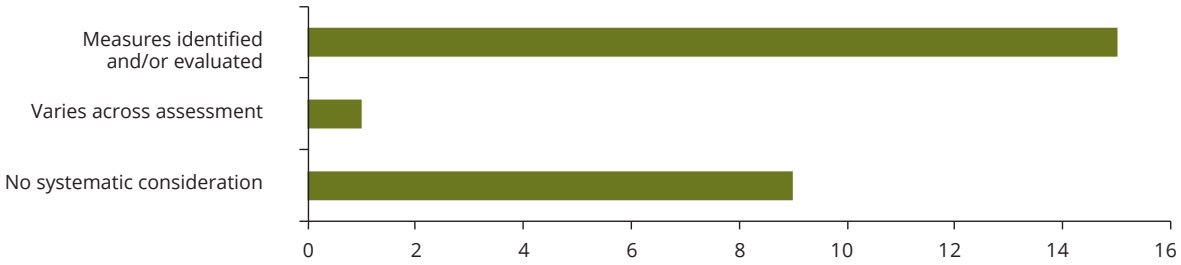
Assessments of climate change risks are necessarily fraught with uncertainties, from climate scenarios to the response of complex human-environment systems. Consideration of these uncertainties is an important part of the assessment process in order to determine the robustness of specific assessment results. Notably, the IPCC has developed sophisticated guidance material for assessing the likelihood or confidence of statements in its summary documents (Mastrandrea et al., 2010). This survey did not ask how uncertainties were addressed within a CCIV assessment (see, for example, Füssel and Hildén, 2014). However, it did ask whether and how uncertainties or the robustness of the main assessment results were communicated.

More than half of the CCIV assessments (14 out of 25) communicated uncertainties related to the main assessment results (Figure 3.15). Three assessments (one each from Austria and Germany and the evidence report of the United Kingdom's assessment) communicated uncertainties using discrete categories; two other assessments (Norway and Switzerland) used other systematic ways for communicating uncertainties. In the remaining seven assessments, the communication of uncertainties varies across different sectors and impacts. For example, in the case of Spain, each sectoral chapter includes a section on main uncertainties and knowledge gaps. [Q38]

3.10 Dissemination of results

The results of the CCIV assessments have been disseminated via many 'physical' and 'virtual' channels (Figure 3.16). Half of the respondents stated that the results of their assessment were disseminated via more than five dissemination channels (out of a pre-selection of seven media products and five types of events). Almost all CCIV assessments have been published as printed and/or electronic reports. Summary or synthesis documents have been produced for about two thirds of assessments. Other outreach material (such as press highlights and videos), web publications (such as indicators and interactive maps) and invited contributions (such as interviews and blog posts) were used less often. Social media (such as Facebook and Twitter) have been used by only a few countries. Most countries (21 out of 25) also used interactive forms of communication. Among them, press conferences and stakeholder events were

Figure 3.14 Did the assessment identify, evaluate or prioritise adaptation measures on a systematic basis? [Q37]



used for about half of the assessments, followed by scientific events and public events; webinars were not held at all. [Q39]

There is a clear relationship between the stated target group of an assessment and the dissemination channels. For example, the nine CCIV assessments that included the public as a main target group used more diverse dissemination activities than the other ones. Seven of them communicated their results via press conferences, and four used public events. Furthermore, five out of six countries aiming to reach the media have done so by invitation to a press conference (among other activities). [Q20, Q39]

Figure 3.15 How were uncertainties from different sources communicated in the assessment results? [Q38]

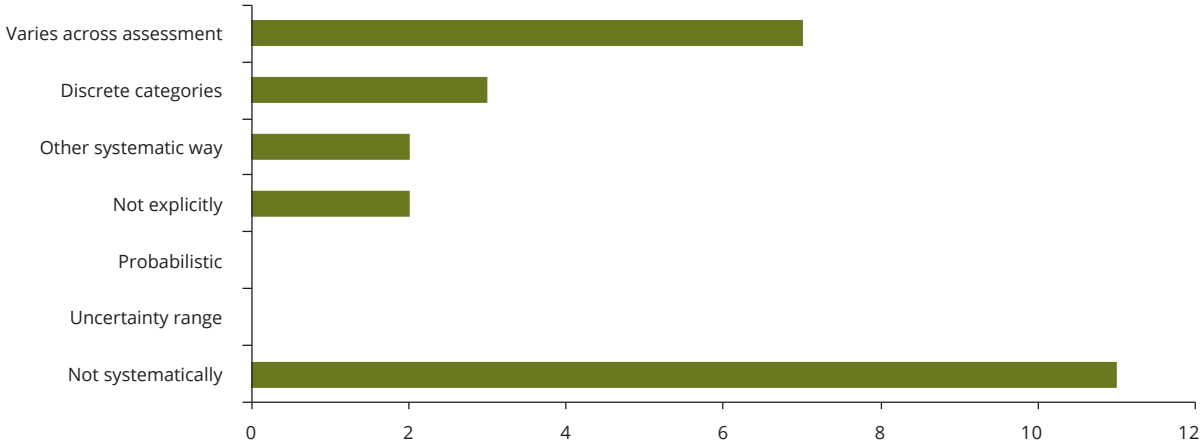
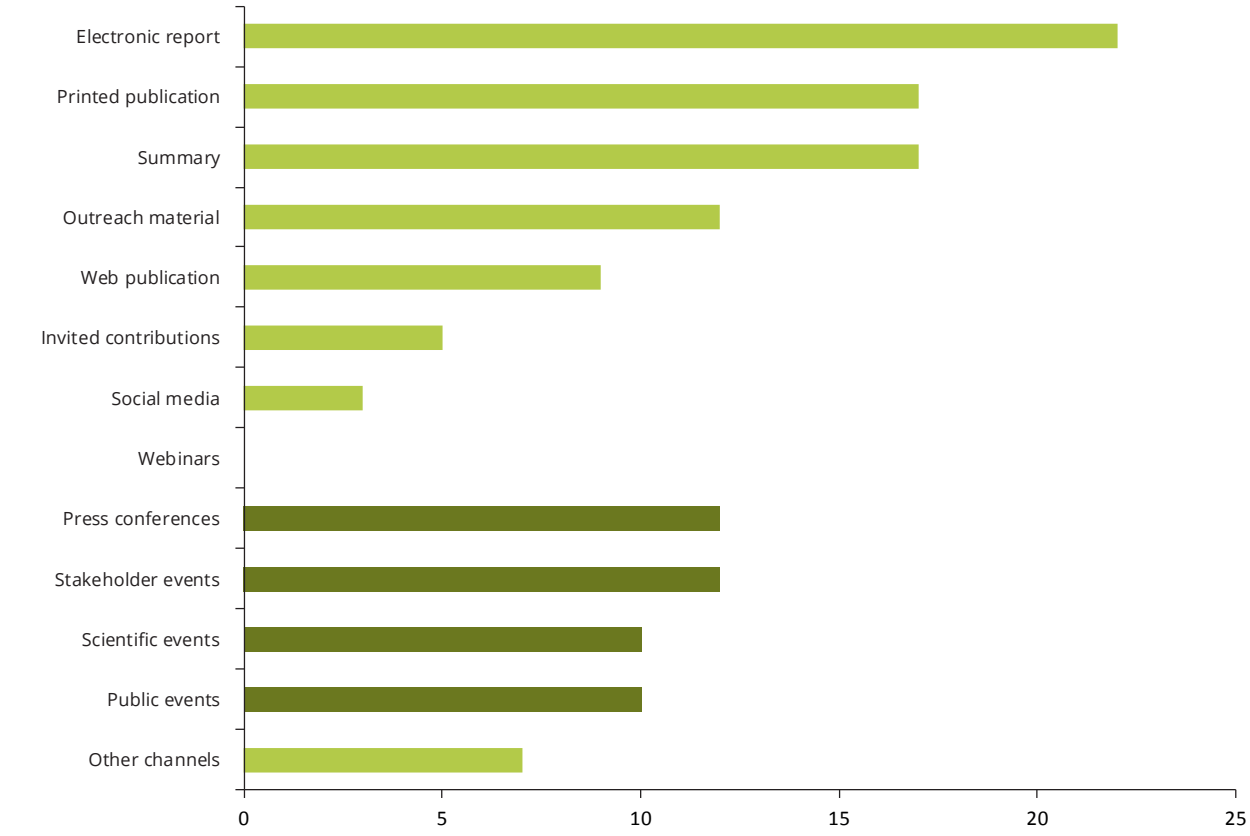


Figure 3.16 How were the assessment results disseminated? [Q39]



Note: Multiple answers were possible.

4 CCIV assessments and national adaptation policy development

Key messages

- The findings in this chapter are based on the survey responses received by the EEA from relevant experts in national authorities and institutions. Their interpretation should consider that they are based on the experiences and views of only a limited number of experts.
- Multi-sectoral national CCIV assessments are a crucial source of information for developing national adaptation policies in Europe. However, other information sources are also important. The diversity of relevant information sources reflects the complexity and individual nature of science-policy interfaces on adaptation in different countries.
- Adaptation policy development is the major reason for national CCIV assessments. The policy demand can be in the form of direct commissioning, or more generally as an explicit or implicit need for information that becomes evident during the preparation or revision of a national adaptation strategy or plan.
- National CCIV assessments are relevant in multiple stages of the adaptation policy cycle and for actors from different sectors and at different scales. These assessments have thus made connections to a policy development that not only focuses on climate impacts and vulnerabilities, but also pays attention to other societal objectives, such as the conservation of biodiversity or disaster risk reduction.
- The development of both national CCIV assessments and adaptation policies varies significantly from country to country. However, national CCIV assessments have some common challenges, such as having to deal with a lack of or gaps in data, the integration of quantitative and qualitative information, and the comparison of diverse climatic risks across sectors.
- Lessons learned from past CCIV assessments include the importance of providing relevant information at the sub-national level, because climate risks are not uniform within a country, using current climate vulnerabilities as a starting point of the analysis, and the consideration of climate change jointly with other drivers and policy concerns.

4.1 CCIV assessments in the adaptation policy cycle

CCIV assessments refer to evidence-gathering activities that seek to assess climate change impacts, vulnerability and/or risks (see Box 1.1 for more information on related terminology). They have evolved over the past decades, and so has their use in adaptation policy development. While the importance of CCIV assessments as information sources for adaptation policy development is generally recognised, the exact nature and reason of a CCIV assessment can vary greatly from country to country.

For example, some national CCIV assessments originated from the scientific community, others were primarily aimed at raising awareness or producing a general picture of the need for adaptation action, and still others were designed specifically to support the development of national adaptation policies. These differences in purpose and target audiences are reflected in the scope, methods and approaches used as well as in their outputs and delivery mechanisms. In particular, they affect how the assessments are valued and used by policymakers and other decision-makers, and ultimately how they are linked with the national adaptation policy cycle. [Q7, Q19, Q40]

The adaptation policy cycle is a generic and simplified description of how national adaptation policies are developed and revised in a series of steps over time. Such policies typically include NASs, NAPs and/or other adaptation-related sector policies. The concept of a policy cycle forms the basis of the European Adaptation Support Tool (hosted by Climate-ADAPT ([30])), which recognises six steps in the development of adaptation policies (see Figure 1.1). This tool aims to support the development, implementation, monitoring and evaluation of adaptation policies and their outcomes. The development of adaptation policy is context-specific, and the steps do not always follow one another in a consecutive manner in practice. It is often necessary to return to previous steps, for example, to take into account identified knowledge gaps and uncertainties, or new options recognised only after a first round of an assessment cycle. Therefore, some adaptation guidelines describe the adaptation policy cycle as consisting of a sequence of multiple, interacting stages or steps (e.g. Willows and Connell, 2003).

The aim of the present chapter is to improve the understanding of the role and positioning of CCIV assessments in the adaptation policy cycle. Doing so involves considering how the assessments are developed and how they are framed within the wider set of research activities and policy decisions that constitute this cycle.

4.2 Role of CCIV assessments in national adaptation policy development

The Climate-ADAPT Adaptation Support Tool is based on the assumption that a CCIV assessment is carried out and used primarily in the early stages of developing adaptation policies. This is often, but not always, the case (see the timeline figures in Section 4.3 for further information). Notably, the survey has shown that CCIV assessments also provide essential input in the later stages of the process or in a second cycle of policy development. [Q40]

Almost all respondents to the survey identified multi-sectoral CCIV assessments as 'very important' for the development of adaptation policy. However, other sources of information have also fulfilled policy needs, and no single source of CCIV information fully dominates. Furthermore, the particular set of information sources used in different countries is diverse (see Section 2.3 for further information). The diversity of relevant information sources reflects the complexity and individual nature of science-policy interfaces on adaptation in different countries.

4.2.1 Reasons for conducting CCIV assessments

The commissioning of CCIV assessments is one important sign of the role of CCIV information in the adaptation policy cycle. A combined analysis of responses to several survey questions suggests that 17 out of the 25 assessments have been specifically commissioned to support the development or revision of a NAS or NAP (see Table 4.1). The remaining eight assessments were described as not having been directly commissioned by the policy authorities leading the national policy development, although the assessment results may have been used for that purpose. While the public commissioning of a CCIV assessment cannot be seen as an assurance of a specific role in the policy cycle, commissioned CCIV assessments seem to hold a higher level of importance in the policy cycle than non-commissioned ones. [Q7, Q16, Q19, Q40]

Support for developing or revising a NAS or a NAP was stated as one of the main reasons for 20 out of 25 CCIV assessments reported here, and all assessments were targeted at national-level government authorities (see Section 3.1). This means that even when a CCIV assessment was not specifically commissioned for policy development (e.g. set up via bottom-up research initiatives), it was generally conducted with adaptation policy development in mind. [Q19]

Table 4.1 Commissioning of national CCIV assessments

CCIV assessment was commissioned to support the development or revision of a NAS or NAP (17 out of 25)	CCIV assessment was *not* commissioned to support the development or revision of a NAS or NAP (8 out of 25)
Austria (AT-1, AT-2); Belgium; Croatia; Czech Republic; Estonia; Finland; Germany (DE-1); Ireland; Italy; Latvia; Lithuania; Norway; Spain; Switzerland; Turkey; United Kingdom	France; Germany (DE-2); Greece; Hungary; Luxembourg; Portugal; Romania; Slovenia

Note: Based on the responses to several survey questions [Q7, Q16, Q19, Q40]

([30]) http://climate-adapt.eea.europa.eu/knowledge/tools/adaptation-support-tool

4.2.2 *Use of CCIV assessment results for adaptation policy development*

The survey asked countries 'How were the assessment results used (or planned to be used) for policy development?'. The responses indicate that the reported CCIV assessments served as background documents and helped to define goals, objectives and targets of NASs and NAPs, as well as to identify priority sectors and/or the most relevant climate-related risks and impacts that require policy attention. For example, the prioritisation and selection of preferred adaptation options should ideally identify effective options that 'reduce a particular vulnerability or number of vulnerabilities to a desired level' ([31]). In practice that implies the need to return to the results of the CCIV assessment and propose adaptation actions that address identified risks and vulnerabilities. For example, in Finland the assessment results provided a base for more specific planning for adaptation actions. The responses also highlighted that the national CCIV assessments have supported not only adaptation policy development at the national level, but in some cases also at the regional and local levels. Finally, several CCIV assessments have not only contributed to adaptation policies per se, but also to other sectoral policies, thus helping to mainstream adaptation across multiple sectors (highlighted by Croatia, Finland, Portugal, Turkey and the United Kingdom). This influence appears to go beyond the influence of adaptation policymaking on other sectors that are usually part of the inter-institutional administrative 'structures' of a NAS or NAP. [Q40]

CCIV assessments have also helped to guide future funding activities in terms of research needs and gaps. In addition, they have supported the reflection about necessary adaptation options and measures as well as the identification of funding for their implementation. In one specific case (Latvia), results were applied to the development of a monitoring, reporting and evaluation (MRE) system for adaptation. In another particular case (Germany), the assessment was also used as the basis for a proposal for an international ISO standard on vulnerability assessments (see Section 1.7). Finally, several CCIV assessments were reported to have served as underlying information for the planning of future assessments. [Q28, Q37, Q40]

According to the survey results, multi-sectoral national CCIV assessments are relevant in multiple stages of the adaptation policy cycle as well as for actors from different sectors and at different scales. These assessments have thus made connections to a policy development that not only focuses on climate impacts and vulnerabilities, but also pays attention to other societal objectives, such as the conservation of biodiversity or disaster risk reduction.

4.3 Development of national adaptation policy and the knowledge base over time

The survey results show that the development of CCIV assessments and national adaptation policy over time varies significantly across countries. In turn, this means that the positioning and role of CCIV assessments in the national adaptation policy cycle are strongly country dependent. The reported cases show that CCIV assessments can precede the initial policy instrument (NAS and/or NAP) by up to 10 years without a direct link (as in the extreme case of Portugal). On the other hand, CCIV assessment can be directly connected to different stages of the development of a particular adaptation policy instrument. Examples include assessments that were directly used in the initial preparation (Italy), the development (Czech Republic), regular reporting (Germany) or revision (Austria) of a NAS or NAP. Finally, seven countries indicated a 'legal requirement' as the main reason for conducting the assessment. For example, the United Kingdom stated: 'The Climate Change Act (2008) requires the UK Government to produce a UK Climate Change Risk Assessment (CCRA) every 5 years followed by a National Adaptation Programme (NAP) to address the risks identified.' In this case, the CCIV assessment is directly commissioned during the implementation of one adaptation policy instrument (the NAS) to serve as an input to another adaptation policy instrument (in this case a NAP). [Q7, Q19]

Figure 4.1 to Figure 4.6 illustrate the development of the knowledge base for adaptation as well as of national adaptation policy for those EEA member countries that have provided relevant information in the survey. The underlying information was derived from an open question, to which 21 countries responded ([32]). The content and the level of detail of the responses varied greatly across countries, which is also reflected in the

([31]) http://climate-adapt.eea.europa.eu/knowledge/tools/adaptation-support-tool/step-4/prioritise-and-select

([32]) Survey question 7 read: 'How has CCIV information for your country developed over time? Please highlight any major milestones, such as the publication of specific reports, and explain how this information has supported policy development, such as the development of national adaptation strategies or action plans.' Details of the responses to this question (e.g. dates, names) were fact-checked using the country information in Climate-ADAPT. However, no comprehensive analysis of information in Climate-ADAPT was conducted. Hence, the country pages of Climate-ADAPT may contain additional information that is not depicted in the figures here.

figures. Information about the development of NASs and NAPs was taken from the same sources as in Section 2.1. In each figure, elements in green represent the adoption of a national adaptation policy instrument, such as a NAS (light green) or NAP (dark green). Orange elements refer to one of the 25 multi-sectoral CCIV assessments that were covered in Part II of the survey. Finally, blue elements represent other sources of CCIV information that were reported to have influenced the development of adaptation policies in the country. These include other CCIV assessments beyond the ones reported in the survey, research programmes and projects, and related documents such as key reports and publications. All elements are linked to a specific 'end date', such as the publication of a report or the end of a research programme. Additional information about one specific country (Finland) is provided in Box 4.1. [Q7]

The survey results show that the development of CCIV assessments and other sources of information as well as the emergence of national adaptation policies have varied across countries, and over time. Multi-sectoral CCIV assessments and other sources of CCIV information have supported the development of adaptation policies, but no particular order of steps has emerged as an 'ideal' sequence. This diversity may point towards a more cumulative mode of science-policy interaction at the national and sub-national level. In this mode, CCIV knowledge expands over time, applying pressure and driving policy developments and vice versa, with adaptation policy 'demands' driving the need for additional CCIV information. Such findings are in line with an earlier study, which concluded that the motivating reasons and the science-policy nexus (including CCIV assessments) behind the development of NASs in 10 European countries were strongly country dependent (Biesbroek et al., 2010).

Box 4.1 Finland: Gradual accumulation of knowledge about climate change impacts and vulnerabilities

To date, Finnish understanding of climate change impacts and vulnerabilities (CCIV) has not been gained through periodic, systematic and comprehensive assessments. Rather, knowledge has accumulated incrementally through dedicated research efforts. These efforts were primarily within research programmes with an emphasis, though not sole focus, on CCIV and their potential implications for policy. The SILMU programme — the Finnish Research Programme on Climate Change — of the Academy of Finland (1990-1995), initiated many strands of climate change research in 80 individual research projects, but it did not aim at a systematic CCIV assessment. It was followed by the Academy's FIGARE-programme (1999-2002), devoted to global change, which also provided individual analyses.

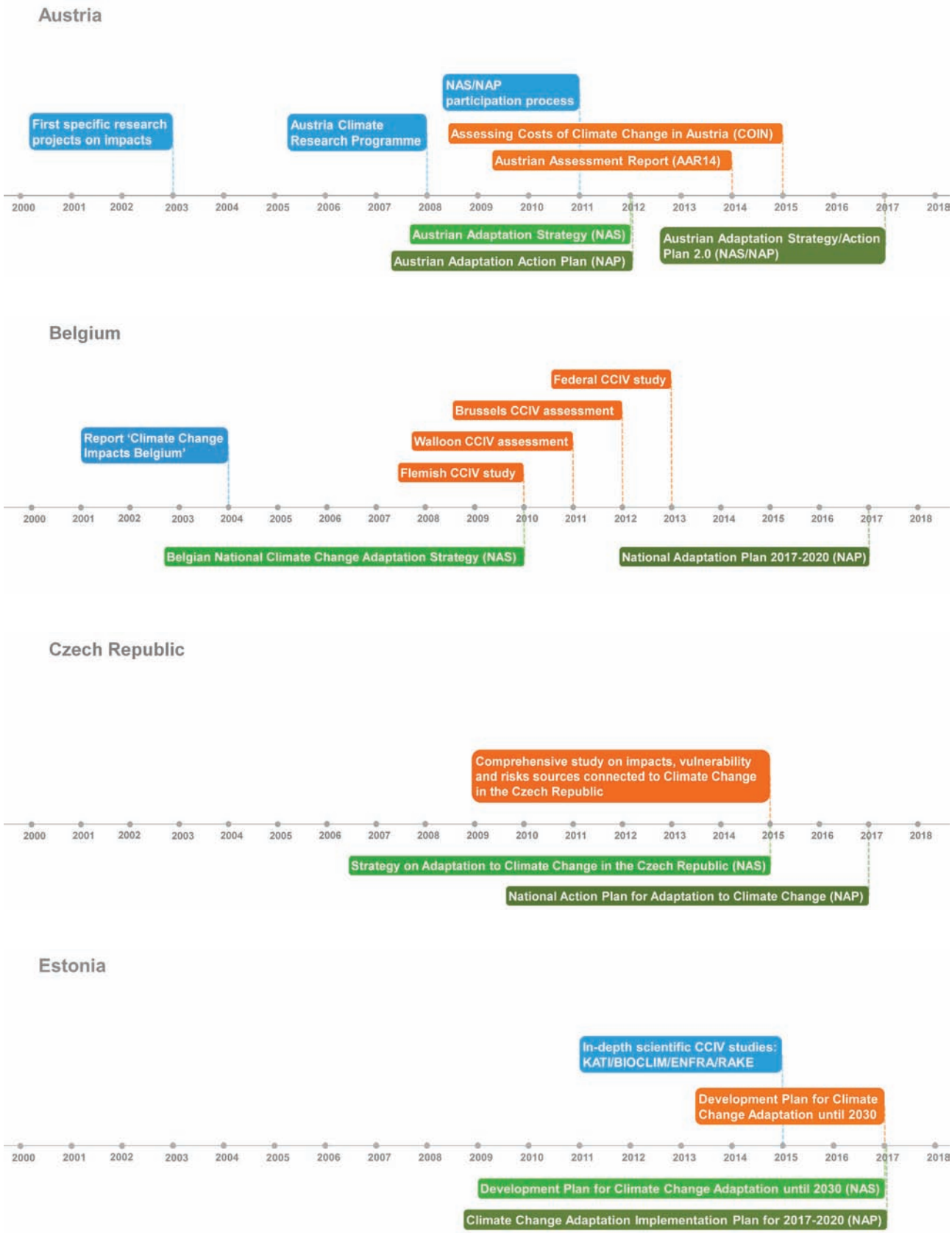
The FINADAPT project 'Assessing the adaptive capacity of the Finnish environment and society under a changing climate' ([33]) was the first attempt to examine impacts and adaptation systematically across multiple sectors using a common framework. It was carried out by a consortium of 11 partner institutions between 2004 and 2005 and based on literature reviews, interactions with stakeholders, seminars and targeted research. The outcome was a series of 10 sector-based and five cross-cutting reports and a summary for policymakers. It contributed to the work leading to the NAS and became a springboard for several in-depth studies.

In the period 2006-2010, arising out of a NAS recommendation, the government-funded Research Programme on Adaptation to Climate Change (ISTO) brought together a large portion of the relevant research community with the common goal of reflecting on how society could respond to the potential impacts of climate change through adaptation. Further in-depth studies were carried out in the Academy-funded Research Programme on Climate Change (FICCA, 2011-2014) and as separate research and development projects for sectors and topics with different funding sources. None of the aforementioned programmes or projects was intended to serve as a national CCIV assessment, but they provided elements for such work. In this vein, in 2013 a systematic review was carried out on the impacts and vulnerabilities of sectors as support for the revision of the national climate strategy (which was published in 2014 as the NAP). It created a basis for both sector-specific analyses and an ongoing overall CCIV assessment that is expected to provide a new synthesis in 2018.

By alternating between separate research-driven projects and programmes on the one hand and synthesis work based on reviews of impacts and vulnerabilities on the other, Finland has gradually improved its CCIV assessments. These have been coupled with follow-up and monitoring of the NAP. Monitoring is distributed to the sectors, but a common framework is being developed to facilitate cross-sector learning.

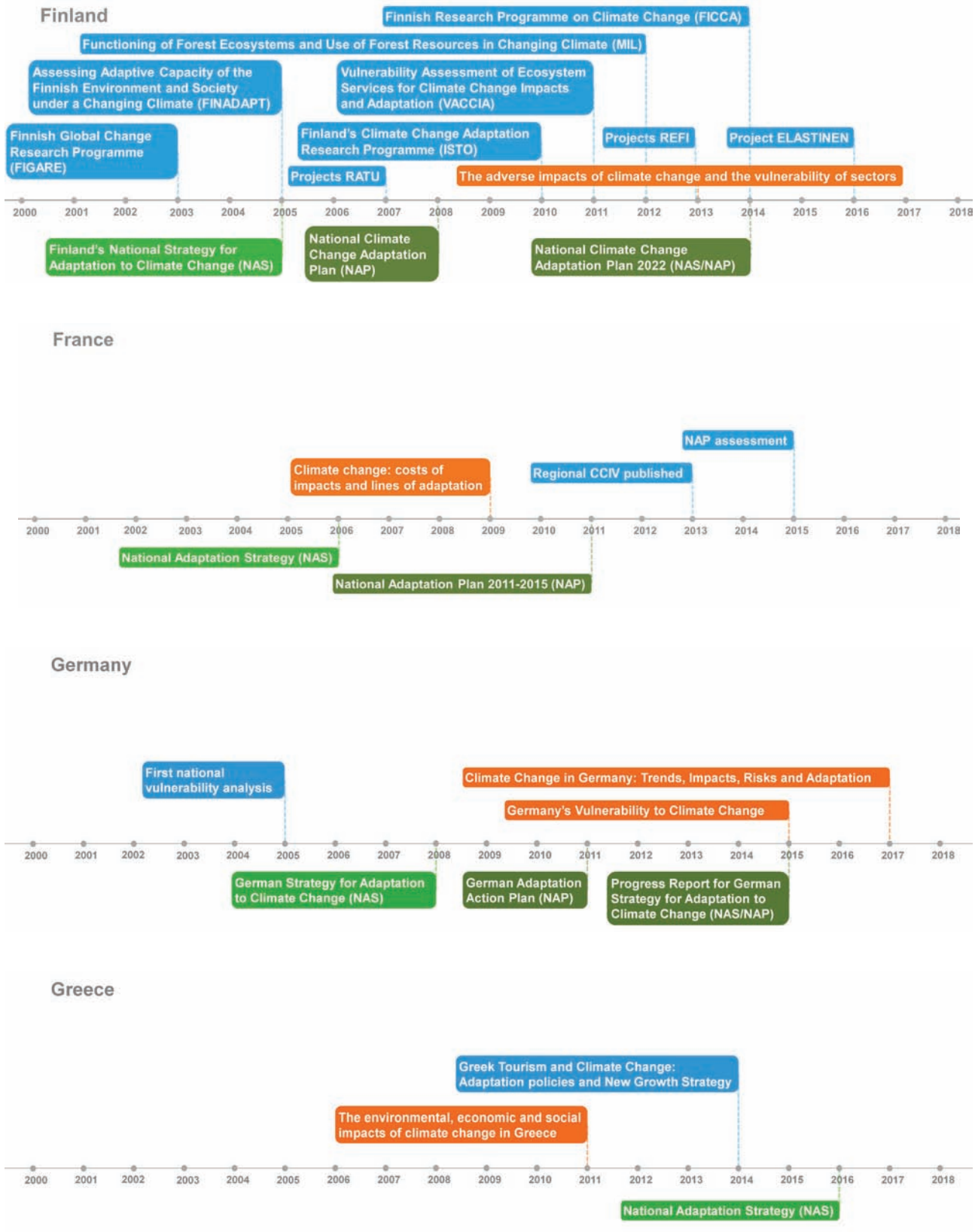
([33]) http://www.syke.fi/projects/finadapt

Figure 4.1 **Timelines of CCIV information and adaptation policy developments: Austria, Belgium, Czech Republic, Estonia**



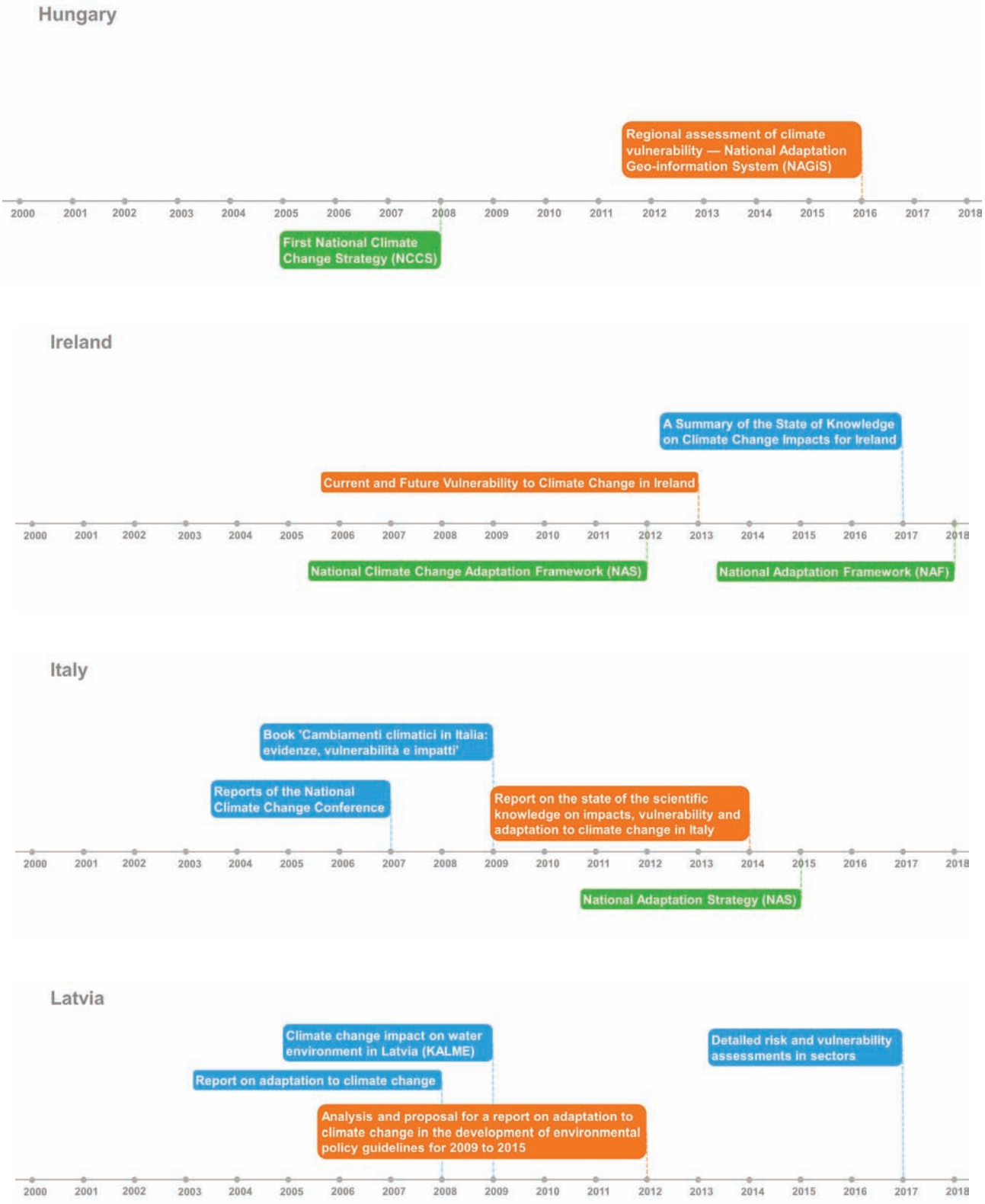
Note: The figures are explained in the main text.

Figure 4.2 Timelines of CCIV information and adaptation policy developments: Finland, France, Germany, Greece



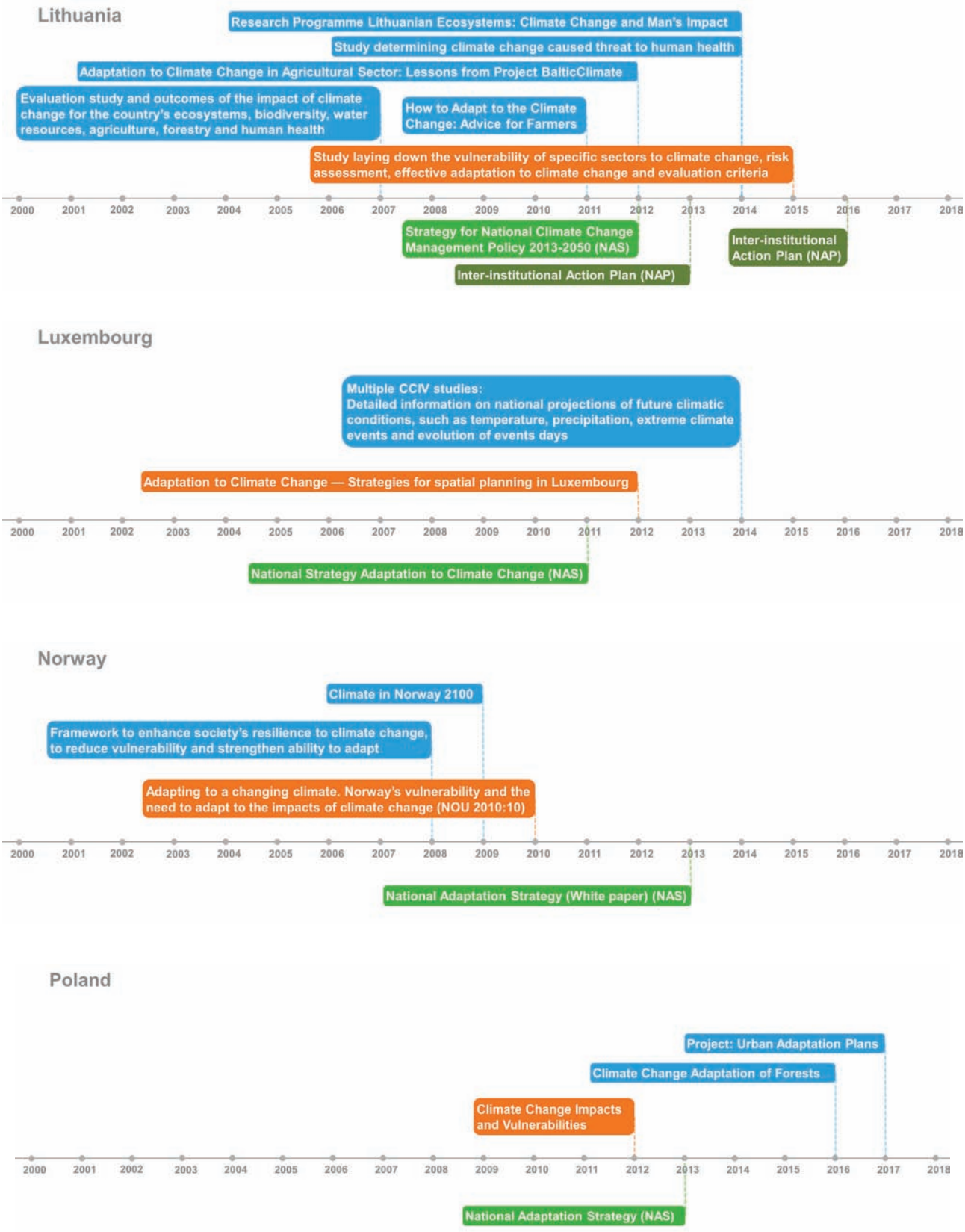
Note: The figures are explained in the main text.

Figure 4.3 **Timelines of CCIV information and adaptation policy developments: Hungary, Ireland, Italy, Latvia**



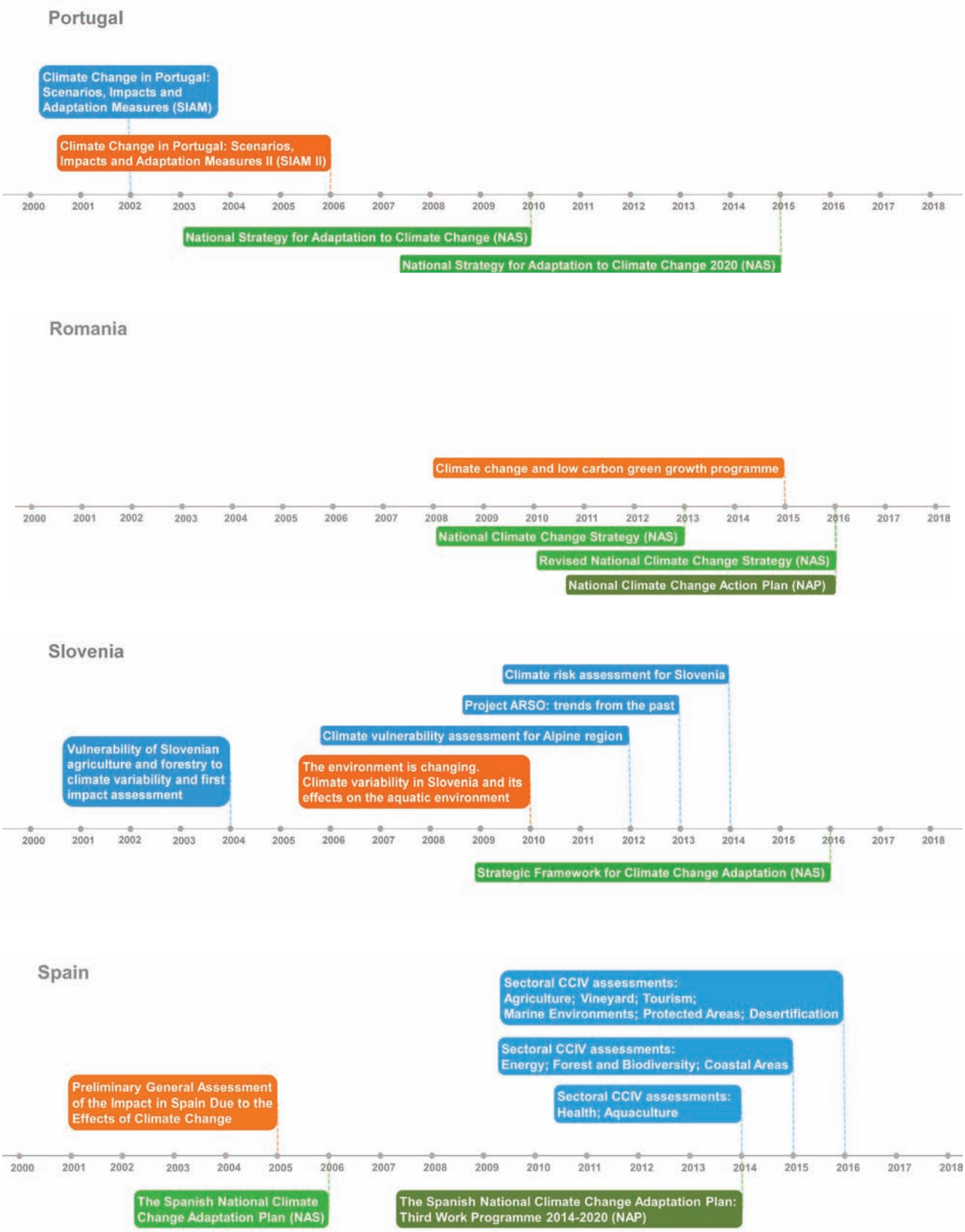
Note: The figures are explained in the main text.

Figure 4.4 **Timelines of CCIV information and adaptation policy developments: Lithuania, Luxembourg, Norway, Poland**



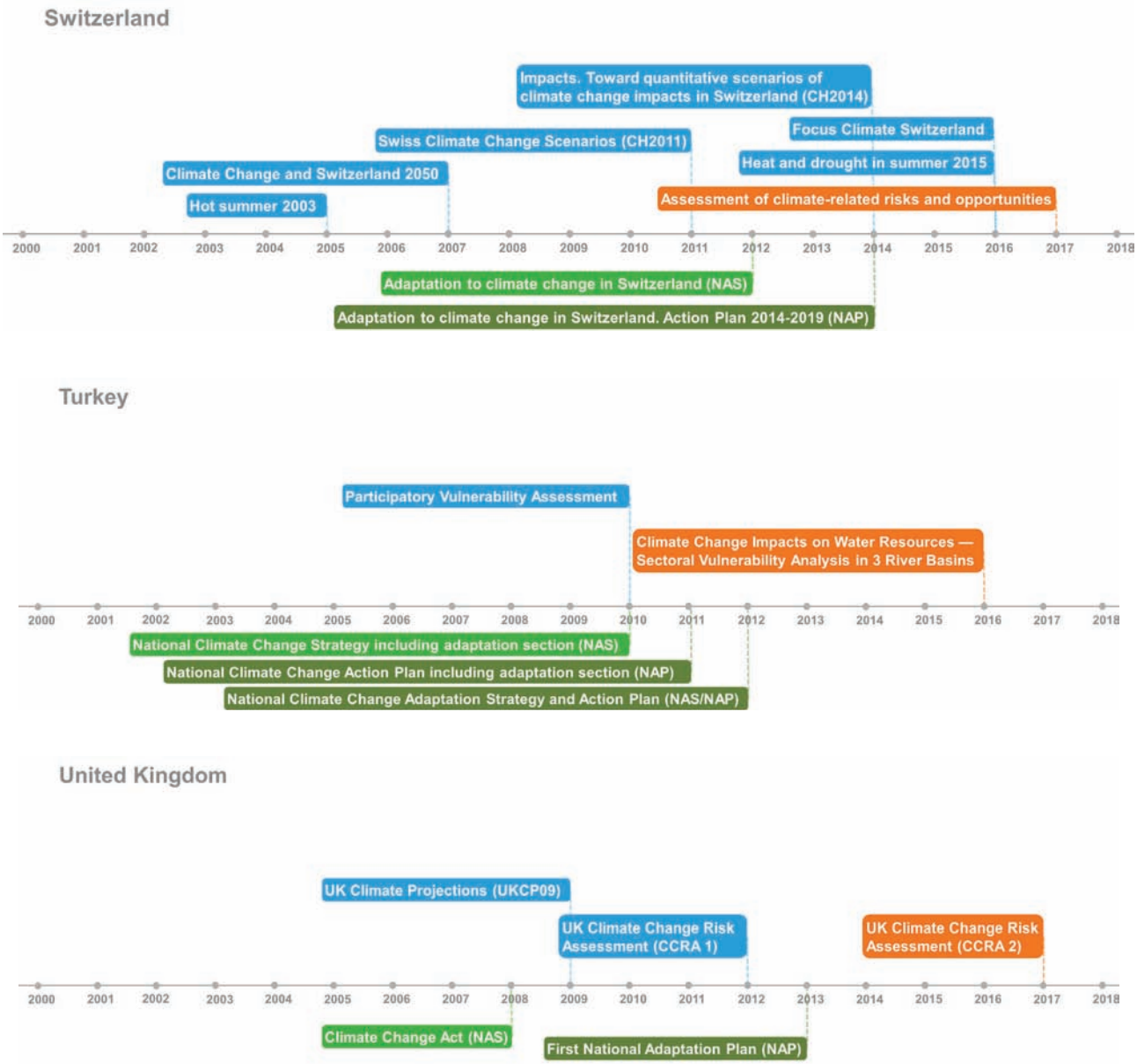
Note: The figures are explained in the main text.

Figure 4.5 **Timelines of CCIV information and adaptation policy developments: Portugal, Romania, Slovenia, Spain**



Note: The figures are explained in the main text. The Spanish National Adaptation Plan (PNACC) was classified as a NAS based on the EEA's understanding of this term (see Section 2.1).

Figure 4.6 **Timelines of CCIV information and adaptation policy developments: Switzerland, Turkey, United Kingdom**



Note: The figures are explained in the main text.

4.4 Experiences with development and use of national CCIV assessments

The previous sections of this chapter have highlighted the variability of roles and uses of CCIV assessments for (national) adaptation policy development. The survey revealed that it is not always possible to establish causal relationships between conducting a CCIV assessment and its uptake in adaptation policy development. Multiple factors contribute to this disparity and results vary greatly from country to country, which makes extracting comparable lessons and good practices a difficult task. However, the results do allow for the definition of a set of common challenges for the uptake of CCIV assessments across the adaptation policy cycle. Concurrently, a set of benefits and common lessons can be distilled from the experience of the assessed countries. These challenges and lessons can be of interest to those involved in CCIV assessments, in adaptation policy development or at the science-policy interface.

4.4.1 Positive experiences

According to the survey respondents, the development and use of results from CCIV assessments produces multiple benefits within the adaptation policy cycle. Table 4.2 provides a summary of the comments related to the positive experiences reported from conducting the assessment. CCIV assessments enabled the compilation of fragmented information from different sources, which were available within different sectors and institutions at national or sub-national levels. In addition, the joint effort of many actors working together to prepare interdisciplinary assessments has led to the formation of thematic and sectoral expert networks, which in turn has led to improved understanding and increased collaboration across the different themes and actors (e.g. ministries, research institutes, non-governmental organisations and others). The results show further that the reported assessments improved the understanding of how climate change impacts affect individual sectors, groups or systems, and what were the risks and possible benefits associated with future climate change, thus raising awareness about the need for adaptation. The assessments also helped and supported the identification of priority sectors and highlighted differences between sectors in terms of available data, knowledge and capacities. In addition, the assessments improved the harmonisation of terminology and language used by actors across different fields. In summary, these positive experiences demonstrate the important role and position of CCIV assessments within the overall adaptation policy cycles in European countries. However, the adaptation policy cycle implies a learning process that takes place over time. [Q41]

4.4.2 Challenges

Table 4.3 lists the challenges reported in the development and use of CCIV assessments. These challenges included data availability, which can vary considerably between sectors as well as within sectors. These data gaps also reflect resource and knowledge constraints that were reported to limit what CCIV assessments can achieve. For example, where quantitative data and indicators are lacking, there is a stronger emphasis on qualitative assessments, which in turn increase the reliance on subjective judgements.

Table 4.2 Positive experiences from CCIV assessments [Q41]

Positive experience	Number of comments
Improved understanding, knowledge sharing and learning from each other within and across the sectors and governance levels (capacity building, dialogue, cooperation, networks)	6
Input from a range of contributors	5
Raising awareness of the need for planning for climate change	4
Consistency and harmonisation — presenting consistent format, approach and terminology	3
Improved knowledge base and understanding of impacts, risks, benefits and policy measures for climate change adaptation	3
Stakeholder input — sources of knowledge when data are limited, greater acceptance of outcomes and buy-in	2
Prioritisation of sectors or risks	2
Others: differentiating between science and value-based decisions increases transparency; stimulated spin-off projects; differences between the sectors were made visible; integrative approach for water sector	(4)

The lack of data also underlines questions on how to use different sources of information and how to best upscale and/or integrate pilot study results into the national CCIV assessments. Integrating different sources of information such as peer-reviewed and grey literature, or quantitative data, qualitative information and expert opinion, was considered difficult.

The (lack of) coordination between experts from various disciplines, fields, sectors and institutions was reported as a difficulty in the multi-sectoral CCIV assessments considered here. This includes challenges related to differences in the terminologies used by disciplines. In combination with the identified tension between scientific validity on the one hand and an understandable language on the other, coordination of the multiple messages across the different sectors represented in the CCIV assessment also matters for the uptake and use of its results. A well-coordinated CCIV assessment can be expected to provide coherent messages for policy development across sectors, whereas lack of political coordination and/or interest was identified as a challenge for its use. In addition, the survey identified the assessment of adaptive capacity and the lack of forward-looking socio-economic data as methodological challenges for CCIV assessments.

4.4.3 Lessons learned and future plans

The survey also asked about lessons learned and whether different approaches might be applied in future CCIV assessments. The responses suggest that this is indeed the case, both in terms of the methods used and in terms of their intended use to support adaptation policy development.

The reported lessons learned included, among others:

- the need to further refine and develop robust and coherent intra- and inter-sectoral CCIV assessment methodologies alongside the identification of quantitative indicators;
- the need to develop methodologies that highlight how climate-related risks change over time and how they affect the evaluation of measures, programmes and policies;
- the need to focus on a stronger territorialised (i.e. sub-national) approach regarding specific types of risks;
- the need for a stronger focus on current vulnerabilities to climate-related risks, as the basis for an analysis of future climate risks;
- the need to consider future socio-economic development and other drivers of change alongside future climate change.

A common feature of successful CCIV assessments has been the recognition of the importance of stakeholder involvement from the very beginning. However, stakeholder involvement throughout CCIV assessments was also reported as a challenge. This challenge is relevant for the way the assessment is carried out, but also for the use of its results. One particular aspect concerns the high importance of getting support from stakeholders for data collection and getting access to their expertise (e.g. via interviews and/or workshops). The importance of stakeholder participation is further highlighted in those cases where sectoral or

Table 4.3 Challenges for the development and use of CCIV assessments [Q42]

Challenge	Number of comments
Lack of data availability or gaps in the data	6
Integrating different sources of information (e.g. peer-reviewed and grey literature, quantitative data with qualitative information and expert judgement)	4
Development and use of a unified methodology (e.g. common climate scenarios, metrics)	4
Lack of political coordination/interest	3
Involvement of stakeholders	2
Collection of information is expensive in terms of time and resources	2
Development of indicators	2
Qualitative data was not exact	2

Note: This table includes those challenges that were mentioned by more than one country.

regional data are not available or are insufficient. The importance of the sharing and exchange of data and information between different levels and actors was also stressed in the responses.

Some countries are considering updates of their assessments in the future. Planned updates generally involve further development in some areas, such as better regional climate modelling, improvements to the methodology, adding data and indicators, and looking at cross-cutting issues and interdependencies. Methodological improvements tend to aim for standardised methods that can be updated in future assessments and that create disaggregated data for sectors and regions while using common reporting formats. Achieving these potentially conflicting and technically complex advances will be a challenge in future CCIV assessments. Several countries have indicated their plans to evaluate their studies and to use the evaluation to make further improvements.

Box 4.2 provides more detailed information about the development from the first to the second national CCIV assessment for the United Kingdom. Box 4.3 provides information about the development of a framework for CCIV indicators in Italy.

Box 4.2 United Kingdom: From the first to the second UK Climate Change Risk Assessment

Under the 2008 Climate Change Act, the United Kingdom Government is required to publish a UK-wide Climate Change Risk Assessment (CCRA) every 5 years that assesses the latest evidence on the current and future risks and opportunities to the United Kingdom from climate change. The first CCRA (CCRA1) was published in 2012 and covered five themes: agriculture and forestry, business, health and well-being, natural environment, and buildings and infrastructure ([34]).

The second CCRA (CCRA2) addressed a number of gaps that were identified in the first CCRA ([35]). These gaps included: risks to the United Kingdom from climate change overseas, interacting risks and compounding effects of socio-economic change, cross-cutting issues related to adaptation, and how the steps already being taken to adapt impact on the level of risk.

Some of the knowledge gaps identified in CCRA1 needed further research to fill them. The research commissioned for CCRA2 covered future projections of UK flood risk and water availability, developing high-end climate change scenarios, and the goods and risks to the services provided by natural assets. The CCRA2 evidence report was prepared by the independent Adaptation Sub-Committee, which identified specific areas where further action is felt to be needed in the next 5 years, based on the available evidence. It is not an appraisal of potential adaptation options and does not recommend what specific actions should be taken. This is the role of the UK Government and devolved administrations within the National Adaptation Programme.

A range of dissemination products was created for different types of user to ensure that the main messages from CCRA2 are accessible to the widest possible audience. These products include a synthesis report, an evidence report with eight chapters (available as independent files), four national summaries, four research reports and blogs, a press release and a video for journalists, eight two-page factsheets and five infographics.

([34]) http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=15747#RelatedDocuments
([35]) https://www.theccc.org.uk/tackling-climate-change/preparing-for-climate-change/uk-climate-change-risk-assessment-2017

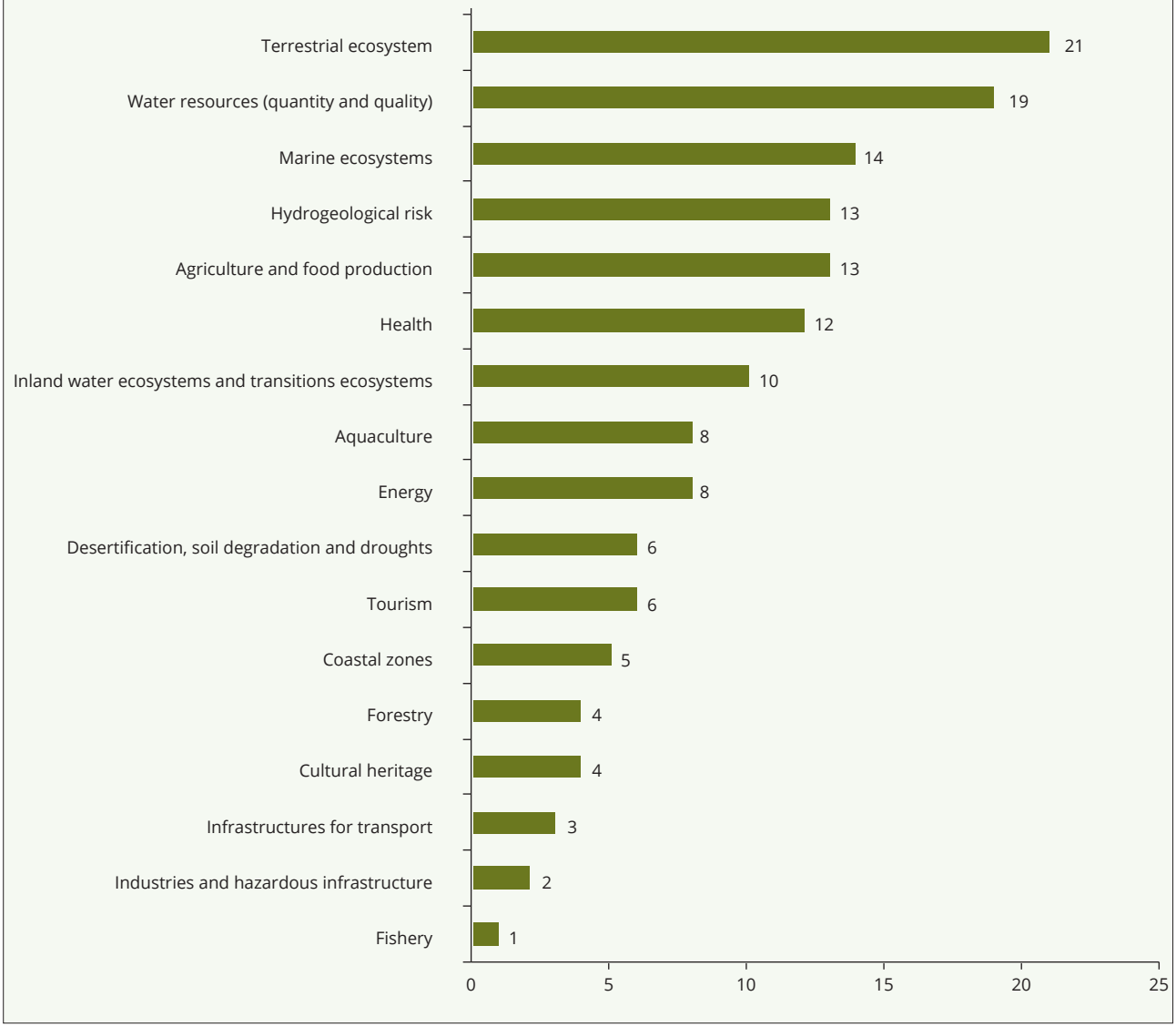
Box 4.3 Italy: Towards a national framework of climate change impact indicators

Climate change and its impacts are already occurring in Italy, yet with different intensities and unequal distributions in the various regions and in the different sensitive sectors. In this context, new problems will arise and existing phenomena will be exacerbated. The scientific community will therefore be required to face new challenges, which will call for new knowledge tools and decision support systems.

From this perspective, in 2016 the National System for Environmental Protection launched an initiative aimed at defining a national set of climate change impact indicators with multiple purposes: (1) to improve the knowledge framework on current climate change impacts in Italy; (2) to support decision processes; (3) to facilitate communication and awareness-raising processes; and (4) to establish a reference scenario for the monitoring of the effectiveness of adaptation measures. To date, about 150 'potential climate impact indicators' have been identified, based on the existing literature and guided by expert judgement (see Figure 4.7).

In the short term, specific criteria for the prioritisation of key impacts of climate change as well as for the evaluation and selection of the most suitable climate impact indicators will be applied in order to select and focus first on the most relevant national concerns. Existing barriers to the implementation of this activity are various. Lack of scientific evidence about the cause-effect link, limited availability of data in terms of time and spatial coverage, lack of adequate monitoring systems, and uncertainties affecting the evaluation are among the main examples.

Figure 4.7 Sectoral distribution of potential climate impact indicators for Italy



5 Reflections and possible future directions for CCIV assessments

Key messages

- The choice of assessment approaches and methods needs to take into account the particular information needs and the purpose of the CCIV assessment. The different needs and purposes will maintain diversity in CCIV assessments.
- In many countries, the interest has moved, from simply assessing the impacts of climate change and related vulnerabilities, to identifying adaptation measures and actions that reduce these vulnerabilities. This is illustrated by the fact that about two thirds of the CCIV assessments reported in the survey considered adaptation measures to some degree.
- Stakeholder engagement can provide access to relevant knowledge, ensure buy-in and facilitate mutual learning. It is most effective when stakeholders are included throughout all stages of the assessment.
- Regular updating of national CCIV assessments, e.g. every 5 years, allows the incorporation of relevant developments in the knowledge base as well as in policy.
- National CCIV assessments could benefit from closer coordination with national risk assessments conducted with a view to disaster prevention and risk reduction.
- National CCIV assessments provide a general overview and can assist in setting thematic and regional priorities, but sub-national and local information is required for developing targeted adaptation measures.
- Future CCIV assessments would benefit from addressing more systematically the following elements:
    1. non-climatic factors, including those affecting adaptive capacity;
    2. cross-sectoral and international (cross-border) impacts;
    3. developing harmonised metrics of impacts and vulnerabilities, potentially internationally harmonised, in addition to context-specific regional and local metrics;
    4. assessing and communicating uncertainties;
    5. assessing climate change impacts over time under different scenarios; and
    6. communicating key findings to different audiences.

This chapter reflects on the state of CCIV assessments in Europe in the light of the findings of the survey. It builds on the previous chapters and selected published studies, including a recent knowledge assessment study commissioned by the European Commission (see Section 1.4). The purpose is to reflect on how CCIV assessments could be further developed in order to support the design and implementation of adaptation policies. Where needed, the text explains explicitly which conclusions are based directly on the outcomes of the survey and which are based on additional information and analysis.

5.1 Assessment purpose, approaches and methods

The number of CCIV assessments in EEA member countries has grown considerably since 2010; this growth parallels the proliferation of national adaptation strategies and plans (Chapter 2). Improved CCIV information provides a firmer base for revising and focusing these adaptation strategies and plans. In some countries, several national CCIVs have been carried out, either by different institutions or one assessment as a sequel to an earlier assessment (Chapter 4). Early assessments typically focused on biophysical factors, such as climate and land use changes. Subsequent assessments have aimed to fill existing gaps, for example incorporating data on social factors, greater coverage of sectors or impacts, involving more stakeholders, and the creation of data at finer resolution (Downing et al., 2017). According to the survey, the development and revision of NASs or NAPs have been key reasons for the majority of the reported assessments (Chapters 2 and 3).

CCIV assessments have long been regarded as an important element of adaptation planning (Chapter 1). Early studies stressed that they should be carried out using frameworks that match the specific role of the assessments (e.g. Burton et al., 2002). The results from this survey suggest that national CCIV assessments can fulfil different purposes along the adaptation policy cycle, from awareness raising to informing specific adaptation actions, considering other policy objectives (Chapter 4).

General information on impacts and vulnerabilities related to climate change, in combination with stakeholder opinions, can be sufficient for raising awareness, building capacity and mobilising a public debate on adaptation to climate change. For these CCIV studies, the appropriate methodological focus is on systematic reviews of research and possibly surveys. The allocation of resources for concrete adaptation actions usually requires more detailed and specific assessments, which are also methodologically more demanding, as they will often require new primary data and quantitative analyses.

The survey showed that multi-sectoral, national CCIV assessments commissioned by public authorities have been a key source of information for the subsequent development or revision of adaptation policies. However, they are not the only possible source of information for policy development, as countries have identified a host of other sources of CCIV information, including international and European CCIV assessments, and expert and stakeholder opinions (Chapters 2 and 4).

The diversity of roles and related information needs suggests that CCIV assessments will remain diverse, and that they need to be designed by taking the specific purpose into account (Chapter 4). The ongoing development of an ISO standard *Adaptation to climate change — Vulnerability, impacts and risk assessment* (see Section 1.7) will hopefully take account of this diversity.

The importance of focus and purpose for the choice of framings, methods and approaches in CCIV assessments has been stressed in various generic guidance documents for assessments to which the survey referred. About half of the reported assessments had used their own, tailor-made approach, relevant for the specific national context. However, these approaches use many elements and features from existing generic guidelines and mostly involve some combination of steps linked to the policy cycle (Chapter 3).

A wide range of methods to collect and analyse the evidence has been used in the reported national CCIV assessments. Similar findings have been found in related studies (Downing et al., 2017). Nearly all the assessments covered in this report have included literature reviews of existing information, whereas technically more demanding approaches such as coordinated modelling have been used in approximately half of the assessments. The review processes have also differed, with about half of the assessments including reviews by external scientists. The survey suggests, as expected, that greater diversity in approaches, more technically demanding approaches and rigorous review processes have demanded more resources than general assessments based on literature reviews and expert opinions (Chapter 3).

The country-specific context has influenced how CCIV assessments have been conducted. Ultimately the choice of methods and approaches for any CCIV assessment will be influenced by the expectations, focus and purpose of the assessment as well as resource constraints. The history of assessments is also significant (Chapter 4). If broad, comprehensive and resource demanding CCIV assessments are already available, subsequent assessments can focus on specific sectors and deepen the understanding of the most relevant impacts and vulnerabilities. If a broader 'framework assessment' is lacking, individual narrowly focused assessments may yield a scattered view that is difficult to use because it does not provide information that can be compared across sectors or used to determine adaptation policy priorities. Ideally, an overarching assessment that sets the scene and can look at interdependencies between sectors and cross-cutting risks is accompanied by tailor-made

sectoral and/or regional assessments that provide detailed information to prioritise adaptation actions.

5.2 From impacts assessment to identifying adaptation priorities

The general evolution of climate change vulnerability assessments has been 'characterised by the shift from estimating expected damages to attempting to reduce them' (Füssel and Klein, 2006, p. 301). This survey suggested that in many countries the interest has moved, from simply understanding what the impacts and vulnerabilities are, to identifying adaptation measures and actions that reduce them (Chapter 3). The extent to which potential adaptation measures are identified and explored in a CCIV assessment is thus linked to the role and purpose of the assessment.

CCIV assessments carried out primarily for awareness raising are usually mainly based on reviews of available studies and research. They may benefit from some examples of measures for reducing vulnerabilities, but they are not expected to evaluate specific adaptation actions. Assessments that aim to guide national policy planning and priority setting require more quantitative data. They benefit from a common assessment approach, possibly including common metrics for climate impacts or vulnerability. Assessments aimed at directly contributing to the discussion on specific adaptation actions require inclusion of or combination with a more systematic scan of policies and measures, e.g. by compilation of statistical information, in-depth interviews and possibly modelling of specific risks. Such studies are demanding, and they can only be included in assessment processes that have been allocated sufficient resources.

Nearly all of the reported assessments have provided national overviews of impacts and vulnerabilities covering multiple sectors. Standardised (common) categories for vulnerability or risk were used in many assessments, either in addition to or instead of impact-specific metrics (Chapter 3). Obviously, the use of common metrics makes it easier to display a general overview of impacts and vulnerabilities, e.g. by using colour codes to identify sectoral or regional climate change 'hotspots' that require particular attention from policymakers. Assessment of climate change impacts in economic terms can also identify sectors worth particular attention. The drawback of common metrics and categories is that they tend to be abstract and crude, and they may obscure the underlying value judgements (Kelman et al., 2015). Monetary estimates may depend greatly on details of the method, in particular if extended to non-market impacts, such as those on human health, biodiversity and ecosystem services.

Sectoral or impact-specific metrics can be more concrete than general categories and linked with the specific features of the sector. Therefore, they can provide a more solid base for specific actions or policy development, but make the general comparison across sectors more demanding. An ideal assessment could combine the two approaches and provide both an overview and more specific contextualised information. The survey did not directly provide detailed information on combined approaches (Chapter 3).

5.3 Trends in knowledge needs and the assessment process

The prioritisation and planning of adaptation actions requires not only knowledge about climate change impacts, but also of adaptive capacity: human capital (such as education and local knowledge), social capital (institutions, networks and culture), economic resources (financial capital and technology), accessibility of information, and the public's perception of risk. The survey showed that approximately half of the assessments have considered current adaptive capacity in qualitative terms, while fewer assessments considered future adaptive capacity. Similarly, the inclusion of non-climatic factors of vulnerability, such as current and future socio-economic information, is still limited. Less than half of the assessments had included quantitative scenarios of non-climatic developments (Chapter 3).

Similar findings were made in a previous study in which less than a quarter of EU Member States had developed future socio-economic scenarios and projections, or assessed current social vulnerabilities (factors such as economic diversity, poverty and wealth, education, social capital, equity, governance and policy priorities) (Downing et al., 2017). Lack of attention to future non-climatic developments has also been documented for local vulnerability studies (McDowell et al., 2016). The observation suggests that current climatic vulnerabilities and impacts have dominated the thinking on how to prepare for climate change. However, neglecting other long-term trends, such as changes in demography or in economic structure, or mitigation-related challenges, increases the risk of inefficient policy responses or maladaptation.

An appreciation of non-climatic drivers is particularly important in the context of an 'adaptation pathways' approach. This approach stresses the importance of different temporal sequences of actions by analysing the sequence of decisions and measures that respond

to the progression of climate change (Haasnoot et al., 2013). It therefore requires broad understanding of why a particular action can or should be taken at a given point in time.

A better understanding of non-climate factors on vulnerabilities and adaptation can be gained through future-oriented interviews with stakeholders, which help in identifying and characterising climatic risks and adaptive responses (Fawcett et al., 2017). Most of the reported CCIV assessments had included stakeholder input (Chapter 3). By making the stakeholder engagement more systematic and by improving documentation of stakeholder arguments, new insights could be gained concerning possible future adaptation actions, taking into account emerging trends in the sectors.

Uncertainties are an unavoidable component of any CCIV assessment. The importance of communicating uncertainties has been recognised in the reported assessments at a general level, but their communication has not been particularly systematic (Chapter 3). Finding suitable ways of assessing and communicating uncertainties is important for all assessments. Thus, there is a need to explicitly communicate uncertainties in multi-sectoral assessments to prevent users from, for example, drawing premature conclusions on the distribution of vulnerabilities across regions or sectors. Assessments that support more specific development of policies and measures benefit from adequate communication of uncertainties to identify 'robust' ways of reducing impacts and vulnerabilities (Capela Lourenço et al., 2014).

The survey showed that the benefits of most CCIV assessments extend beyond collecting data and information. A significant outcome of the process of conducting a multi-sectoral CCIV assessment is that it can bring together experts from many different fields and other stakeholders, thereby facilitating the creation of knowledge networks that remain active after the assessment. When asked about innovative aspects of the assessments, several respondents identified the interaction between experts and stakeholders as a key innovation and success factor (Chapters 3 and 4).

The survey responses suggest that the process of a CCIV assessment should receive as much attention as its content and its analytical approach (Chapter 4). A well-designed process includes interaction among experts to identify relevant links of vulnerability between sectors ('interdisciplinarity') as well as active involvement of relevant stakeholders to support the use of assessment findings as a base for practical actions ('transdisciplinarity'). Such a process is likely to pay off through deeper insights into the factors determining impacts and vulnerabilities, and through better decision support. Conversely, a failure to consider the assessment process may lead to silo thinking — or unwillingness to share knowledge — with respect to specific impacts and vulnerabilities whereby important links between sectors or activities may be missed.

5.4 Policy development and CCIV assessments

CCIV assessments have evolved in conjunction with the development of adaptation policies (Chapter 4). The challenge for the future is to maintain a fruitful interaction between science and policy in an increasingly diverse context. The main task is to create different opportunities for feedback between policy development and CCIV assessments. Some standardisation of approaches and process may be useful, but it is important not to lock CCIV assessments into a restricted role specified by a static view of policy development.

According to the survey, the reported CCIV assessments, including those that have been initiated by the research community, have contributed to policy development. As adaptation policies develop and mainstreaming of adaptation progresses, new information needs arise for follow-up CCIV assessments. Hence, there is a dynamic interaction between CCIV assessments and policy design, and it is an iterative process (Chapter 4).

The survey has identified a need for more information, both in sectors that are already recognised and included in CCIV assessments and in 'new' areas. For example, international (cross-border) impacts have not been extensively dealt with in CCIV assessments before, but many countries have identified knowledge gaps in this area (Chapter 2). These novel areas may require new approaches in CCIV assessments, as it will, for example, be necessary to consider relevant developments outside national borders. The demand for CCIV assessments that include more detailed socio-economic information, including on the differential social vulnerability to climate change impacts, is also likely to increase.

The increasing mainstreaming of adaptation at the local level creates a demand for more specific and spatially disaggregated CCIV assessments (Rauken et al., 2015). This development can strengthen the role of national CCIV assessments as synthesisers of diverse CCIV information. The task is likely to become more challenging as the multiplicity of

local assessments increases the width and diversity of available information. It may be advisable to set up a national process that brings together experts who systematically examine and provide 'meta-assessments' of available studies of impacts and vulnerabilities, including those published as 'grey' literature. This could be organised by, for example, national panels on climate change or bodies set up for the monitoring and evaluation of national adaptation strategies and plans.

European countries covered by the European Union Civil Protection Mechanism are regularly preparing NRAs. There is considerable potential for improving the coherence between CCIV assessments and NRAs, for example by using common scenarios, assessment approaches and risk metrics (EEA, 2017a; OECD, 2018).

5.5 Strengthening assessment practice

This survey and previous studies that have reviewed national CCIV assessments have contributed to a learning process. This process has improved the understanding of how assessments have evolved over time, what drives their development, and where consensus about the process of carrying out an assessment is building. These insights can be used to strengthen practice in future CCIV assessments.

5.5.1 Data and methods

According to the survey, the national CCIV assessments considered in this report have improved the integration of existing fragmented information, but further learning about how to best integrate diverse sources of information, such as quantitative data, qualitative information and expert opinions, is needed. A key challenge reported has been the availability of, and access to, data for CCIV assessments. There is large variation between countries, between sectors and within sectors, among others due to resource constraints. Data availability limits the level of detail that a CCIV assessment can provide.

The balance between different types of data is worth considering. It is often advisable to combine qualitative and quantitative data as they have different advantages and disadvantages with respect to coverage, robustness, objectivity and uncertainties. Quantitative data is not necessarily 'better' or more objective than qualitative data, since normative aspects (e.g. in the selection of the data) might be hidden. An approach that combines qualitative data to provide an overview and quantitative data to explore detailed information on certain aspects of CCIV is likely to yield a more robust assessment than studies based mainly on a single type of data. In all cases it is essential that the reasoning behind conclusions on impacts and vulnerabilities and the factors affecting them must be transparent, comprehensive and replicable.

According to the survey, methodological improvements tend to aim for standardised methods (e.g. using common climate scenarios and common metrics) that can be updated in future assessments and that also generate disaggregated data for sectors and regions. The development of such standardised methods for multi-sectoral CCIV assessments is challenging, but it can facilitate comparisons across policy areas and the prioritisation of risks. However, there is also a need for diverse approaches in sub-national and sector-specific assessments dealing with specific types of risks and potential adaptation measures.

There is potential for improving the links between CCIV assessments and national risk assessments for security and disaster risk reduction, e.g. by using common assessment approaches, scenarios or metrics.

5.5.2 Process

The survey results suggest that it is worth aiming for the involvement of a wide range of experts and stakeholders, from academia, public authorities, non-governmental organisations and possibly the private sector, from the very beginning of a CCIV assessment. This broad involvement provides practical advice on conducting the assessment, supports data collection, contributes to a greater acceptance of the outcomes, and raises awareness of the need for adaptation. It also enhances data sharing and the exchange of information between policy levels (vertical integration) and across sectors (horizontal integration). However, broad involvement requires careful planning, strong coordination and provision for extra time. According to the survey, there has been as yet limited involvement of the private sector (i.e. insurances, utilities, industry and others) in national CCIV assessments. This engagement could be improved, in particular in sector-specific assessments.

It is often easier to engage stakeholders by asking them to think about their current vulnerabilities to weather events, rather than focusing on future climate projections. An understanding of the current vulnerability to weather and extremes is therefore a useful starting point for CCIV assessments in general and stakeholder engagement in particular.

According to the survey, time and resource constraints have been major limiting factors for collecting information and for meeting political or other deadlines. Some assessments also suffered from a lack of coordination of the process or lack of political interest. The lessons learned suggest giving as much attention to the process, including an iterative dialogue between stakeholders and assessors, as to developing the content.

5.5.3 Outputs

Common metrics of impacts and vulnerabilities can facilitate cross-sector comparisons and the identification of priority areas for action. In the case of international harmonisation, they could also support international adaptation activities and reporting. However, achieving such comparability involves value judgements, and it can mask relevant details. Hence, its applicability depends on the scope, mandate and institutional set-up of a particular CCIV assessment. In any case, there is also a need for context-specific regional and local metrics of impacts and vulnerabilities that guide specific adaptation actions.

Assessment reports are often detailed and complex. It is essential that the results are 'translated' into specific communication products that meet the needs of different target groups such as ministries, sector organisations and the wider public.

5.5.4 Evaluation and update

The development of adaptation policies requires regular updates of CCIV assessments. Such updates should consider developments in the scientific knowledge base as well as in policy. Several countries have adopted a 5-year cycle for updating their national CCIV assessments.

Additional CCIV information needs have been identified for sectors already covered as well as for new thematic areas, such as international (cross-border) impacts. This is a result of the growing recognition that a country can be strongly affected by the impacts of climate change occurring abroad, e.g. through cross-border water flows, trade relationships or climate-induced migration.

5.5.5 Future developments

One of the major tasks in further developing CCIV assessments that aim to support policy integration is the more systematic inclusion of the following topics:

1. Non-climatic factors that influence the development of exposure and vulnerability should be systematically explored, e.g. using demographic projections and other relevant socio-economic scenarios. Improved consideration of social vulnerability factors would also lead to a better understanding of the social justice implications of climate change, as some population groups are more strongly affected than others.

2. Cross-sectoral interactions and international (cross-border) impacts are playing an important role in determining overall vulnerability and therefore deserve attention.

3. Common metrics for climate impacts and vulnerability can support cross-sector comparison and priority setting, but the unavoidable value judgements require a transparent approach and a proper mandate.

4. Uncertainties should be systematically assessed and communicated in a way that helps users of the assessments to consider the robustness of the conclusions.

5. CCIV assessments aiming to support long-term adaptation decisions would benefit from assessing climate impacts over time for different scenarios. Such CCIV assessments would facilitate decision-making approaches that consider different temporal sequences of possible adaptation actions ('adaptation pathways').

6. The findings of CCIV assessments are relevant for many different groups of actors, including central and local administrations, but increasingly also the private sector and civil society. The use of the assessments can be enhanced by targeting the communication of key findings specifically to the various audiences.

Some countries may choose to address these challenges in a comprehensive multi-sectoral national CCIV assessment, whereas others may leave some of them for more targeted sector-specific or regional assessments.

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Annex 1 EEA country survey

EEA survey on the use of information about climate change impacts, vulnerability and/or risk for the development of national adaptation policy

Part I: General information on national adaptation policy development and underlying information on climate change impacts, vulnerability and/or risk (CCIV)

A. Institutional context

This section collects information about the organisations involved in adaptation policy development at the national level and in filling out this survey.

1. Country

Filled in by EEA

2. What is the lead organisation for adaptation at the national level?

The lead organisation is understood as the organisation or institution that is responsible for coordinating adaptation activities at the national level. Please state the name in English and provide a web link.

[Lead organisation

3. What organisation has filled out this survey

[Your organisation]

4. What other organisations have been consulted in filling out this survey (including Part II)?

[Other organisations]

B. National adaptation policy

This section includes general information about national adaptation policy. Pre-filling is based on information previously reported by EEA member countries as reported on Climate-ADAPT. If you change the pre-filled text, please provide an explanation, so that EEA can follow up as needed.

5. Does your country have a national adaptation strategy?

○	a. Yes *Please provide further information below.*
○	b. No
Date of adoption or last revision of the national adaptation strategy [Year]	
Title (including an English translation) and web link(s). [National adaptation strategy]	
Additional information, e.g. if the national adaptation strategy is comprised of several sub-national and/or sectoral strategies. [Additional information]	
Please provide an explanation if you changed any of the entries above. *Your response in this field will only be used for follow-up by EEA; it will not be published.* [Explanation of changes]	

6. Does your country have a national adaptation action plan?

○	a. Yes, separate from the national adaptation strategy *Please provide further information below.*
○	b. Yes, integrated with the national adaptation strategy *Please provide further information below.*
○	c. No
Date of adoption or last revision of the national adaptation action plan [Year]	
Title (including an English translation) and web link(s). [National adaptation action plan]	

Additional information, e.g. if the national adaptation action plan is comprised of several sub-national and/or sectoral action plans. [Additional information]
Please provide an explanation if you changed any of the entries above. *Your response in this field will only be used for follow-up by EEA; it will not be published.* [Explanation of changes]

C. CCIV information supporting adaptation policy development

This section collects information about how CCIV information has supported the development of adaptation policy over time.

7. How has CCIV information for your country developed over time?

Please highlight any major milestones, such as the publication of specific reports, and explain how this information has supported policy development, such as the development of national adaptation strategies or action plans.

[Timeline of CCIV and adaptation policy development]

8. How important have different sources of CCIV information been for the development of national adaptation policy?

Please choose one option from each line. 'Very important' means that an information source has had a major influence on setting the priorities and focusing actions; 'somewhat important' means that the information has been used together with other sources of information, without necessarily playing a decisive role. Please consider also planned development of adaptation policy, in particular if the most recent CCIV assessment has not yet been used for adaptation policy development.

	Very important	Somewhat important	Not important or not available	Do not know
a. Multi-sectoral national CCIV assessments commissioned by government authority *Please provide further information below.*	○	○	○	○
b. Multi-sectoral national CCIV assessments (including review type assessment) initiated by scientists *Please provide further information below.*	○	○	○	○
c. Sectoral national CCIV assessments commissioned by government authorities	○	○	○	○

d.	Sectoral national CCIV assessments initiated by other organisations (e.g. research projects, private sector)	○	○	○	○
e.	European or transnational CCIV assessments (e.g. EU research projects, EEA reports)	○	○	○	○
f.	International CCIV assessments (e.g. IPCC reports)	○	○	○	○
g.	Stakeholder and expert opinions obtained through active engagement in drafting the national adaptation strategy or action plan	○	○	○	○
h.	Other sources of CCIV information *Please provide further details.* [Other CCIV information]	○	○	○	○
Please specify the multi-sectoral national CCIV assessment(s) that shall be covered in Part II of this survey (see Introduction for further guidance). [Title of CCIV assessment(s)]					

9. Please select up to five sectors or impact domains, for which you think that better CCIV information would be particularly important in order to significantly improve adaptation policies in your country.

☐	a.	Agriculture
☐	b.	Biodiversity
☐	c.	Built environment
☐	d.	Civic and disaster protection
☐	e.	Coastal areas
☐	f.	Cultural heritage
☐	g.	Digital communication (ICT) infrastructure
☐	h.	Energy
☐	i.	Financial and insurance services
☐	j.	Forestry
☐	k.	Human health
☐	l.	Industry
☐	m.	Marine and fisheries

☐	n. Regional and urban development
☐	o. Tourism
☐	p. Transport
☐	q. Water
☐	r. Cross-border impacts (e.g. through international trade or migration)
☐	s. Other sectors or impact domains [Please provide further details]
☐	t. Cross-sectoral policy domains [Please provide further details]
☐	u. I cannot answer this question
Please provide further details if relevant. [Further details]	

10. Are there plans for obtaining more precise or systematic CCIV information in the future?

☐	a. Yes, by conducting a new multi-sectoral national CCIV assessment
☐	b. Yes, by updating an existing multi-sectoral national CCIV assessment
☐	c. Yes, by conducting multi-sectoral CCIV assessments for sub-national regions
☐	d. Yes, by conducting CCIV assessments for specific sectors or impact domains
☐	e. Yes, through other sources of information
☐	f. No, the current information is sufficient
☐	g. The matter has not been discussed, or a decision has not been taken
Please provide additional information on planned CCIV assessments, such as whether they will use the same approach as earlier assessments (if any). [Planned CCIV assessments]	

Part II: Detailed information about a specific multi-sectoral national CCIV assessment

D. General information about the CCIV assessment

This section collects general information about this specific multi-sectoral CCIV assessment.

11. Assessment code

Provided by EEA

12 What is the title of the assessment?

If the assessment is published in a language other than English, please provide the title in the original language together with an English translation.

[Title]

13. Please provide the full reference and a web link for the assessment.

Please provide separate entries for each language version and if synthesis/summary documents were published separately.

[Reference(s), including web link(s)]

14. When was the assessment published?

[Year]

15. What is the geographic coverage of the assessment?

Please explain if the assessment does not cover the whole country or if coverage differs across different parts of the assessment.

[Coverage]

16. Which organisation or authority initiated or requested the assessment?

[Initiating organisation]

17. Which organisation(s) carried out the assessment?

If several organisations were involved, please state the organisation that took the thematic lead first.

[Organisations involved]

18. How many experts participated in carrying out the assessment?

Please estimate the number of experts if possible.

[Assessment team]

E. Assessment purpose and context

This section collects information on the purpose and context of the CCIV assessment, including the resource requirements.

19. What were the main reasons for conducting the assessment?

☐	a. Legal requirement
☐	b. Regular reporting (without legal requirement)
☐	c. To support the development or revision of national adaptation strategy
☐	d. To support the development or revision of national adaptation action plan
☐	e. Bottom-up initiative by scientists
☐	f. Other reasons (please specify below)
Please provide further details on the reasons for conducting the assessment. [Further details on reasons for assessment]	

20. Who were the main target users of the assessment?

☐	a. Politicians
☐	b. Government authorities at national level
☐	c. Government authorities at sub-national level
☐	d. International organisations
☐	e. Academic researchers
☐	f. Non-governmental stakeholders
☐	g. Media
☐	h. General public
☐	i. Other users (please explain) [Further details on other target users]

21. How long did the assessment project take?

[Duration]

22. What were the total resources dedicated to the assessment, and who provided the funding?

Please estimate the amount of resources dedicated to this assessment according to different categories. If quantitative estimates are not possible, please provide a verbal description of the resources.

Type of resource	Amount of resources	Source of funding
Contracted costs for producing the actual assessment		
Staff time in your own organisation (monetary costs or person months)		
Research activities dedicated to providing the scientific base for the assessment (monetary costs or verbal description)		
In-kind contributions (e.g. experts writing or reviewing draft texts without specific funding)		
Other resources (please explain) [Other resources]		

F. Assessment scope

This section collects information on the scope of the CCIV assessment.

23. Which sectors/impact domains were covered in the assessment?

☐	a. Agriculture
☐	b. Biodiversity
☐	c. Built environment
☐	d. Civic and disaster protection
☐	e. Coastal areas
☐	f. Cultural heritage
☐	g. Digital communication (ICT) infrastructure
☐	h. Energy
☐	i. Financial and insurance services
☐	j. Forestry
☐	k. Human health
☐	l. Industry

☐	m. Marine and fisheries
☐	n. Regional and urban development
☐	o. Tourism
☐	p. Transport
☐	q. Water
☐	r. Cross-border impacts (e.g. through international trade) [Please provide further details]
☐	s. Other sectors/impact domains [Please provide further details]
☐	t. Cross-sectoral impact domains [Please provide further details]

24. Which time periods were explicitly addressed in the assessment?

☐	a. Present (including past trends)
☐	b. Early 21st century (e.g. 2030)
☐	c. Mid-21st century (e.g. 2050)
☐	d. Late 21st century (e.g. 2100)
☐	e. Beyond 21st century (e.g. 2200)
Please provide further details if relevant. [Further details on time horizon]	

G. Assessment approach

This section collects information on the methods used to perform the assessment, including the involvement of stakeholders.

25. Did the assessment follow any specific assessment guidelines or framework?

○	a. IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptation
○	b. PROVIA Guidance on Assessing Vulnerability, Impacts and Adaptation to Climate Change
○	c. UKCIP Wizard and UKCIP risk framework
○	d. GIZ Vulnerability Sourcebook

○	e. DG CLIMA Guidelines on developing adaptation strategies and/or Climate-ADAPT Adaptation Support Tool
○	f. PROVIA/MEDIATION Adaptation Pathfinder
○	g. Other existing assessment guidelines or a combination of guidelines [Please describe guidelines applied]
Please provide further details on the assessment framework if relevant, such as whether existing guidelines were used fully or partly and/or how and why this assessment deviated from them. [Further details on assessment framework]	
○	h. No, the assessment approach was developed specifically for this assessment *Please describe the 5 to 12 main steps of the assessment. If the methodology for this assessment was published separately, please include a link.* [Main steps of the assessment]

26. Which were the main assessment methods used?

☐	a. Review of existing literature
☐	b. Modelling exercise specifically dedicated to producing this CCIV assessment
☐	c. Composite indicator approach (e.g. by combining information on hazards, exposure and sensitivity/vulnerability)
☐	d. Expert workshops or interviews
☐	e. Stakeholder workshops
☐	f. Other methods [Please specify other methods]
Please provide further details on the assessment methods, including when different methods were used for different sectors. [Please provide further details]	

27. Were external stakeholders involved in the assessment, and how?

Please tick all boxes that apply. If a given group of stakeholders was not involved, simply leave the corresponding boxes unticked

		Review of drafts	Online survey	Interviews or hearings	Advisory committee	Workshops
a.	Government authorities at national level	☐	☐	☐	☐	☐
b.	Government authorities at sub-national level	☐	☐	☐	☐	☐
c.	International organisations	☐	☐	☐	☐	☐
d.	External scientists	☐	☐	☐	☐	☐
e.	Non-governmental stakeholders (e.g. interest organisations, business associations)	☐	☐	☐	☐	☐
Please provide any additional information on stakeholder involvement that you consider relevant. [Additional information on stakeholder involvement]						

28. Please describe briefly any aspects of the assessment that you consider particularly innovative.

[Innovative aspects]

H. Scenarios and drivers

This section collects information on the climatic and non-climatic scenarios and drivers underlying the CCIV assessment.

29. What was the main source of climate projections applied in the assessment?

○	a. No quantitative climate projections
○	b. Existing projections based on global climate models (e.g. CMIP3 or CMIP5)
○	c. Existing projections for Europe based on regional climate models (e.g. PRUDENCE, ENSEMBLES, EURO-CORDEX)
○	d. National projections downscaled from existing global or European projections
○	e. National projections based on own regional climate models (i.e. not downscaled from existing global or European projections)

○	f. Synthetic climate scenarios (e.g. uniform changes in temperature and precipitation)
○	g. Different sources of climate projections (e.g. in case of a literature review)

Please provide further details, in particular which emissions scenarios were used as drivers for the climate projections (if relevant).

[Please provide further details]

30. Did the assessment consider scenarios for non-climatic changes, such as demographic changes or socio-economic development, on a systematic basis?

☐	a. No systematic consideration of non-climatic changes
☐	b. Qualitative consideration of non-climatic changes
☐	c. Quantitative scenarios of demographic changes
☐	d. Quantitative scenarios of socio-economic changes
☐	e. Other quantitative scenarios (please specify below)

Please provide further details, in particular if the use of non-climatic scenarios varies across different parts of the assessment.

[Please provide further details]

31. Did the assessment consider the adaptive capacity of regions and/or sectors on a systematic basis?

☐	a. No systematic consideration of adaptive capacity.
☐	b. Qualitative estimates of current adaptive capacity (e.g. assessed by experts)
☐	c. Quantitative estimates of current adaptive capacity (e.g. using proxy indicators)
☐	d. Qualitative estimates of future adaptive capacity (e.g. assessed by experts)
☐	e. Quantitative estimates of future adaptive capacity (e.g. scenarios for proxy indicators)
☐	f. Consideration of adaptive capacity differs across the assessment

I. Assessment results

This section collects information about how the main assessment results are summarised and presented at the highest aggregation level. Many assessments do this in a dedicated summary chapter or synthesis report, whereas others summarize information in key messages or through homogeneous graphical illustrations for individual sectors or indicators. The questions below aim at capturing the most important ways of summarising and presenting aggregated assessment results, but they may not be able to capture the full range of CCIV assessments. If the standard answers do not appropriately reflect this specific assessment, please provide explanatory text rather than skipping the question completely.

32. Was the level of vulnerability or risk for different sectors or impacts presented in a common metric?

○	a. Yes, through common vulnerability/risk categories (e.g. high/medium/low risk) *Please explain how the assignment of vulnerability/risk categories was done.* [Please explain the assignment of vulnerability/risk categories]
○	b. Yes, through monetised metrics (e.g. costs, welfare loss) *Please explain how the monetisation of non-market impacts was done, and by whom.* [Please explain the monetisation of non-market impacts]
○	c. No, different impact/vulnerability/risk metrics were used *Please provide further details on the metrics used.* [Please provide further details]

33. Were the main assessment results across sectors or impacts presented in a summary illustration, such as a table or a map?

☐	a. Summary table or matrix *Please provide further details, such as the metrics used, and the number of sectors, impacts and/or regions distinguished in the table/matrix.* [Please provide further details]
☐	b. Quantitative map(s) *Please provide further details, such as the metrics used, and the number of maps.* [Please provide further details]
☐	c. Qualitative map(s) (e.g. infographics) *Please provide further details on the information presented.* [Please provide further details]
☐	d. No specific summary illustration

34. At what level(s) of regional aggregation were the main assessment results presented?

☐	a. Whole country
☐	b. Several sub-national regions
☐	c. High-resolution maps
☐	d. Other level or does not apply
Please provide further details. [Further details on regional aggregation]	

35. Did the assessment unambiguously identify particularly affected sectors or priority impacts/risks?

This question focuses on the unambiguous identification of particularly affected sectors or priority impacts/risks, in particular through common metrics and/or summary tables. In this context, the term 'unambiguous' means that there can be no disagreement as to which sectors or impacts/risks are particularly affected (under a given scenario).

☐	a. Particularly affected sectors were identified unambiguously
☐	b. Priority impacts/risks were identified unambiguously
☐	c. Neither particularly affected sectors nor priority impacts/risks were identified
Please provide any additional information on this topic that you consider relevant. [Please provide additional information]	

36. Did the assessment unambiguously identify particularly affected regions?

This question focuses on the unambiguous identification of particularly affected regions, in particular through common metrics and/or summary maps or tables.

☐	a. Particularly affected regions aggregated across all sectors were identified unambiguously
☐	b. Particularly affected regions for individual sectors were identified unambiguously
☐	c. Particularly affected regions for individual impacts/risks were identified unambiguously
☐	d. The assessment did not identify particularly affected regions unambiguously
Please provide any additional information on this topic that you consider relevant. [Please provide additional information]	

37. Did the assessment identify, evaluate or prioritise adaptation measures on a systematic basis?

○	a. Adaptation measures were not identified or evaluated on a systematic basis
○	b. Potential adaptation measures were identified
○	c. Specific adaptation measures were evaluated and/or prioritised
○	d. Consideration of adaptation measures varied across the assessment
Please provide further details. [Further details on adaptation measures]	

38. How were uncertainties from different sources communicated in the assessment results?

○	a. Not explicitly (i.e. only central estimate)
○	b. Not systematically (e.g. some uncertainties are described qualitatively)
○	c. Discrete categories (e.g. low/medium/high confidence or uncertainty)
○	d. Uncertainty range
○	e. Probabilistic results
○	f. Other systematic way (please explain below)
○	g. Communication of uncertainties varies across the assessment
Please provide further details. [Further details on uncertainty communication]	

J. Dissemination and use

This section collects information on how the assessment results were disseminated and how they were used for policy-making.

39. How were the assessment results disseminated?

If the CCIV assessment was an integral part of a national adaptation strategy or action plan, please focus on the dissemination of the CCIV-related aspects if possible.

☐	a. Printed publication
☐	b. Electronic book or report (e.g. PDF, ePub)
☐	c. Summary/synthesis documents
☐	d. Web publication (value added material, such as indicators, interactive maps, etc.)
☐	e. Outreach material (e.g. press highlight, video)
☐	f. Invited contributions (e.g. opinion pieces, blogs, interviews)

☐	g.	Social media (Facebook, Twitter, etc.)
☐	h.	Press conferences
☐	i.	Stakeholder events
☐	j.	Scientific events
☐	k.	Public events
☐	l.	Webinars
☐	m.	Other dissemination channels (please explain) [Other dissemination channels]
Please provide further details if relevant [Please provide further details on dissemination products and events]		

40. How were the assessment results used (or how are they planned to be used) for policy development?

Please note that policy development comprises not only the development of adaptation plans and strategies at national and subnational level, but also awareness raising, enabling action, etc. Please answer this question even if you have provided related information in Part I under Question 7.

[Please describe the use for policy development]

K. Experiences

This section collects information about experiences with the development and use of the assessment.

41. What positive experiences did the development and use of this assessment provide?

[Please describe positive experiences]

42. What challenges were encountered during the development and use of this assessment?

[Please describe challenging experiences]

43. What lessons have been learned during the development and use of this assessment?

If a formal evaluation exists, please include a link to the evaluation.

[Please describe lessons learned]

44. What would possibly be done differently in a future assessment, and why?

[Please describe possible changes in a future assessment]

L. Concluding question

45. Do you have any feedback regarding this survey?

[Feedback]

European Environment Agency

National climate change vulnerability and risk assessments in Europe, 2018

2018 — 79 pp. — 21 x 29.7 cm

ISBN 978-92-9213-940-7
doi:10.2800/348489

TH-AL-18-002-EN-N
doi:10.2800/348489

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